







B.Sc. (Hons) Chemistry with Mathematics
Year: Second/ Semester: Third (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	B020301T/CH232	Chemical Dynamics & Coordination Chemistry	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					
2	B020302P/CH234	Physical Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					
3	B030301T/MT228	Algebra & Mathematical Methods	T		5	1	-	15	10	25	75	100	06								-
4	• B000301V/CH237 • --	• Food Testing and Quality Control • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√	√	√		√			
5	H040304T/LN230 H040305T/LN231	• Functional Hindi (कार्यात्मक हिंदी)* OR Amozish e Urdu*	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√			-
TOTAL					11	02	06	60	40	100	400	500	17								




*Anyone from Hindi, Urdu, Awadhi, Sanskrit etc.

B.Sc. (Hons) Chemistry with Physics
Year: Second/ Semester: Third (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	B020301T/CH232	Chemical Dynamics & Coordination Chemistry	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					4 QUALITY EDUCATION 
2	B020302P/CH234	Physical Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					4 QUALITY EDUCATION 
3	B010301T/PY207	Electromagnetic Theory & Modern Optics	T		3	1	-	15	10	25	75	100	04								-
4	B010302P/PY208	Demonstrative Aspects of Electricity & Magnetism	P		-	-	4	15	10	25	75	100	02								-
5	• B000301V/CH237 •	• Food Testing and Quality Control • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√	√	√		√			4 QUALITY EDUCATION 
6	-	Regional Language*	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√			-
TOTAL					09	02	10	75	50	125	475	600	17								




*Anyone from Hindi, Urdu, Awadhi, Sanskrit etc.

B.Sc. (Hons) Chemistry with Zoology
Year: Second/ Semester: Third (Odd Semester)

B.Sc. (Hons) Chemistry with 2001657													Year: Second/ Semester: Third/ 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	B020301T/CH232	Chemical Dynamics & Coordination Chemistry	T	Core Major	3	1	-	15	10	25	75	100	04	√		√						4 QUALITY EDUCATION 	
2	B020302P/CH234	Physical Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√						4 QUALITY EDUCATION 	
3	B050301T/BS264	Molecular Biology, Bioinstrumentation & Biotechniques	T		3	1	-	15	10	25	75	100	04									-	
4	B050302P/BS265	Bioinstrumentation & Molecular Biology Lab	P		-	-	4	15	10	25	75	100	02									-	
5	<ul style="list-style-type: none">• B000301V/CH237•	<ul style="list-style-type: none">• Food Testing and Quality Control• MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√	√	√		√				4 QUALITY EDUCATION 	
6	-	Regional Language*	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√				-	
TOTAL					09	02	10	75	50	125	475	600	17										

*Anyone from Hindi, Urdu, Awadhi, Sanskrit etc.

B.Sc. (Hons) Chemistry with Botany
Year: Second/ Semester: Third (Odd Semester)

B.Sc. (Hons) Chemistry with Botany													Year: Second/ Semester: Third/ 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	B020301T/CH232	Chemical Dynamics & Coordination Chemistry	T	Core Major	3	1	-	15	10	25	75	100	04	√		√							4 QUALITY EDUCATION 
2	B020302P/CH234	Physical Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√							4 QUALITY EDUCATION 
3	B040301T/BS266	Flowering Plants Identification & Aesthetic Characteristics	T		3	1	-	15	10	25	75	100	04										-
4	B040302P/BS267	Plant Identification technology	P		-	-	4	15	10	25	75	100	02										-
5	<ul style="list-style-type: none">• B000301V/CH237• --	<ul style="list-style-type: none">• Food Testing and Quality Control• MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√	√	√		√					4 QUALITY EDUCATION 
6	-	Regional Language*	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√					-
TOTAL					09	02	10	75	50	125	475	600	17										

*Anyone from Hindi, Urdu, Awadhi, Sanskrit etc.



B.Sc. Chemistry

Effective from Session: 2025-26

Course Code	B020301T/CH232	Title of the Course	Chemical Dynamics & Coordination Chemistry	L	5	T	1	P	0	C	4
Year	II	Semester	III								
Pre-Requisite	Certificate	Co-requisite	-								
Course Objectives	To develop a comprehensive understanding of the characteristics and physical properties of the three states of matter through kinetic theory and crystallography, and to equip students with knowledge of liquid crystals and physicochemical techniques such as conductometric, potentiometric, optical methods, polarimetry, and spectrophotometry for studying chemical kinetics and equilibrium, along with developing insights into metal-ligand bonding in transition metal complexes and understanding their thermodynamic and kinetic behaviour.										

Course Outcomes	
CO1	Learners will be able to analyze the rate and order of chemical reactions, evaluate concentration dependence, apply mathematical expressions for reaction order determination, and interpret the effects of temperature using the Arrhenius equation, activation energy concepts, collision theory, transition state theory, and thermodynamic parameters related to rate constants.
CO2	Learners will be able to interpret equilibrium constants, relate them to free energy changes, apply Le-Chatelier's principle to predict shifts in equilibrium, and analyze phase equilibria using the reaction isotherm, reaction isochore (Clapeyron-Clausius equation), derive the Gibbs phase rule, and evaluate phase equilibria in one-component (H ₂ O, CO ₂ , O ₂) and two-component systems (solid-liquid equilibria and simple eutectic systems).
CO3	Learners will be able to explain the kinetic theory of gases, apply the van der Waals equation to real gases, describe critical phenomena, interpret PV isotherms, continuity of states, the law of corresponding states, the reduced equation of state, and analyze Maxwell's distribution of molecular velocities. They will also compare the liquid state with other states of matter, explain intermolecular forces, liquid structure, and differentiate liquid crystals, their types, structures, phases, and examine gels, including their classification, preparation, properties, and applications.
CO4	Learners will be able to describe the basics of Werner's theory of coordination complexes, classify ligands and chelates, determine coordination numbers, apply IUPAC nomenclature (up to dinuclear complexes), and differentiate types of isomerism (constitutional, stereoisomerism, geometrical, and optical) in square planar and octahedral complexes.
CO5	Learners will be able to analyze electronic spectra of transition metal complexes, explain d-d transitions, interpret spectroscopic ground states, construct Orgel and energy-level diagrams, and evaluate the electronic spectrum of the [Ti(H ₂ O) ₆] ³⁺ ion. They will also assess magnetic properties, identify different types of magnetic behavior, apply methods to determine magnetic susceptibility, calculate magnetic moments using the spin-only formula and L-S coupling, and use magnetic data to interpret the behavior of 3d-metal complexes.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Chemical Kinetics & Theories of chemical kinetics	i. Rate of a reaction, molecularity and order of reaction, concentration dependence of rates, mathematical characteristics of simple chemical reactions: zero order, first order, second order, pseudo-order, half-life, and mean life; determination of the order of reaction: differential method, method of integration, half-life method, and isolation method. ii. Effect of temperature on rate of reaction; Arrhenius equation; concept of activation energy; Simple collision theory based on the hard sphere model, transition state theory (equilibrium hypothesis); Expression for the rate constant based on equilibrium constant and thermodynamic aspects (no derivation).	8	1
2	Chemical Equilibrium	Equilibrium constant and free energy; thermodynamic derivation of the law of mass action; Le-Chatelier's principle, reaction isotherm, and reaction isochore-Clapeyron Clausius equation and its applications.	7	2
3	Phase Equilibrium	Statement and meaning of the terms phase, component, and degree of freedom; derivation of Gibbs phase rule, phase equilibria of one component system water, CO ₂ , and O ₂ systems Phase equilibria of two component systems: Solid-liquid equilibria, simple eutectic (Bi-Cd, Pb Ag systems)	7	2
4	Kinetic theories of gases	i. <i>Gaseous State</i> : Postulates of the kinetic theory of gases: deviation from ideal behaviour, van der Waals equation of state. ii. <i>Critical phenomena</i> : PV isotherms of real gases, continuity of states, the isotherms of the Van der Waals equation, relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state. iii. <i>Molecular Velocities</i> : Qualitative discussions of Maxwell's distribution of molecular velocities, collision number, mean free path, and collision diameter.	7	3
5	Liquid State	i. <i>Liquid State</i> : Intermolecular forces and the structure of liquids (a qualitative description) Structural differences between solids, liquids, and gases. ii. <i>Liquid crystals</i> : Difference between liquid crystal, solid, and liquid; classification and structure of the nematic and cholesterol phases. iii. Liquids in solids (gels): Classification, preparation, and properties, inhibition, general application.	7	3
6	Coordination Chemistry	Werner's theory of coordination complexes, classification of ligands, ambidentate ligands, chelates, coordination numbers, IUPAC nomenclature of coordination complexes (up to two metal centers), Isomerism in coordination compounds, constitutional and stereo isomerism, and geometrical and optical isomerism in square planar and octahedral complexes.	8	4
7	Theories of Coordination Chemistry	Metal-ligand bonding in transition metal complexes, limitations of valance bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral, and square planar complexes, the John Teller effect, and factors affecting the crystal- field parameters. A brief outline of the thermodynamic stability of metal complexes; the concept of hard and soft acids and bases and factors affecting their stability.	8	4

8	Inorganic Spectroscopy and Magnetism	Electronic spectra of transition metal complexes Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel- energy level diagrams for d1 and d9 states, and discussion of the electronic spectrum of the $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion. Magnetic properties of transition metal complexes, types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula, L-S coupling.	8	5
Reference Books:				
1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press 13 (2006).				
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).				
3. Cotton, F.A, Wilkinson, G and Gaus, P. L ,Basic Inorganic Chemistry, 3rd Edition ,Wiley 1995				
4. Lee, J.D, Concise Inorganic Chemistry 4th Edition ELBS, 1977				
5. Douglas, B, McDaniel, D and Alexander, J , Concepts of Models of Inorganic Chemistry, John Wiley & Sons; 3rd edition , 1994				
6. Shriver, D.E Atkins, P.W and Langford, C .H, Inorganic Chemistry ,Oxford University Press, 1994.				
7. Porterfield, W.W, Inorganic Chemistry, Addison Wesley 1984.				
8. Sharpe, A .G, Inorganic Chemistry, ELBS, 3RD edition ,1993; Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).				
9. Miessler, G.L, Tarr, D.A, Inorganic Chemistry, 2nd edition , Prentice Hall, 2001; Bahl and Bahl, Essential of Physical Chemistry, S.Chand				
10. R Gopalan & V Ramalingam, Concise Coordination Chemistry, Vishal publishing house; Tn Srivastva and Pc Kampoj, Systematic Analytical Chemistry, Shoban Lal Nagin Chand				
e-Learning Source:				
1. https://swayam.gov.in/				
2. https://www.coursera.org/learn/physical-chemistry				
3. https://www.mooc-list.com/tags/physical-chemistry				
4. https://www.openlearning.com/courses/introduction-to-physical-chemistry/				
5. https://www.my-mooc.com/en/categorie/chemistry				
6. https://onlinecourses.swayam2.ac.in/ncel19_sc15/preview				
7. https://swayam.gov.in/				
8. https://www.coursera.org/browse/physical-science-and-engineering/chemistry				
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	-	-	-	-	2	2	2	3	2	1	1	4 (Quality Education)
CO2	3	-	-	-	-	2	1	2	2	2	1	-	
CO3	3	-	-	-	-	2	1	1	3	2	1	1	
CO4	3	-	-	-	-	1	2	2	3	3	-	1	
CO5	3	-	-	-	-	2	2	2	3	2	1	1	

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

Name & Sign of Program Coordinator					Sign & Seal of HoD				
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B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-26							
Course Code	B020302P/CH234	Title of the Course	Physical Analysis	L	T	P	C
Year	II	Semester	III	-	-	4	2
Pre-Requisite	Certificate	Co-requisite	-	To provide practical knowledge of how to prepare solutions of various concentrations, know the strengths of solutions, estimate components through volumetric analysis, surface tension, and viscosity, as well as perform dilatometric experiments: one- and two-component phase equilibrium experiments.			
Course Objectives							

Course Outcomes	
CO1	Learners will be able to demonstrate proficiency in calibrating laboratory equipment, performing solution dilutions (e.g. converting 0.1 M to 0.001 M solutions), and apply concepts of molecular weight, formula weight, equivalent weight, and various concentration units.
CO2	Learners will be able to determine experimentally the surface tension and viscosity of pure liquids or solutions.
CO3	Learners will be able to identify the boiling points of organic compounds with boiling points below 180°C.
CO4	Learners will be able to determine the transition temperature of substances using thermometric or dilatometric methods.
CO5	Learners will be able to analyze the effect of solutes on critical solution temperature and construct corresponding phase diagrams.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Strengths of Solution	i. Calibration of fractional weights, pipettes, and burettes. Preparation of standard solutions. ii. Dilution: 0.1 M to 0.001 M solutions. iii. Mole Concept and Concentration Units: Mole Concept, molecular weight, formula weight, and equivalent weight. iv. Concentration units: Molarity, Formality, Normality, Molality, Mole fraction, Percent by weight, Percent by volume, Parts per thousand, Parts per million, Parts per billion, pH, pOH, milli equivalents, Milli moles	20	1
2	Surface Tension and Viscosity	i. Determination of the surface tension of a pure liquid or solution ii. Determination of the viscosity of a pure liquid or solution	10	2
3	Boiling point and Transition Temperature	i. Boiling point of common organic liquid compounds (any five): n-butyl alcohol, cyclo-hexanol, ethyl methyl ketone, cyclo-hexanone, acetylacetone, isobutyl methyl ketone, isobutyl alcohol, acetonitrile, benzaldehyde, and acetophenone [The boiling points of the chosen organic compounds should preferably be within 180 °C.] ii. Transition Temperature: Determination of the transition temperature of the given substance by thermometric or dilatometric method (e.g. MnCl ₂ ·4H ₂ O or SrBr ₂ ·2H ₂ O)	20	3, 4
4	Phase Equilibrium	i. To study the effect of a solute (e.g., NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g., phenol-water system) and to determine the concentration of that solute in the given phenol-water system. ii. To construct the phase diagram of a two-component (e.g., diphenylamine-benzo-phenone) system by the cooling curve method.	10	5

Reference Books:

1. G. D. Christian, Analytical Chemistry, 6th Ed. John Wiley & Sons, New York (2004).
2. D.C. Harris, Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman (2016).
3. E. Stocchi, Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
4. J. A. Kent, (ed) Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi, (1997).
5. Pani, B. Textbook of Environmental Chemistry, I.K. International Publishing House, (2017).
6. A. K. De, Environmental Chemistry, New Age International Pvt Ltd, New Delhi (2012).
7. S. M .Khopkar,, Environmental Pollution Analysis, New Age International Publishe (2010)

e-Learning Source:

8. <https://www.labster.com/chemistry-virtual-labs/>
9. <https://www.vlab.co.in/broad-area-chemical-sciences>

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	2	2	2	2	2	2	2	4 (Quality education)
CO2	3	1	1	-	1	2	2	2	2	2	2	2	
CO3	3	1	1	-	1	2	2	2	2	2	2	2	
CO4	3	1	1	-	1	2	2	2	2	2	2	2	
CO5	3	1	1	-	1	2	2	2	2	2	2	2	

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-26							
Course Code	B000301V/CH237	Title of the Course	Food Testing and Quality Control	L	T	P	C
Year	II	Semester	III	1	-	2	3
Pre-Requisite	Certificate	Co-requisite	-				
Course Objectives	To enable students to comprehend the significance and evolution of food, understand the functions of food, identify and analyze plant and animal sources of food, gain knowledge of food processing from diverse plant sources, develop insights into milk and its products, understand the different types of food, and acquire comprehensive knowledge of the food industry.						

Course Outcomes	
CO1	Learners will be able to explain the fundamentals of food chemistry, including its history, water structure, and the interactions among food components.
CO2	Learners will be able to describe the foundations of carbohydrates (monosaccharides, oligosaccharides, and polysaccharides), starch and cellulose derivatives as food constituents, and evaluate the nutritional value of sugars and related products; they will also be able to explain the components of lipids, food lipids and their health implications, and the role of antioxidants.
CO3	Learners will be able to explain the basics of protein structure and functions, enzyme structure and functions, vitamin structure, types and functions, minerals and their nutritional aspects, as well as the bioavailability of nutrients in vegetables and fruits.
CO4	Learners will be able to describe the basics of food pigments and colours, and identify common preservatives and food adulterants.
CO5	Learners will be able to evaluate food quality parameters and interpret food laws and standards.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction and history	Food chemistry, history, water structure and relations in food components.	10	1
2	Carbohydrates and Lipids	Carbohydrates: monosaccharide, oligosaccharides and polysaccharides, starch and cellulose derivatives as food constituents, sugar and related products nutritional value, lipids: components, food lipids and health, antioxidants.	10	2
3	Structure and function of Proteins & Vitamins	Protein's structure and functions, enzyme's structure and functions, vitamin's structure, types and functions, minerals and nutritional aspects, vegetables and fruits, bioavailability of nutrients	10	3
4	Food pigments and colors	Food oxidants, food pigments, natural and synthetic food colours, flavouring agents, sweeteners, emulsifiers and stabilizers, spices and herbs	10	4
5	Food preservatives and Adulteration of food	Food preservatives, organic foods, advantages and disadvantages of organic food, food fortification. Food adulteration, types of adulteration: intentional adulteration, incidental adulteration.	10	4
6	Evaluation of food quality, laws & standards	Evaluation of food quality, sensory tests, types of tests, objective evaluation and instruments used for texture evaluation Food laws, food standardization and regulation agencies in India, national standards, international standards.	10	5

Reference Books:

1. Voet D and Voet JG. Principles of Biochemistry. John Wiley and sons New York.
2. Moat AG and Foster J. W. Microbial Physiology. John Wiley and Sons, New York.
3. Willey J, Sherwood L. and Woolverton C. Prescott's Microbiology, McGraw Hill
4. U. Satyanarayan. Biochemistry, Elsevier; Robinson Dairy Microbiology.
5. Jay JM Modern Food Microbiology. Van Nostraaand Reinhold Co., New York.
6. Andrew Proctor Alternatives to conventional food processing, RSC pub.
7. Frazer WC and Westhoff DC Food Microbiology. Mcgraw Hill, New York.; Srilakshmi B Food Science, New Age Publication

e-Learning Source:

1. <https://www.bing.com/videos/search?q=Evaluation+of+food+quality>
2. <https://www.youtube.com/watch?v=g-Pp4UybXXo>
3. <https://www.bing.com/videos/search?q=Carbohydrates+and+Lipids&&view=detail&mid=>
4. <https://www.bing.com/videos/search?q=Structure+and+function+of+Proteins+%26+Vitamins&&view=detail&mid=>
5. <https://www.youtube.com/watch?v=C7RtgEe8o9Y>

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	2	-	1	2	2	2	2	2	2	2	4 (Quality education)
CO2	2	1	2	-	1	2	2	2	2	2	2	2	
CO3	2	1	2	-	1	2	2	2	2	2	2	2	
CO4	2	1	2	-	1	2	2	2	2	2	2	2	
CO5	2	1	2	-	1	2	2	2	2	2	2	2	

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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Integral University, Lucknow

Effective from Session: 2025-26 Regional Language Co-Curricular							
Course Code	H040304T/ LN230	Title of the Course	कार्यात्मक हिंदी / Functional Hindi	L	T	P	C
Year	NA	Semester	NA	2	0	0	2
Pre-Requisite	10+2 (Any Discipline)	Co-requisite	None				
Course Objectives	After the completion of course, the students will: <ul style="list-style-type: none"> Master the Hindi Language Skills. Develop LSRW Skills in Hindi Cultivate essential tool for accessing the precious heritage of our ancient culture. Be acquainted with Hindi Knowledge System. Be able to utilize functional aspects of Hindi. Learn the translation aesthetics of the language. Get acquainted with the major works in vast Hindi literature. 						

Total No. of Lectures: 45

Minimum Marks: 100

Course Outcomes	
CO1	To introduce the knowledge system of Hindi Language.
CO2	To equip students with the basics of Hindi Grammar.
CO3	To highlight the descriptive use of Hindi Grammar and its analysis.
CO4	To familiarize students with functional use of Hindi through literature.
CO5	To acquaint students with the influence of Hindi Literature on Ancient Indian Culture and Aesthetics.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	भाषा एवं भाषिक संरचना तथा स्तर	भाषा : परिभाषा, स्वरूप, अभिलक्षण भाषाविज्ञान: परिभाषा, प्रकार, क्षेत्र, शाखाएं ध्वनि, शब्द, रूप, वाक्य, प्रोक्ति, अर्थ	09	CO1
2	हिंदी भाषा की उत्पत्ति तथा विकास	पृष्ठभूमि अपभ्रंश अवहट्ट पुरानी हिंदी मानक हिंदी	09	CO2
3	हिंदी शब्द सम्पदा और उसके मूल स्रोत	हिंदी ध्वनियों का वर्गीकरण आधार- स्थान, प्रयत्न, इन्द्रिय या करण	09	CO3
4	हिंदी साहित्य	हिंदी साहित्य का उद्गम: आदि काल भक्ति काल रीती काल आधुनिक काल नव्योत्तर काल	09	CO4
5	प्रमुख हिंदी साहित्यकार	सूर्यकांत त्रिपाठी 'निराला' (कवि) प्रेमचन्द (हिन्दी गद्यकार) भीष्म साहनी (नाटककार)	09	CO5

Reference Books:

Hindi Sahitya ka Itihas by Dr. Nagendra

Karyalay Karya Vidhi by Ramchandra Singh Sagar

Anuvaad Vigyaan by Bholanath Tiwari

Bhasha Vigyan ki Bhoomika by Acharya Devendranath Sharma

Hindi Basha Ka Itihas by Dr Ramkishor Sharma

Loksahtya or Sanskriti by Dr Dinneswar Prasad

E-Resources

<https://www.youtube.com/watch?v=vh9J2XCde3c>

<https://www.youtube.com/watch?v=1lrz11BbqCA>

<https://www.youtube.com/watch?v=TeDB2qSNz1Y>

Course Articulation Matrix (POs PSOs COs)													
PO- PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	3	3	3	3	3	3	2	3	2	3
CO2	2	3	1	2	3	3	2	3	3	1	3	1	3
CO3	1	2	1	2	3	3	3	3	2	2	3	2	3
CO4	3	3	2	2	3	3	2	2	3	1	2	1	2
CO5	2	3	2	2	3	3	3	3	2	3	2	3	2
CO6	2	3	1	1	3	3	3	2	3	2	2	2	2
CO7	3	2	3	3	3	3	3	2	2	2	3	2	3

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



Integral University, Lucknow
Department of Languages
W.E.F- 2025-26

Syllabus

Regional (languages) as co-curricular Subject

Program: Designed as per NEP 2020 for all the UG Programs		Year: 2		Semester: III	
Course code: H040305T/LN231		Course Title: Amozish -e- Urdu آموزش اردو			
L 2		T	P 0	Credits 2	
Major (I)		Minor (I)		Vocational (I)	
Pre-requisite (If any)		None 10+2		Co-curricular (✓)	
Course Objectives		1. 2. Language Proficiency Development 3. Literary Engagement 4. Communication Skills 5. Preservation of Linguistic Identity 6. Translation and Interpretation Skills 7. Support for Multilingualism.			
Course Outcomes: (COs)					
CO1		The student will be introduced to the Urdu alphabet, consonants, vowels, aspirated & retroflexed letters, and other forms of alphabet.			
CO2		The students will be able to read and write the Urdu text.			
CO3		Students will be introduced to everyday Urdu idioms and be able to use them in their daily conversation. They will also learn Urdu suffixes and prefixes.			
CO4		Students will be able to write letters and applications in Urdu Language and will be able to use the Introductory dialogue and etiquette in the Urdu language with Jargons.			
Max. Marks: 25+75		Min. Passing Marks: 10+25			
Total No. of Lectures- 30					
Unit	Topics			Contact Hrs.	Mapped CO
I	Introduction of Alphabet. Urdu alphabet, consonant, vowels, aspirated & retroflexed letters, doted & non doted letters and their forms putting letters together. Reading practice of Urdu words, practicing of writing Urdu words, combines letters to write two-letter, three-letter, and four-letter words, and writing Urdu in the Nastaliq script.			1	1
II	Reading & Dictation: Prose: Tote ki chalaki, Guftgu ke aadaab, KahawateN, Urdu news. Poetry: Sari Dunya ke Malik, Barsaat, Lab pe aati hai. Shaam. Urdu writings dictation			2	2
III	Jargons and Idioms: Privileged Urdu idioms & proverbs Use of suffixes & prefixes, Urdu writings dictation			3	3
IV	Compositions: Urdu Letters & applications writings skills Introductory dialogue & etiquette in the Urdu language			4	4
Suggested Readings: 1. Ibtidai Urdu: I, II & III (NCERT Book, Class I, II & III) 2. Urdu ki pahli kitab by Ismail Merathi. 3. Amozish -e- Urdu 5. Muhawairat w Zerbul Amsaal By Hafiz Asadurrahmaan Chisthi					
This course can be opted as an elective by the students of the following subjects: Open for all					
Suggested Continuous Evaluation Methods: Continuous Internal Evaluation shall be based on allotted Assignments and Class Tests. The marks shall be as follows:					
Overall performance throughout the Semester (includes Attendance, Behaviour, Discipline, Participation in Different Activities)				(05 marks)	
Suggested equivalent online courses:					
Course Articulation Matrix: (Mapping of COs with POs and PSOs)					

Course Articulation Matrix: (Mapping of COs with POs and PSOs)									
Course outcome	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	2	1	1	2	-	2	-
CO2	2	1	1	2	2	-	1	1	1
CO3	2	2	2	2	2	1	-	2	2
CO4	3	2	2	2	1	1	2	2	1

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



Integral University, Lucknow
Department of Languages
Study and Evaluation Scheme
 Co-Curricular (Regional Language) (Theory)
As per NEP 2020

Wef. 2025-2026

Program: All NEP STUDENTS

Year: II

Semester: III

Semester: III																				
S.No.	Course code	CourseTitle	Type ofPaper	Period Per Hr./Week/UE			EvaluationScheme				Sub Tot.	Credit	Total Credits	Attributes						
				L	T	P	CA		Total	ASE				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics
							CT	TA												
THEORY																				
1.	H040305T/ LN231	Amozish –e- Urdu آموزش اردو	Co-Curricular (Regional Languages)	2	0	0	15	10	25	75	100	2:0:0	2	✓	✓	✓		✓	✓	
Total				2	0	0	15	10	25	75	100	2:0:0	2							

L=Lecture, T=Tutorial, P=Practical, CA=Continuous Assessment, CT=Class Test, TA=Teacher's Assessment, ESE=End Semester Examination; CA=CT+TA; Subject Total=CA+ ESE.

اردو نصاب برائے تھریڈ سمسٹر
حسب ہدایات نیشنل ایجوکیشن پالیسی

Syllabus of Urdu for III Semester Urdu
National Education Policy (NEP)
With the effect from
2025-26- Odd Semester

Total Units: 04		مجموعی اکائیاں: 04
Credits 02:		کریڈٹس: 02

Unit I

Introduction of Alphabet:

- 1.1 Urdu alphabet, consonant, vowels, aspirated & retroflexed letters, and the recognition of different forms of the letters.
- 1.2 Reading practice of Urdu words, practicing of writing Urdu words, combines letters to write two-letter, three-letter, and four-letter words, and writing Urdu in the Nastaliq script.
- 1.3 Exercises and activities

اکائی اول

تعارف علم ہجا

- ۱.۱: حروف تہجی، مصوتے/مضمتے، حروف ہکاری یاہائے، حروف حلقی، حروف منقوٹ وغیرہ منقوٹ، حرکات و سکنات، حروف علت حروف کی اشکال کی پہچان
- ۲.۱: کتابت: حروف ہجا کی مشق، دو حرفی، سہ حرفی اور چار حرفی الفاظ کے حروف کو ملا کر لکھنے کی مشق، اردو نستعلیق کے لکھنے کی مشق۔
- ۳.۱: لکھنے اور پڑھنے کی مشق و سرگرمیاں:

Unit II

Reading & Dictation:

- 2.1 a) Prose: Tote ki chalaki, Guftgu ke aadaab, KahawateN, Urdu news. (NCERT Book, Class III)
b) Poetry: Sari Dunya ke Malik, Barsaat, Lab pe aati hai. Shaam. (NCERT Book, Class III)
- 2.2 Urdu writings dictation
- 2.3 Exercises and activities

اکائی دوم

اردو عبارت خوانی و املا نویسی

- ۲.۱: مجوزہ اردو متن نظم و نثر، اخبار اور رسائل
نشر: طوطے کی چالاکی، گفتگو کے آداب، کہاوتیں، اردو خبریں (این سی آر ٹی بک، درجہ سوم)،
نظم: ساری دنیا کے مالک، برسات کی رات، لب آتی ہے، شام، (این سی آر ٹی بک، درجہ سوم)
- ۲.۲: اردو املا نویسی، و نقل نویسی کی مشق
- ۳.۲: لکھنے اور پڑھنے کی مشق و سرگرمیاں:

Unit III

Jargons and Idioms:

- 3.1 Urdu idioms, their kinds and examples.
- 3.2 Use of suffixes & prefixes, Urdu writings dictation
- 3.3 Exercises and activities

اکائی سوم

اردو محاورات، سابقہ و لاحقہ:

- ۱.۳: مروجہ اردو محاوروں اور ضرب الامثال کی مشق
- ۲.۳: سابقہ اور لاحقہ کا استعمال
- ۳.۳: لکھنے اور پڑھنے کی مشق اور سرگرمیاں

Unit IV

Compositions:

- 4.1 Urdu Letters & applications writings skills
- 4.2 Introductory dialogue & etiquette in the Urdu language
- 4.3 Exercises and activities

اکائی چہارم

خط و کتابت و درخواست نویسی

- ۱.۴: اردو خط و کتابت اور درخواست نویسی کی مشق
- ۲.۴: تعارف، نشست و برخاست میں استعمال ہونے والے اردو جملے و مکالمے
- ۳.۴: لکھنے اور پڑھنے کی مشق اور سرگرمیاں





**INTEGRAL
UNIVERSITY**

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: Second/ Semester: Fourth (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	B020401T/CH239	Quantum Mechanics and Analytical Techniques	T	Core Major	3	1	-	15	10	25	75	100	04	√		√						4 QUALITY EDUCATION 
2	B020402P/CH241	Instrumental Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√						4 QUALITY EDUCATION 
3	B030401T/MT229	Differential Equation & Mechanics	T		5	1	-	15	10	25	75	100	06									
4	<ul style="list-style-type: none">A040405T/LN234--	<ul style="list-style-type: none">Effective Professional Communication SkillsEVS/BS	T	Minor Course	3	1	4	15	10	25	75	100	06	√	√	√		√	√	√		
5	B020405R/CH259	Chemistry Summer Internship	P	Internship	-	-	6	-	-	-	100	100	03	√	√	√		√			4 QUALITY EDUCATION 	
6	Z040401T/PH201	Physical Education and Yoga	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√	√	√	3 GOOD HEALTH AND WELL-BEING 	
TOTAL					13	03	14	75	50	125	475	600	23									





**INTEGRAL
UNIVERSITY**

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: Second/ Semester: Fourth (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	B020401T/CH239	Quantum Mechanics and Analytical Techniques	T	Core Major	3	1	-	15	10	25	75	100	04	√		√						4 
2	B020402P/CH241	Instrumental Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√						4 
3	B010401T/PY209	Perspectives of Modern Physics & Basic Electronics	T		3	1	-	15	10	25	75	100	04									
4	B010402P/PY210	Basic Electronics Instrumentation	P		-	-	4	15	10	25	75	100	02									
5.	<ul style="list-style-type: none">A040405T/LN234--	<ul style="list-style-type: none">Effective Professional Communication SkillsEVS/BS	T	Minor Course	3	1	4	15	10	25	75	100	06	√	√	√		√	√	√		
6.	B020405R/CH259	Chemistry Summer Internship	P	Internship	-	-	6	-	-	-	100	100	03	√	√	√		√				4 
7.	Z040401T/PH201	Physical Education and Yoga	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√	√	√		3 
TOTAL					11	03	18	90	60	150	550	700	23									

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

B.Sc. (Hons) Chemistry With 2001657														Year: Second/ Semester: Fourth/ 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	B020401T/CH239	Quantum Mechanics and Analytical Techniques	T	Core Major	3	1	-	15	10	25	75	100	04	√		√						4 QUALITY EDUCATION 	
2	B020402P/CH241	Instrumental Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√						4 QUALITY EDUCATION 	
3	B050401T/BS273	Gene Technology, Immunology and Computational Biology	T		3	1	-	15	10	25	75	100	04										
4	B050402P/BS274	Genetic Engineering and Counselling Lab	P		-	-	4	15	10	25	75	100	02										
5.	<ul style="list-style-type: none">A040405T/LN234--	<ul style="list-style-type: none">Effective Professional Communication SkillsEVS/BS	T	Minor Course	3	1	4	15	10	25	75	100	06	√	√	√		√	√	√			
6.	B020405R/CH259	Chemistry Summer Internship	P	Internship	-	-	6	-	-	-	100	100	03	√	√	√		√				4 QUALITY EDUCATION 	
7.	Z040401T/PH201	Physical Education and Yoga	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√	√	√		3 GOOD HEALTH AND WELL-BEING 	
TOTAL					11	03	18	90	60	150	550	700	23										

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

B.Sc. (Hons) Chemistry with Botany														Year: Second/ Semester: Fourth/ 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	B020401T/CH239	Quantum Mechanics and Analytical Techniques	T	Core Major	3	1	-	15	10	25	75	100	04	√		√						4 QUALITY EDUCATION 	
2	B020402P/CH241	Instrumental Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√						4 QUALITY EDUCATION 	
3	B040401T/BS275	Economic Botany, Ethnomedicine & Phytochemistry	T		3	1	-	15	10	25	75	100	04										
4	B040402P/BS276	Commercial Botany & Phytochemical Analysis	P		-	-	4	15	10	25	75	100	02										
5.	<ul style="list-style-type: none">A040405T/LN234--	<ul style="list-style-type: none">Effective Professional Communication SkillsEVS/BS	T	Minor Course	3	1	4	15	10	25	75	100	06	√	√	√		√	√	√			
6.	B020405R/CH259	Chemistry Summer Internship	P	Internship	-	-	6	-	-	-	100	100	03	√	√	√		√				4 QUALITY EDUCATION 	
7.	Z040401T/PH201	Physical Education and Yoga	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√	√	√		3 GOOD HEALTH AND WELL-BEING 	
TOTAL					11	03	18	90	60	150	550	700	23										



B.Sc. Chemistry

Effective from Session: 2025-26

Course Code	B020401T/CH239	Title of the Course	Quantum Mechanics and Analytical Techniques	L	T	P	C
Year	II	Semester	IV	5	1		4
Pre-Requisite	Certificate	Co-requisite	-				
Course Objectives	To provide students with a fundamental understanding of atomic structure, elementary quantum mechanics, the Schrödinger wave equation and its applications, molecular orbital theory, and molecular spectroscopy (rotational, vibrational, electronic) with relevance to photochemistry and kinetics, while emphasizing the principles and societal applications of analytical chemistry in pharmaceuticals, industry, environment, diagnostics, food safety, forensics, and research.						

Course Outcomes

CO1	Learners will be able to analyze and apply the fundamental concepts of elementary quantum mechanics to explore new areas of research in chemistry and allied fields of science and technology.
CO2	Learners will be able to work effectively in interdisciplinary teams, applying their knowledge of molecular spectroscopy to solve complex scientific problems.
CO3	Learners will develop problem-solving skills, critical thinking, and analytical reasoning by interpreting data obtained from various spectroscopic techniques.
CO4	Learners will learn to determine and elucidate the structure of organic molecules using IR, NMR, and mass spectrometry.
CO5	Learners will develop practical skills in purification techniques, including solvent extraction, thin-layer chromatography (TLC), and column chromatography, for effective separation and analysis of compounds.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Elementary Quantum Mechanics	Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Hamiltonian Operator. Schrödinger wave equation (time dependent and time independent) and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one-dimensional box. Schrödinger wave equation for H- atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions. Molecular orbital theory, basic ideas – Criteria for forming MO from AO, construction of MO by LCAO- H ²⁺ ion, calculation of energy levels from wave functions, physical picture of bonding and anti-bonding wave functions, concept of σ , σ^* , π , π^* orbitals and their characteristics.	10	1
2	Molecular Spectroscopy	Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom	5	2
3	Rotational Spectrum, Vibrational Spectrum and Raman spectrum	i. Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect. ii. Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups. iii. Concept of polarizability, pure rotational and pure vibrational, Raman spectra of diatomic molecules, selection rules. Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules.	10	3
4	UV-Visible Spectroscopy	Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules. Types of electronic transitions, λ max, chromophores and auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; application of Woodward Rules for calculation of λ max for the conjugated dienes: alicyclic, homoannular and heteroannular; extended conjugated systems distinction between cis and trans isomers (Cis and trans stilbene).	5	3
5	Infrared Spectroscopy (IR Spectroscopy)	Fundamental and non-fundamental molecular vibrations; Hooke's law selection rule, IR absorption positions of various functional groups (C=O, OH, NH, COOH and nitrile), Effect of H- bonding, conjugation, resonance and ring size of cyclic ketones and lactones on IR absorptions; Fingerprint region and its significance; application in functional group analysis and interpretation of I.R. Spectra of simple organic compounds.	8	4
6	¹ H-NMR Spectroscopy (PMR)	NMR Spectroscopy: introduction; nuclear spin; NMR active molecules; basic principles of Proton Magnetic Resonance; choice of solvent and internal standard; equivalent and non-equivalent protons; chemical shift and factors influencing it; ring current effect; significance of the terms: up-/downfield, shielded and deshielded protons; spin coupling and coupling constant (1st order spectra); relative intensities of first-order multiplets: Pascal's triangle; chemical and magnetic equivalence in NMR; anisotropic effects in alkene, alkyne, aldehydes and aromatics; NMR peak area, integration; relative peak positions with coupling patterns of common organic compounds; interpretation of NMR spectra of simple	8	4

		compounds. Applications of IR, UV and NMR spectroscopy for identification of simple organic molecules such as Ethanol, Ethyl acetate, acetone, acetaldehyde, dimethylformamide, Cis and trans 1,2- dimethyl cyclopropanone, propene, vinyl chloride, acetophenone, benzaldehyde, phenol, Toluene and ethyl benzene.		
7	Introduction to Mass Spectrometry	Principle of mass spectrometry, the mass spectrum, mass spectrometry diagram, molecular ion, metastable ion, fragmentation process, McLafferty rearrangement.	6	4
8	Separation Techniques: Solvent extraction	Classification, principle, and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non- aqueous media. Chromatography: Classification, principle, and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution, and displacement methods.	8	5

Reference Books:

1. Alberty, R A, Physical Chemistry, 4th edition Wiley Eastern Ltd, 2001; Atkins, P.W., the elements of physical chemistry, Oxford, 1991
2. Barrow, G. M., International student Edition. McGraw Hill, McGraw-Hill, 1973; Cotton, F.A, Wilkinson, G and Gaus, P. L., Basic Inorganic Chemistry, 3rd Edition, Wiley 1995
3. Lee, J.D, Concise Inorganic Chemistry 4th Edition ELBS, 1977; Clayden, J., Greeves, N., Warren, S., Organic Chemistry, Second edition, Oxford University Press 2012.
4. Silverstein, R. M., Bassler, G. C., Morrill, T. C. Spectrometric Identification of Organic Compounds, John Wiley and Sons, INC, Fifth edition.
5. Willard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988; Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
6. 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.
7. Mukherji, Singh, Kapoor, Organic Chemistry, Vol 1 and 2. New Age International 2014; R I Madan, Chemistry For Degree Students Elective Sem V/Vi As Per Cbs Quantum And Spectroscopy, S Chand Publishing
8. Y.R.Sharma, Elementary Organic Spectroscopy Vol 4, S Chand; Gurdeep Raj, Advanced Physical Chemistry, Krishna Publishing
9. Pavia, D. L. et al. Introduction to Spectroscopy, 5th Ed. Cengage Learning India Ed.
10. K.L.Kapoor, A Textbook Of Physical Chemistry - Quantum Chemistry And Molecular Spectroscopy, Volume 4, Macmillan; Tn Srivastva And Pc Kamboj, Systematic Analytical Chemistry, Shoban Lal Nagin Chand

e-Learning Source:

1. <https://www.coursera.org/courses?query=chemistry&languages=en>
2. <https://www.mooc-list.com/tags/physical-chemistry>
3. <https://www.coursera.org/learn/physical-chemistry>
4. <https://ocw.mit.edu/courses/chemistry/5-61-physical-chemistry-fall-2017/>
5. <http://heecontent.upsdc.gov.in/Home.aspx>
6. <https://nptel.ac.in/courses/104/108/104108078/>
7. <https://nptel.ac.in/courses/104/106/104106122/>
8. <https://nptel.ac.in/courses/104/108/104108124/>

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	2	2	2	-	1	1	4 (Quality education)
CO2	3	-	-	-	-	1	2	2	2	-	2	2	
CO3	2	-	-	-	-	2	2	2	2	-	1	2	
CO4	3	-	-	-	-	1	2	2	2	-	2	2	
CO5	3	-	-	-	-	2	2	2	2	2	2	2	

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-26

Course Code	B020402P/CH241	Title of the Course	Instrumental Analysis	L	T	P	C
Year	II	Semester	IV			4	2
Pre-Requisite	Certificate	Co-requisite	-				
Course Objectives	To perform, design, interpret, and document laboratory experiments using critical thinking and scientific inquiry. This is at a level suitable to succeed in an entry-level position in the chemical industry or a chemistry graduate program.						

Course Outcomes

CO1	Learners will be able to explore new areas of research in both chemistry and allied fields of science and technology, basically in molecular weight determination.
CO2	Learners will be able to function effectively as members of an interdisciplinary problem-solving team, applying their knowledge of spectrophotometry to analyze and interpret experimental data.
CO3	Learners will be skilled in problem solving , critical thinking, and analytical reasoning as applied to scientific problems, especially spectroscopy.
CO4	Learners will gain an understanding of how to determine the structure of organic molecules using IR and NMR spectroscopic techniques.
CO5	Learners will be able to develop and evaluate the basic skills required for purification, solvent extraction, TLC, and column chromatography.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Molecular Weight Determination	i. Determination of molecular weight of a non-volatile solute by Rast method/ Beckmann freezing point method. ii. Determination of the apparent degree of dissociation of an electrolyte (e.g., NaCl) in aqueous solution at different concentrations by ebullioscopy.	15	1
2	Spectrophotometry	i. To verify Beer – Lambert Law for KMnO ₄ /K ₂ Cr ₂ O ₇ and determining the concentration of the given solution of the substance from absorption measurement ii. Determination of pK _a values of indicator using spectrophotometry.	15	2
3	Spectroscopy	i. Assignment of labelled peaks in the IR spectrum of the same compound explaining the relative frequencies of the absorptions (C-H, O-H, N-H, C-O, C-N, C-X, C=C, C=O, N=O, C≡C, C≡N stretching frequencies; characteristic bending vibrations are included. Spectra to be provided). ii. Assignment of labelled peaks in the ¹ H NMR spectra of the known organic compounds explaining the relative δ-values and splitting pattern. iii. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).	15	3, 4
4	Chromatographic Separations	i. Paper chromatographic separation of following metal ions: Ni (II) and Co (II); Cu(II) and Cd(II) ii. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer Chromatography (TLC) iii. Separation and identification of the amino acids present in the given mixture by paper chromatography. Reporting the R _f values TLC separation of a mixture of dyes (fluorescein and methylene blue).	15	5

Reference Books:

- Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009; Willard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
- Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004; 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 Edition.
- Mikes, O. & Chalmers, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London.

e-Learning Source:

- <https://www.youtube.com/watch?v=xHQM4BbR040&pp=ygUcc3BIY3Ryb3Bob3RvbWV0ZXIgaXhwZXJpbWVudA%3D%3D>
- <https://www.youtube.com/watch?v=LbsNI3WgUso&pp=ygUMc3BIY3Ryb3Njb3B5>

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	2	2	2	2	2	2	2	4 (Quality Education),
CO2	2	1	1	-	-	2	2	2	2	2	2	2	
CO3	3	1	1	-	1	2	2	2	3	-	3	2	
CO4	1	1	-	-	1	2	2	2	3	2	2	2	
CO5	3	1	1	-	1	2	2	2	3	2	2	3	

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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B.Sc. Chemistry

Effective from Session: 2025-26							
Course Code	B020405R/CH259	Title of the Course	Chemistry Summer Internship	L	T	P	C
Year	II	Semester	IV	0	0	6	3
Pre-Requisite	Certificate	Co-requisite	-				
Course Objectives	To provide industrial exposure and enhance technical skills of students						

Course Outcomes	
CO1	Learners will be able to understand and perform hands on training
CO2	Learners will be able to analyze and integrate classroom theory with laboratory practice.
CO3	Learners will be able to understand professional ethics of industry and code of conduct.
CO4	Learners will be able to perform essential in laboratory safety procedures
CO5	Learners will be able to compile and evaluate the data and report writing

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	1	1	2	2	2	2	1	2	2	4 (Quality Education)
CO2	2	2	2	1	1	2	2	2	1	2	1	2	
CO3	1	2	2	1	1	3	2	2	2	1	1	2	
CO4	1	2	2	1	1	2	2	2	2	2	2	2	
CO5	2	2	2	1	1	1	2	2	2	1	2	2	

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2024-25						
Course Code	Z040401T/PH201	Title of the Course	Physical Education and Yoga	L	T	P
Year	II	Semester	IV	2		2
Pre-Requisite	Certificate	Co-requisite	-			
Course Objectives	To develop a comprehensive understanding of physical education, fitness, and wellness. Gain knowledge in physical education, fitness, wellness, weight management, and lifestyle choices. Explore the relationship between yoga and mental health. Emphasize the value of education. Delve into traditional games, their cultural significance, and their benefits. Apply knowledge for physical fitness, mental well-being, and a balanced lifestyle. Develop critical thinking, problem-solving skills, communication skills, and appreciation for traditional games as part of cultural heritage and physical activity promotion.					

Course Outcomes	
CO1	Learners will be able to understand the fundamental concepts and principles of physical education and can explain the concept of fitness and wellness and its significance in maintaining a healthy lifestyle.
CO2	Learners will be able to demonstrate knowledge of weight management techniques and strategies for maintaining optimal body weight as well as identify and analyze various aspects of an individual's lifestyle and its impact on overall health and well-being.
CO3	Learners will be able to recognize the relationship between yoga and mental health and understand how yoga practices contribute to mental well-being. Comprehend the importance of value education and its role in personal and social development.
CO4	Learners will be able to evaluate the traditional games of India and their cultural significance, highlighting their physical and mental benefits. Apply theoretical knowledge and practical skills acquired during the course to promote physical fitness, mental well-being, and a balanced lifestyle. Develop critical thinking and problem-solving abilities related to physical education and wellness.
CO5	Learners will be able to communicate effectively about the importance of physical education, fitness, wellness, and traditional games, both orally and in written form. Foster an appreciation for Indian traditional games and their role in preserving cultural heritage and promoting physical activity. Engage in teamwork, cooperation, and leadership skills through practical activities and group projects related to physical education and wellness.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Physical Education	i. Meaning, Definition, Aim and Objective. ii. Misconception About Physical Education. iii. Need, Importance and Scope of Physical Education in Modern Society. iv. Physical Education Relationship with General Education. v. Physical Education in India before Independence. vi. Physical Education in India after Independence.	15	1
2	Concept of Fitness and Wellness, Weight Management, and Lifestyle	i. Meaning, Definition and Importance of Fitness and Wellness. ii. Components of Fitness. iii. Factor Affecting Fitness and Wellness. i. Meaning and Definition of Obesity. ii. Causes of Obesity. iv. Management of Obesity. v. Health problems due to Obesity. i. Meaning, Definition, Importance of Lifestyle. ii. Factor affecting Lifestyle. iii. Role of Physical activity in the maintains of Healthy Lifestyle.	15	2, 3
3	Yoga and Meditation	i. Historical aspect of yoga. ii. Definition, types of scopes & importance of yoga. iii. Yoga is related to mental health and value education. iv. Yoga is related to Physical Education and sports. v. Definition of Asana, differences between asana and physical exercise. vi. Definition and classification of pranayama. vii. Difference between pranayama and deep breathing. viii. Practical: Asana, Suraya-Namaskar, Bhujang Asana, Naukasana, Halasana, ix. Vajrasana, Padmasana, Shavasana, Makrasana, Dhanurasana, Tad Asana. x. Pranayam: Anulom, Vilom.	15	3, 4
4	Traditional Games of India and Recreation in Physical Education	i. Meaning. ii. Types of Traditional Games Gilli- Danda, Kanche, Stapu, Gutte, etc. iii. Importance/ Benefits of Traditional Games. iv. How to Design Traditional Games. i. Meaning, Definition of Recreation. ii. Scope and Importance of Recreation. iii. General Principles of Recreation. iv. Types of Recreational Activities. v. Aerobics and Zumba (Fir India Movement).	15	4, 5

Reference Books:

Singh, Ajmer, Physical Education and Olympic Abhiyan, "Kalayani Publishers", New Delhi, Revised Addition, 2006; Patel, Shri krishna, Physical Education, "Agrawal Publishers", Agra, 2014-15

Panday, Preeti, Sharirik Shiksha Sankalan, "Khel Sanskriti Prakashan, Kanpur

Kamlesh M.L., "Physical Education, Facts and foundations", Faridabad P.B. Publications; B.K.S. Yengar, "Light and Yog. Yoga Deepika", George Allen of Unwin Ltd., London, 1981.

Braj Bilari Nigam, Yoga Power "The Kpath of Personal achievement", Domes and Publishers, New Delhi, 2001.

Jack Peter, "Yoga Master the Yogic Powers", Abhishek Publications, Chandigarh, 2004.

Janice Jerusalem, "A Guide To Yoga" Parragon Bath, Baiihe-2004.
नारंग, ण्ियंका, परम्परागत भारतीय खेल, " स्पोर्ट्स पब्ललके शन" , नई दिल्ली, 2007.
e-Learning Source:
https://www.bing.com/videos/search?q=yoga&&view=detail&mid=599A4C4B7C3D09CF4930599A4C4B7C3D09CF4930&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dyoga%26FORM%3DHDRSC4
https://www.bing.com/videos/search?q=yoga&&view=detail&mid=C44E1F48814EBF788F1DC44E1F48814EBF788F1D&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dyoga%26FORM%3DHDRSC4
https://www.youtube.com/watch?v=s2NQhpFGIOg
https://www.youtube.com/watch?v=3p4r_ad2Y7g
https://www.youtube.com/watch?v=JYg0Vu6-RUk

	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	2	2	-	-	-	-	-	-	-	-	1	-	-	1	2
CO2	1	2	1	1	-	-	-	-	-	-	-	-	2	-	-	1	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-	1	-	-	2	2
CO4	2	1	-	2	-	-	-	-	-	-	-	-	-	-	-	1	1
CO5	1	1	1	1	-	-	-	-	-	-	-	-	1	-	-	2	1

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

Name & Sign of Program Coordinator	Sign & Seal of HoD