



DEPARTMENT OF CHEMISTRY

Bachelor of Science

(Industrial Chemistry)

1st Semester As Per NEP-2020

Syllabi



Integral University, Lucknow

Effective from Session: 2022-2023							
Course Code	B190101T/CH131	Title of the Course	Fundamental of Industrial Chemistry	L	T	P	C
Year	First	Semester	First	3	1	0	4
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	The purpose of this course is to impart basic and key knowledge of Indian ancient chemistry and fundamentals of chemical calculations; atomic structure; chemical bonding; organic compounds and nomenclature; liquid crystal and solid-state; metallurgical operations; metals and alloys; heat, thermodynamics, and chemical equilibrium. That is found to have a significant role in higher studies. After completing the course, the student will be able to explore subjects in their respective dimensions.						

Course Outcomes	
CO1	Students would get inside the sound knowledge of Indian ancient chemistry and essentials of chemical and also able to evaluate the atomic structure and their properties along with principles, shapes and electronic configurations.
CO2	Students are taught principles, types and strengths of various chemical combinations for effective application of bonding.
CO3	Evaluate the different types of organic reactions and their mechanism in a step-by-step manner.
CO4	Students would able to understand the chemistry of liquid crystal and solid state such as crystal lattices, laws of crystallography, crystal systems, unit cell and space lattice.
CO5	Students would able to understand the basic of metallurgical operations, metals and alloys as well as heat, thermodynamics and chemical equilibrium.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Indian Ancient Chemistry and Fundamentals of Chemical Calculations	Introduction of Indian ancient chemistry, contribution of Indian chemists in context to the holistic development of modern science and technology. Atomic weight, molecular weight, equivalent weight, mole concept, percentage yield, composition of liquid mixtures and gaseous mixtures, molarity, molality, normality.	6	1
2	Atomic Structure	Quantum numbers, Pauli exclusion principle, Hund's rule of maximum multiplicity, Aufbau's principle, Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of Ψ and Ψ^2 , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d, orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule.	8	1
3	Chemical Bonding	Valence bond theory (VBT), concept of hybridization, hybrid orbitals and molecular geometry, valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O , NH_3 , SF_6 , PCl_5 , SF_4 , ClF_3 , I_3 , ClF_2 and SO_4 and H_3O^+ , molecular orbital theory (MOT), molecular orbital diagrams bond orders of mononuclear and heteronuclear diatomic molecules and ions (N_2 , O_2 , C_2 , B_2 , F_2 , CO , NO , and their ions).	8	2
4	Organic Compounds and Nomenclature	Classification, generic and trade names of organic compounds, functional group, aliphatic compound (alicyclic & cyclic), aromatic compound, heterocyclic compound, petroleum, natural gas, crude oil.	6	3
5	Fundamentals of Organic Chemistry and Catalysis	Cleavage of bonds (homolysis and heterolysis), reaction intermediates (carbocation, carbanion and free radicals), electrophiles and nucleophiles, aromaticity: benzenoids and Hückel's rule, inductive effect, electrometric effects, mesomeric effect, resonance, hyperconjugation and stearic effect, tautomerism, isomerism, elementary ideas of stereochemistry (geometrical and optical). Homogeneous and heterogeneous catalysis, basic principles, mechanisms, factors affecting the performance, enzyme catalysed reactions, industrially important reactions.	8	3
6	Liquid Crystal and Solid State	Classification and molecular arrangements, liquid state, density, diffusion, viscosity, evaporation, surface tension, effect of temperature and pressure on surface tension, parachor - definition and applications. Crystal lattices, laws of crystallography, crystal systems, unit cell, space lattice.	8	4
7	Metallurgical Operations, Metals and Alloys	Pulverization, calcination, roasting, refining, principles of extraction of metals, extraction of iron and copper from their ores. Important metals and alloys; mechanical and chemical properties of lead, nickel, iron, titanium and their alloys and their applications.	8	5
8	Heat, Thermodynamics and Chemical Equilibrium	Heat capacity of pure gases and gaseous mixtures at constant pressures, sensible heat changes in liquids, enthalpy changes, entropy, thermodynamic laws, processes and functions, free energy, partial molar quantities, activity, activity co-efficient, and fugacity, thermodynamic criteria and equilibrium constant, effect of temperature and pressure on equilibrium constants in gaseous system (formation of ammonia).	8	5

Reference Books:

- J. E. Huheey, E. A. Keiter, R. L. Keiter, O.K. Medhi, Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education (2006).
 Lee, J.D. Concise Inorganic Chemistry, Pearson Education (2010).
 Carey, F. A., Giuliano, R. M. Organic Chemistry, Eighth edition, McGraw Hill Education (2012).
 Singh J., Yadav L.D.S., Advanced Organic Chemistry, Pragati Edition.
 Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, 2nd edition, Oxford University Press (2012).

e-Learning Source:

- <https://swayam.gov.in/>
<https://nptel.ac.in/courses/112/104/112104113/>
https://onlinecourses.nptel.ac.in/noc19_ph14/preview
<http://heecontent.upsdc.gov.in/Home.aspx>
<https://ncert.nic.in/textbook.php?kech1=0-7>

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

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: 2022-2023							
Course Code	B020101T/CH132	Title of the Course	Fundamental of Chemistry	L	T	P	C
Year	First	Semester	First	3	1	0	4
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	The main aim of this course is to convey fundamental knowledge of weak chemical forces, molecular polarity, and periodic properties such as periodic trends, arising from the arrangement of the periodic table, providing chemists with an invaluable tool to quickly predict an element's properties, recapitulation of acids and bases, stereochemistry, organic reaction mechanisms, and organic fundamentals. Higher education studies have proven that to be quite important. The learner will be able to investigate topics in their appropriate dimensions after completing the course.						

Course Outcomes	
CO1	Students would perceive the sound knowledge of molecular polarity and weak chemical forces such as Van der Waals forces, ion-dipole forces, dipole dipole interactions and induced dipole interaction. Current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters.
CO2	Students got insight knowledge of periodic trends, arising from the arrangement of the periodic table, provide chemists with an invaluable tool to quickly predict an element's properties. These trends exist because of the similar atomic structure of the elements within their respective group families or periods, and because of the periodic nature of the elements.
CO3	Students evaluate fundamentals of chemical reaction, reactive intermediates, transition states and states of all the bonds broken and formed. It enables to understand the reactants, catalyst, stereochemistry and major and minor products of any organic reaction.
CO4	Students would perceive the sound knowledge of stereochemistry that gives the clear picture of two-dimensional and three-dimensional structure of the molecules, and their role in reaction mechanism.
CO5	Students would able to difference between acids and bases with the help of various principles and also understand about the theories of indicators, acid-base, redox, metal ion and adsorption indicators and choice of indicators.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Molecular polarity and Weak Chemical Forces	Resonance and resonance energy, formal charge, 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. Hydrogen bonding, van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction.	8	1
2	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, Allred and Rochow scale, diagonal relationship with examples, summary of horizontal, vertical and diagonal relationships in the periodic table.	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. Effective nuclear charge, shielding or screening effect, Slater rules, Atomic and ionic radii, Electronegativity, Pauling's/ Allred Rochow's scales, Ionization enthalpy, Electron gain enthalpy.	8	2
4	Recapitulation of Basics of Organic Chemistry	Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, Van der Waals interactions, inclusion compounds, Clathrates, Charge transfer complexes, hyperconjugation, Dipole moment; Electronic Displacements: Inductive, electromeric, resonance mesomeric effects and their applications	6	3
5	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, Types of organic reactions, Energy considerations. Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples).	8	3
6	Stereochemistry-I	Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomer, inversion, retention and racemization. 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	Acids and Bases	Lowery - Bronsted concept, Lewis concept, hard and soft acids and bases, Lux- Flood acids and bases, theories of indicators, acid-base, redox, metal ion and adsorption indicators and choice of indicators.	6	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., Giuliano, 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 I, 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

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	2	-	-	-	-	-	3	-	-	2	3
CO2	2	1	-	-	-	-	-	2	-	-	2	2
CO3	1	3	-	-	-	-	-	3	-	-	3	3
CO4	3	2	-	-	-	-	-	2	-	-	2	3
CO5	2	3	-	-	-	-	-	2	-	-	3	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: 2022-2023							
Course Code	B190102P/CH133	Title of the Course	Basic Analytical Methods	L	T	P	C
Year	First	Semester	First	0	0	4	2
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	The purpose of the chemistry lab program in this course at Integral University is to provide the key knowledge of good laboratory practice (GLP), calibration apparatus, preparation of standard solutions, solutions of various concentrations, determination of viscosity, the surface tension of liquids, and simple laboratory techniques.						

Course Outcomes	
CO1	Students are able to understand and performed good laboratory practice (GLP).
CO2	Understand the basic analytical and technical skills to work effectively in the various fields of chemistry.
CO3	Remember to keep records of all performed experiments in the manner which is required in laboratory.
CO4	Able to determine the viscosity and surface tension of liquids.
CO5	Able to preparation of standard solutions and solutions of various concentrations.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Good Laboratory Practices (GLP)	Good laboratory practices, Calibration of thermometer and burette	15	1,2,3
2	Simple Laboratory Techniques	Crystallization, fractional crystallization, distillation, fractional distillation, melting point and boiling point determination.	15	2,3
3	Viscosity and Surface Tension of Liquids	Determination of relative viscosity of a liquid with water and determination of % composition of an unknown solution. Determination of the surface tension of an organic liquid and determination of % composition of an unknown mixture.	15	4
4	Preparation of Standard Solutions	Preparation of standard solution of $K_2Cr_2O_7$. To find out the concentration of unknown $K_2Cr_2O_7$ solution using $Na_2S_2O_3$ solution as an intermediate. Preparation of standard solution of copper sulphate. To find out the concentration of unknown copper sulphate solution using $Na_2S_2O_3$ solution as an intermediate. Preparation of standard $KMnO_4$ and ferrous ammonium sulphate solution. To find out the strength of unknown ferrous ammonium sulphate solution using as an intermediate.	15	5

Reference Books:
Saxena Ruchi, Srivastava Alok Kumar, "Read & Do Practical Chemistry", Kitab Mahal, New Delhi, India (2016).
Skoog D. A., West.D.M and Holler .F.J., "Analytical Chemistry: An Introduction", 7th edition, Saunders college publishing, Philadelphia (2010).
G. Larry Hargis, "Analytical Chemistry: Principles and Techniques" Pearson© (1988)
B.Sc. Physics Practical Book By CI Arora
e-Learning Source:
https://www.labster.com/chemistry-virtual-labs/
https://www.vlab.co.in/broad-area-chemical-sciences
http://chemcollective.org/vlabs

PO-PSO CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	-	-	-	-	-	-	3	2	1	2
CO2	1	2	-	-	-	-	-	-	2	1	2	3
CO3	3	3	-	-	-	-	-	-	3	2	1	2
CO4	3	1	-	-	-	-	-	-	2	3	1	3
CO5	2	3	-	-	-	-	-	-	3	2	1	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: 2022-2023							
Course Code	B020102P/CH134	Title of the Course	Quantitative Analysis	L	T	P	C
Year	First	Semester	First	0	0	4	2
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	The chemistry lab program for this course at Integral University is designed to give students the 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	Students have the knowledge and skills to understand the laboratory methods and tests related to estimation of metals ions and estimation of acids and alkali contents in commercial products.
CO2	Understand and perform the portability tests of water samples.
CO3	Perform estimation of metals ions.
CO4	Perform estimation of alkali and acid contents in samples.
CO5	Perform estimation of 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	Estimation of one anion and cation in a given salt: Anion: CO_3^{2-} , S^{2-} , SO_3^{2-} , SO_4^{2-} , NO_2^- , NO_3^- , Cl^- , Br^- , I^- , PO_4^{3-} , $\text{C}_2\text{O}_4^{2-}$, CH_3COO^- Cation: Pb^{2+} , Cu^{2+} , As^{3+} , Al^{3+} , Fe^{3+} , Mn^{2+} , Ni^{2+} , Zn^{2+} , Co^{2+} , Ca^{2+} , Sr^{2+} , Ba^{2+} , Mg^{2+} , NH_3^+	15	1,2
2	Estimation of Metals Ions	Estimation of ferrous and ferric by dichromate method. Estimation of 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. Estimation of oxalic acid by titrating it with KMnO_4 .	15	2,4
4	Estimation of Inorganic Salts and Hydrated Water	Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture. Estimation of calcium content in chalk as calcium oxalate by permanganometry. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .	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	

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	1	2	-	-	-	-	-	-	2	1	1	2
CO2	2	3	-	-	-	-	-	-	3	2	1	3
CO3	3	2	-	-	-	-	-	-	2	1	1	2
CO4	2	3	-	-	-	-	-	-	3	2	2	3
CO5	3	1	-	-	-	-	-	-	3	3	1	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: 20222-2023							
Course Code	B190103T/CH135	Title of the Course	Water Treatment and Analysis	L	T	P	C
Year	First	Semester	First	3	1	0	4
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	This course aims to familiarize students with the field of water and wastewater treatment. The course will cover sludge disposal, primary, secondary, and tertiary treatment processes; water chemistry; characteristics of water and wastewater; and the design of water and wastewater treatment plants; cleaner water production; and most favorable treatment technologies.						

Course Outcomes	
CO1	Identify the parameters that define the constituents of potable water and wastewater; demonstrate the fundamentals of water and wastewater treatment.
CO2	Able to explain the function and procedural procedures of important water treatment processes, such as coagulation, precipitation, chlorination, etc., used to improve water quality.
CO3	Understand the typical physical, chemical, and biological unit activities used in treatment procedures, and investigate the biological characteristics of water. The operating procedures of treatment systems to handle trash from homes and businesses are examined.
CO4	Students become aware of the potentially dangerous effects of waste on the environment and human health. A sense of sustainable environmental measures is developed via the evaluation of various corrective actions to quantify waste amount and strength.
CO5	To get rid of hazardous trash, awareness will be raised regarding waste generation, its effects, and mitigation techniques. The use of environmental audits in industries would result from keeping in mind their key components.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Industrial pollution	Types of industries and industrial pollution; Characteristics of industrial wastes; Population equivalent; Bioassay studies; effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health; Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.	6	1
2	Purification of Water for Drinking Purpose	Clarification, coagulation, contact & electro chemical coagulation, sterilization & disinfections of water, precipitation, aeration, ozonisation and Chlorination.	8	1,2
3	Determination of Hardness and Softening Methods for Water	Determination of hardness of water: Titration methods - complexometric method using EDTA. Water softening methods: lime soda process, permutit or zeolite process, Ion exchange process or demineralization of water, Desalination of water: electrodiagnosis and Reverse osmosis.	8	2,3
4	Water Analysis	Water analysis: sampling of water for analysis - chemical substances affecting potability - colour, turbidity odour, taste, temperature, pH and electrical conductivity. Analysis of solids present in water: suspended solids, dissolved solids, total acidity, alkalinity, free CO ₂ , and free chlorine.	6	2,3
5	Analysis of Chemical Substances Affecting Health	Analysis of chemical substances affecting health: Ammonia, Nitrate, Nitrite, cyanide, sulphate, sulphide, chloride, fluoride. Analysis of chemical substances indicative of pollution: Dissolved oxygen, Bio Chemical oxygen demand (BOD), Chemical oxygen demand (COD).	8	4
6	Bacteriological Examination of Water	Bacteriological examination of water: total count test; E.coli test, E.coli index, most probable number method, Biological examination of water.	8	1,5
7	Cleaner Water Production	Waste management Approach; Waste Audit; Volume and strength reduction; Material and process modifications Recycle, reuse and byproduct recovery; Applications.	8	4
8	Treatment Technologies	Equalisation; Neutralisation; Removal of suspended and dissolved organic solids; Chemical oxidation, Adsorption Removal of dissolved inorganics; Combined treatment of industrial and municipal wastes; Residue management; Dewatering; Disposal.	8	1,5

Reference Books:	
Chemical Thermodynamics by R.P.Rastogi et al	
Principles of physical chemistry by Puri Sharma and Pathan	
Essentials of Physical Chemistry, Bahl & Tuli, S. Chand & Co. Ltd.	
e-Learning Source:	
https://condorchem.com/en/industrial-wastewater-treatment/	
https://www.chemicalprocessing.com/articles/2018/understand-industrial-wastewater-treatment/	
https://www.encyclopedia.com/environment/encyclopedias-almanacs-transcripts-and-maps/industrial-waste-treatment	

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	-	-	-	-	-	3	1	1	2	3
CO2	3	2	-	-	-	-	-	2	1	1	2	3
CO3	2	2	-	-	-	-	-	2	1	1	2	2
CO4	3	3	-	-	-	-	-	3	1	1	2	3
CO5	2	3	-	-	-	-	-	3	1	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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Integral University, Lucknow

Effective from Session: 2022-2023							
Course Code	B190104P/CH136	Title of the Course	Water Quality Analysis	L	T	P	C
Year	First	Semester	First	3	1	0	4
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	Students will possess the practical, technical, communicative, and conceptual knowledge necessary to solve both qualitative and quantitative problems as well as transferrable abilities like the capacity to work both individually and in teams. They will also be able to work efficiently and safely in a laboratory environment.						

Course Outcomes	
CO1	To work effectively in the various domains of chemistry, keep records of all experiments you perform in the manner required in the lab. You should also be aware of the fundamental analytical and technical abilities needed.
CO2	Understand the basic titration methods and technical skills to work in the different fields of chemistry.
CO3	Able to evaluate water quality parameters like DO, BOD, COD, TDS and alkalinity.
CO4	Students should be aware of how to measure the amount of alkali in antacid tablets.
CO5	Analyze the chloride content in the water sample and also the percent chlorine in the bleaching powder sample.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Standard and buffer solution	Preparation of standard solution related to normality & molarity. Preparation of buffer solution, pH measurement.	15	1,2
2	Water quality parameters	Estimation of hardness of water by EDTA. Determination of Dissolved oxygen (DO) in the given water sample. Determination of chemical oxygen demand (COD). Determination of Biological oxygen demand (BOD).	15	1,2,3
3	Total dissolved solid and total alkali content	Determination of Total dissolved solid (TDS) in the given water sample. Determination of alkali content in antacid tablet using HCl.	15	1,2,3,4
4	Chloride content	Determination chloride content in the given water sample. Determination the percentage of available chlorine in the given bleaching powder sample.	15	1,2,5

Reference Books:	
Advance Practical Chemistry: Jagdamba Singh, L.D.S Yadav, Jaya Singh, I.R. Siddiqui, Pragati Edition.	
Practical Organic Chemistry, A.I.Vogel.	
Practical Physical Chemistry: B. Viswanathan and P.S.Raghavan.	
Experimental Inorganic Chemistry –W.G.Palmer.	
e-Learning Source:	
https://www.fandm.edu/uploads/files/79645701812579729-genchem-reference-for-web.pdf	
http://file.akfarmahadhika.ac.id/E-BOOK/12-1213-akfarmahad-16-1-vogelqu-d.pdf	
https://faculty.psau.edu.sa/filedownload/doc-6-pdf-f06110ef2e1e1ae119cbacf71dd17732-original.pdf	
https://www.stem.org.uk/resources/collection/3959/practical-chemistry	
https://www.stem.org.uk/resources/collection/3959/practical-chemistry	

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

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: 2022-2023							
Course Code	B000101V/CH137	Title of the Course	Plastic Waste Management	L	T	P	C
Year	First	Semester	First	1	0	2	3
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	This course's primary goal is to equip students with the fundamental knowledge of how laboratories operate; how to calibrate equipment, how to prepare standard solutions, solutions in a range of concentrations, and how to solve qualitative and quantitative problems both independently and collaboratively associated with the treatment of waste like plastic, pharmaceuticals, agrochemicals, households etc.						

Course Outcomes	
CO1	After completing this course, students will be able to analyses qualitatively, comprehend the fundamentals of treating plastic and industrial waste, and analyses physical parameters of wastes.
CO2	Students would be capable of handling and sampling plastic and industrial waste.
CO3	Understand the handling of radioactive waste and its disposal, conductivity and its measurements
CO4	Able to conduct and analyses electro-analytical procedures and potentiometric measurements.
CO5	Learning about garbage recycling and sustainability.

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.
Environmental Chemistry by A. K.De , New Age International Publishers, (9th edition)
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
https://rajyasabha.nic.in/rsnew/publication_electronic/E-Waste_in_india.pdf

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

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: 2022-23							
Course Code	Z010101T/BE105	Title of the Course	Food, Nutrition and Hygiene	L	T	P	C
Year	First	Semester	First	2	0	0	2
Pre-Requisite	-	Co-requisite	-				
Course Objectives	To learn the basic concept of food, nutrition, hygiene, common diseases prevalent in society alongwith 1000 days nutrition concept.						

Course Outcomes	
CO1	To learn the basic concept of the Food and Nutrition, and meal planning.
CO2	To learn about macro and micro nutrients and its RDA, sources, functions, deficiency and excess.
CO3	To learn 1000 days Nutrition Concept and study the nutritive requirement during special conditions like pregnancy and lactation.
CO4	To study 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' Requirement and 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
CO1	-	-	-	2	2	3	2	3	3	2	2	-
CO2	-	-	-	3	2	3	2	3	3	2	2	-
CO3	-	-	-	3	3	2	3	3	-	-	2	-
CO4	-	-	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
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DEPARTMENT OF CHEMISTRY

Bachelor of Science

(Industrial Chemistry)

2nd Semester As Per NEP-2020

Syllabi



Integral University, Lucknow

Effective from Session: 2022-2023							
Course Code	B190201T/CH138	Title of the Course	Material Science and Techniques in Chemical Industries	L	T	P	C
Year	First	Semester	Second	3	1	0	4
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	This course aims to educate fundamental and essential understanding of cutting-edge materials for use in environmental applications. The implications of these cutting-edge materials and their applications on the environment, security, the recycling and reuse of raw materials and treatment agents, economic gains, and potential societal issues have all been studied in detail. Students who successfully complete this theory course will have an understanding of various materials, surface chemistry and interfacial phenomena, catalysis, advanced materials, and material balance, both material balances with and without chemical reactions. Pharmaceuticals and X-ray powder diffraction; distillation, evaporation, and absorption; filtering, extraction, and drying; and organic chemical purification are all examples of crystallization.						

Course Outcomes	
CO1	Students would get sound knowledge of various materials along with the material balance without chemical reactions and with chemical reactions.
CO2	Students would be able to understand surface chemistry and ceramics.
CO3	Students would restate a brief idea about water, steam, and air boilers used in chemical industries along with crystallization.
CO4	Students would be able to understand the basic definitions and terms in X-ray powder diffraction and pharmaceuticals along with the Distillation, evaporation and absorption processes.
CO5	The basics and principles of filtration, extraction, and drying would be clear to the students. They are renowned for using a variety of techniques to purify organic molecules.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Advanced Materials and Material Balance	Nanomaterials, superconductors, biomaterials and fullerenes. Material balance without chemical reactions: Flow diagram for material balance and material balance calculations for distillation, absorption, evaporation, extraction filtration, crystallization. Material balance involving chemical reactions: Concepts of stoichiometric equations, limiting reactant, excess reactant, percent excess, conversion, yield, selectivity and liquid phase reaction, gas phase reaction with or without recycle or bypass.	6	1
2	Surface Chemistry and Ceramics	Adsorption isotherm, sols, gels, emulsions, micro emulsions, micelles, aerosols, effect of surfactants. Introduction of ceramics, types, manufacturing processes and applications of ceramics.	8	2
3	Utilities in Chemical Industry	A brief idea about water, steam and air boilers used in chemical industries. A brief idea about fans, blowers, compressors and vacuum pumps, reciprocating pumps, gear pumps, centrifugal pumps, ejectors used in chemical industries.	8	3
4	Crystallization	Equilibrium solubility, super saturation, definition, nucleations, crystallization, equipment-tank crystallizer and circulating liquid evaporator crystallizer.	6	3
5	X-ray Powder Diffraction and Pharmaceuticals	Introduction, different solid forms and their role in drug development, salts, solvates, co-crystals, characterization of amorphous materials.	8	4
6	Distillation, Evaporation and Absorption	Batch and continuous distillation, azeotropic and extractive distillation. Evaporator equipments; short tube evaporator and forced circulation evaporators. Equipments: Tray (Plate) towers for absorption, packed towers for absorption.	8	4
7	Filtration, Extraction and Drying	Filter media and filter aids, filtration equipment- bed filters, plate and frame press filters, rotary drum filter and centrifuges. Extraction equipments: spray column and packed column extraction, rotating disc column extractors, liquid-liquid extraction, acid-base extraction. Purpose of drying, equipment- tray dryer, rotary dryer, flask dryer, fluid bed dryer, drum dryer, spray dryer.	8	5
8	Purification of Organic Compounds	Simple crystallization, fractional crystallization, sublimation, simple distillation, fractional distillation, distillation under reduced pressure, steam distillation, azeotropic distillation.	8	5

Reference Books:

W. D. Bowen, H. K. Kingery, D.R. Uhlmann, Introduction to Ceramics, Wiley Publishers, New Delhi (1976)
J. A. Kent, J. A. (ed), Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.(1997)
G. Cao, Nanostructures and Nanomaterials: Synthesis, Properties & Applications by Guozhong Cao, Imperial college Press, London (2004).
W. L. Mc. Cabe, J. C. Smith & Parriet Unit Operators of Chemical Engineering, Mc. Graw Hill Book Company Singapore, 7th edition (2017)
W. D. Callister Jr., D. G. Rethwisch Materials Science and Engineering: An Introduction, John Wiley & Sons (2018) .

e-Learning Source:

https://nptel.ac.in/courses/112/106/112106227/
https://onlinecourses.nptel.ac.in/noc21_cy45/preview
https://nptel.ac.in/content/storage2/courses/102103047/PDF/mod4.pdf
https://authors.library.caltech.edu/25034/10/BPOCchapter9.pdf (purification) chemistry-europe.onlinelibrary.wiley.com/journal/23656549
https://link.springer.com/content/pdf/10.1007/s41745-017-0026-4.pdf file:///C:/Users/dell/Downloads/144_Sample-Chapter.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
CO1	3	1	-	-	-	-	-	2	-	-	2	1
CO2	1	3	-	-	-	-	-	2	-	-	3	3
CO3	2	3	-	-	-	-	-	3	-	-	2	2
CO4	3	2	-	-	-	-	-	1	-	-	3	3

CO5	3	3	-	-	-	-	-	3	-	-	2	3
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1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

<p style="text-align: center;">Name & Sign of Program Coordinator</p>	<p style="text-align: center;">Sign & Seal of HoD</p>
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Integral University, Lucknow

Effective from Session: 2022-2023							
Course Code	B020101T/CH139	Title of the Course	Bioorganic and Materials Chemistry	L	T	P	C
Year	First	Semester	Second	3	1	0	4
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	This course aims 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	To understand that biomolecules are important for the functioning of living organisms and also the chemistry of carbohydrates.
CO2	Students are able to understand the physiological function that regulates the proper growth and development of a human body along with the chemistry of proteins and nucleic acids.
CO3	Students understand the fundamentals of solid state chemistry like space lattice, unit cell, laws of crystallography and X-ray diffraction by crystals.
CO4	Students would be able to understand the basic chemical calculations, units and dimensions, material balance and energy balance.
CO5	Students would get in-depth sound knowledge of medicinal chemistry such as antibiotics, antipyretics, analgesics, antimaterials, and cardiovascular drugs.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Chemistry of Carbohydrates	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). 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
2	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
3	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
4	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
5	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
6	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
7	Energy Balance	Energy balance: Forms of energy, Energy balance, Energy changes in physical processes, Energy changes in reactions, Energy balance Calculations.	6	4
8	Medicinal Chemistry	Evaluation and study of introduction, examples and uses of various antibiotics, antipyretics and analgesics, antimaterials and cardiovascular drugs.	8	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/>

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

CO5	3	3	-	-	-	-	-	3	-	-	2	2
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1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

<p style="text-align: center;">Name & Sign of Program Coordinator</p>	<p style="text-align: center;">Sign & Seal of HoD</p>
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Integral University, Lucknow

Effective from Session: 2022-2023							
Course Code	B190102P/CH140	Title of the Course	Materialistic Analysis	L	T	P	C
Year	First	Semester	Second	0	0	4	2
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	This lab course's main goal is to teach students the fundamentals of creating solutions of various concentrations, calculating concentrations, extracting compounds from solutions, determining materials' refractive indices, understanding molar and specific reactivity of solutions, and performing chromatographic separations.						

Course Outcomes	
CO1	Students would gain knowledge of preparing solutions of various concentrations, determination of concentrations, extraction of compounds from solutions.
CO2	Understand the basic analysis of solution molecular weight determination.
CO3	Able to perform extraction process.
CO4	Able to analyze refractive index of a liquid by using Abbe's Refractometer
CO5	Understand and perform various chromatography techniques such as column, paper and thin layer.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Analysis of Solution	Molecular weight determination by depression in freezing point and elevation in boiling points.	15	1,2
2	Extraction Process	Phase diagram, partition coefficient. To find out the partition coefficient of Iodine between CCl ₄ and water, Acetic acid between water and benzene.	15	1,3
3	Refractometer	Determination of Refractive Index of a liquid by Abbe's refractometer. Determination of Molar refractivity and specific refractivity of a liquid by using Abbe's refractometer.	15	1,4
4	Chromatography	Column, paper, thin layer To separate and identify the amino acids by ascending paper chromatography. To separate and identify the organic compound by the use of thin layer chromatography. Separation of a mixture of organic compound by column chromatography.	15	1,5

Reference Books:

- A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, Vogel's Textbook of Practical Organic chemistry (1989)
 B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5e, Pearson (2003).
 G. Svehla, Vogel's Qualitative Inorganic Analysis, 7e Pearson (2008).
 G.D. Christian, Analytical Chemistry, 6th Ed. John Wiley & Sons, New York (2004).
 Harris, D.C., Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman (2016).

e-Learning Source:

- https://fac.ksu.edu.sa/sites/default/files/vogel_-_practical_organic_chemistry_5th_edition.pdf
<http://faculty.chas.uni.edu/~manfredi/860-121/ORG%20LAB%20MAN%20S08.pdf>
https://www.ipinnovative.com/media/open-access-books/Practical_Lab_Manual_of_Pharmaceutical_Organic_Chemistry_-1_Low.pdf
https://gtu.ge/Agro-Lib/Vogels_Textbook_Of_Quantitative_Chemical_Analysis_5th_ed_-_G_H_Jeffery.MsuCity.pdf

PO-PSO CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	-	-	-	-	-	-	3	2	1	3
CO2	2	2	-	-	-	-	-	-	2	3	1	2
CO3	2	3	-	-	-	-	-	-	2	3	1	2
CO4	3	2	-	-	-	-	-	-	3	2	2	1
CO5	2	3	-	-	-	-	-	-	3	1	1	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: 2022-2023							
Course Code	B020102P/CH141	Title of the Course	Biochemical Analysis	L	T	P	C
Year	First	Semester	Second	0	0	4	2
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	This course aims 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	To develop the qualitative and quantitative experimental skills of biomolecules such as carbohydrates, proteins, amino acids, and nucleic acids.
CO2	To perform a qualitative and quantitative analysis of carbohydrates
CO3	To perform a qualitative and quantitative analysis of proteins, amino acids, and fats
CO4	To determine and identify nucleic acids and their strength components.
CO5	Able to synthesize simple drug molecules.

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:	
Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).	
Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education.	
G. Svehla, Vogel's Qualitative Inorganic Analysis, 7e Pearson (2008).	
Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, ELBS.	
Wilson, K. & Walker, J. Practical Biochemistry. Cambridge University Press (2009). 9. Varley, H., Gowenlock, A.H & Bell, M.: Practical Clinical Biochemistry, Heinemann.	
e-Learning Source:	
https://www.labster.com/chemistry-virtual-labs/	
https://www.vlab.co.in/broad-area-chemical-sciences	
http://chemcollective.org/vlabs	
https://gtu.ge/Agro-Lib/Vogels_Textbook_Of_Quantitative_Chemical_Analysis_5th_ed_-_G_H_Jeffery.MsuCity.pdf	

PO-PSO CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	-	-	-	-	-	-	3	2	1	2
CO2	3	2	-	-	-	-	-	-	3	3	1	1
CO3	3	3	-	-	-	-	-	-	2	2	2	2
CO4	2	3	-	-	-	-	-	-	3	1	1	2
CO5	3	3	-	-	-	-	-	-	2	2	3	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: 2022-2023							
Course Code	B190203T/CH142	Title of the Course	Inorganic Chemical Process Industry	L	T	P	C
Year	First	Semester	Second	3	1	0	4
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	This course's goal is to familiarize students with various industrial processes. The course will cover leather and textile chemistry, glass, industrial carbon, ceramics and refractories, pulp and paper, special types of papers and their production processes, and ceramics and refractories.						

Course Outcomes	
CO1	Understand the composition of glass and their types, properties and uses.
CO2	Understand the classification, properties and uses of ceramics and refractories and their respective characteristics.
CO3	Students will be able to apply the knowledge to produce various types of pulp and papers and also know the processing techniques to produce special types of papers.
CO4	Student will be able to demonstrate the basic mechanism and processes involved in leather industry and also know about a challenge which arises from leather industries and their handling.
CO5	Student will be able to know about Indian textile industries and products.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Glass	Introduction, Classification and General Properties of Glass, Characteristics, raw Materials, Chemical Reactions, Methods of Manufacture and Uses.	6	1
2	Industrial Carbon	Lampblack, Carbon Black, Activated Carbon, Natural Graphite, Manufactured Graphite and Carbon, Industrial Diamonds.	8	2
3	Ceramics and Refractories	Introduction, Types of ceramics materials, properties and applications. Refractories, classification of refractories, characteristics of refractories materials, properties of refractories. Neutral refractories; Silicon carbide. Acid refractories; High Alumina refractories.	8	2
4	Pulp and Paper	Introduction - Manufacture of pulp, Sulphate or Kraft pulp, Soda pulp, Sulphite pulp Rag pulp, Beating, refining, filling, sizing and coloring, manufacture of paper and paper making additives; processing aids, functional additives, strength additives and binders.	6	3
5	Special Types of Papers and their Manufacturing Process	Ammonia paper, Art paper, Bituminized water proof paper, Emery Paper, Toilet paper, Wall paper, Wax coated paper and polymeric modified papers	8	3
6	Leather Industry-I	Introduction - Constituents of Animal Skin - Preparing skins and hides - Cleaning and soaking - Liming and degreasing.	8	4
7	Leather Industry-II	Introduction, Manufacture of leather, Preparation of hides for tanning, Vegetable, chrome and oil tanning - Byproduct.	8	4
8	Textiles Chemistry	Indian textile industries, general consideration of textile fibres: cotton, wool, silk, and rayon fibres; General considerations of synthetic fibres; Identification of textile fibres; Water soluble resins, and epoxy resins.	8	5

Reference Books:	
Shreve R.N. Brink. J.A., Chemical Process Industries, International student edition, Pubs: McGraw Hill Book Co. New York, 1960.	
Groggins P.M., Unit Process in Organic Synthesis, 5th edition, International student edition, Pubs: McGraw-Hill Book Co., New York, 1998.	
Dryden's outlines of Chemical Technology, edited and revised by Gopala Rao M. and Marshall S, Pubs: East-West Press, New Delhi, 2004.	
Industrial Chemistry B.K.Sharma, goel publishing house.	
Chemical process principles: part 1 & II – O.A / Hougen, K.M Watson RA Ragatz (CBS)	
e-Learning Source:	
https://encyclopedia2.thefreedictionary.com/chemical+process+industry	
https://www.youtube.com/watch?v=RjZJjneJ5fk	
https://www.chemicalprocessing.com/	
https://authors.library.caltech.edu/25034/10/BPOCchapter9.pdf (purification) chemistry-europe.onlinelibrary.wiley.com/journal/23656549	
https://www.britannica.com/science/phosphorus-chemical-element	

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

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: 2022-2023							
Course Code	B190204P/CH143	Title of the Course	Titrimetric Analysis	L	T	P	C
Year	First	Semester	Second	0	0	4	2
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	This course is designed to introduce students to the fundamentals of various methods of titration, including acidimetry, alkalimetry, relaxometry, iodometric, complexometric, and argentometric titration. Students also understand titrimetric analysis to work effectively in the various fields of chemistry and also understand the basic titration methods and technical skills to work in the different fields of chemistry. Remember to keep records of all performed experiments in the manner which is required in the laboratory. Analyze the importance of personal safety and care of equipment and chemicals.						

Course Outcomes	
CO1	Students understand titrimetric analysis to work effectively in the various fields of chemistry
CO2	Able to know about the fundamentals of various methods of titration, including acidimetry, alkalimetry, relaxometry, iodometric, complexometric, and argentometric titration.
CO3	Understand the basic titration methods and technical skills to work in the different fields of chemistry.
CO4	Remember to keep records of all performed experiments in the manner which is required in the laboratory.
CO5	Analyze the importance of personal safety and care of equipment and chemicals.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Acidimetry and Alkalimetry Titration	Determination of the strength of NaOH and Na ₂ CO ₃ present together in a solution. Determination of the strength of Na ₂ CO ₃ and NaHCO ₃ present together in a solution.	15	1,2
2	Relaxometric Titration	Determination of the strength of oxalic acid solution. Determination of the strength of ferrous ammonium sulphate (Mohr's salt) solution. Determination of the strength of calcium in an calcium chloride solution.	15	1,3
3	Iodometric Titration	Determination of the strength of copper solution iodometrically. Determination of the strength of potassium dichromate solution. Determination of the strength of potassium permanganate solution.	15	1,4
4	Complexometric and Argentometric Titration	Estimation of the Calcium with EDTA. Estimation of the Magnesium with EDTA. Determination of the strength of a Silver nitrate solution by Mohr's method.	15	1,5

Reference Books:

Advance Practical Chemistry: Jagdamba Singh, L.D.S Yadav, Jaya Singh, I.R. Siddiqui, Pragati Edition.
 Practical Organic Chemistry, A.I.Vogel.
 Practical Physical Chemistry: B. Viswanathan and P.S.Raghavan.
 Experimental Inorganic Chemistry –W.G.Palmer.
 Wilson, K. & Walker, J. Practical Biochemistry. Cambridge University Press (2009). 9. Varley, H., Gowenlock, A.H & Bell, M.: Practical Clinical Biochemistry, Heinemann.

e-Learning Source:

<https://www.fandm.edu/uploads/files/79645701812579729-genchem-reference-for-web.pdf>
<http://file.akfarmahadhika.ac.id/E-BOOK/12-1213-akfarmahad-16-1-vogelqu-d.pdf>
<https://faculty.psau.edu.sa/filedownload/doc-6-pdf-f06110ef2e1e1ae119cbacf71dd17732-original.pdf>
<https://www.stem.org.uk/resources/collection/3959/practical-chemistry>

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	2	3	-	-	-	-	-	-	3	2	1	2
CO2	3	2	-	-	-	-	-	-	3	3	1	1
CO3	3	3	-	-	-	-	-	-	2	2	2	2
CO4	2	3	-	-	-	-	-	-	3	1	1	2
CO5	3	3	-	-	-	-	-	-	2	2	3	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: 2022							
Course Code	B030202T/MT148	Title of the Course	Basic Mathematics & Statistic	L	T	P	C
Year	First	Semester	Second	3	1	0	4
Pre-Requisite		Co-requisite					
Course Objectives	The purpose of this undergraduate course is to impart basic and key knowledge of elementary mathematics. By using the principal of applied mathematics to obtain quantitative relations which are very important for higher studies. After successfully completion of course, the student will able to explore subject into their respective dimensions						

Course Outcomes	
CO1	Students will be able to interpret limits and continuity of functions. Also they can find differential coefficient, differentiation of functions including function of a function, differentiation of parametric form, simple and successive differentiation.
CO2	Students will evaluate and interpret integration as an inverse of differentiation; They will be able to find indefinite integrals of standard form, integration by parts, by substitution and by partial fraction method. They can evaluate definite integrals.
CO3	Students can describe the basic concepts of simple random sampling and stratified random sampling. They can understand and find measures of central tendency (mean, median and mode), measures of variation (mean deviation and standard deviation), measure of coefficient if variation. Student will be able to understand and evaluate covariance and correlations, Karl Pearson's Coefficient of correlation and Spearman's coefficient of rank correlation. They can also be able to find regression by method of least squares.
CO4	Students can interpret the fundamental principle of counting. They will also be able to find permutations, permutations under certain conditions, combinations, combinatorial identities. They can also apply Binomial theorem (without proof)
CO5	Students will be able to understand the random experiment and associated sample space, events. They can also find probability and can use addition and multiplication theorems for finding probability (without proof). They will be able to understand probability distributions, and will be able to find Binomial, Poisson and Normal distributions.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Limit and Continuity	Set and functions, left hand limit and right hand limit, limits of function, continuity of function	7	1
2	Differentiability	Definition of differential coefficient, differentiation of function including function of a function, differentiation of parametric form, simple and successive differentiation, Leibnitz rule	8	1
3	Integrations	Integration as inverse of differentiation, indefinite integrals of standard form, integration by parts, substitution method and partial fraction method. evaluation of definite integrals.	8	2
4	Univariate Statistics	Basic concepts of simple random sampling and stratified random sampling, measures of central tendency (mean, median and mode), measures of variation (mean deviation, quartile deviation and standard deviation), coefficient of variation	7	3
5	Bivariate Statistics	Covariance, correlations, scatter diagram, Karl Pearson's coefficient of correlation, Spearman's coefficient of rank correlation, regression and its coefficient, estimation of regression lines by the method of least square	7	3
6	Permutations and Combinations	Fundamental principle of counting, permutations, permutations under certain conditions, combinations, combinatorial identities, Binomial theorem (without proof), some applications of Binomial theorem	7	4
7	Probability theory	Random experiment and associated sample space, events, definition of probability, algebra of events, addition and multiplication theorems on probability (without proof), conditional probability, Baye's theorem	8	5
8	Probability Distributions	Probability distribution, probability mass function, probability distribution function, expectations, Binomial, Poisson, normal distributions and their mean and variance, fitting the expected frequency of Binomial and Poisson distributions.	8	5

Reference Books:

1. Murray R. Spiegel, 1980, Probability and Statistics, Schaum's (Outline Series) McGraw-Hill Book Co.
2. Q. S. Ahmad, V. Ismail and S. A. Khan: Biostatistics, Laxmi Publications Pvt. Ltd.
3. E. Kreyszig, "Advanced Engineering Mathematics", 5th Edition, Wiley Eastern, 1985.

e-Learning Source:

1. NPTEL, MOOC

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				1		3	2		2	2	
CO2	3				1		3	2		2	1	
CO3	3				3		3	2		1	2	
CO4	3				1		3	2		2	3	
CO5	3				3		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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Integral University, Lucknow

Effective from Session: 2022							
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
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Integral University, Lucknow

Effective from Session: 2022-2023							
Course Code	B000201V/CH144	Title of the Course	Laboratory Safety & Sample Handling	L	T	P	C
Year	First	Semester	Second	1	0	2	3
Pre-Requisite	10+2	Co-requisite	-				
Course Objectives	This course's main objective is to give students a foundational 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	Recognize how to perform safety procedures in a science laboratory with great skill in sample handling.
CO2	Students would be capable of managerial skills in minimizing waste.
CO3	Understand the fundamentals of elementary knowledge of chemistry.
CO4	Capable of working with laboratory instruments, reagents, and solutions.
CO5	Students understand the expertise in handling sophisticated instruments for any pharma/chemical company/testing labs, etc.

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, percent 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	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.
 Vogel's Textbook of Quantitative Chemical Analysis, Pearson Education, sixth edition
 Hand book of solid waste management, second edition, McGraw-Hill education.

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
<https://www.epa.gov/sites/production/files/2016-03/documents/industrial-waste-guide.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
CO1	3	3	-	-	-	-	-	-	3	2	1	1
CO2	3	3	-	-	-	-	-	-	2	3	2	2
CO3	2	3	-	-	-	-	-	-	3	2	2	1
CO4	3	1	-	-	-	-	-	-	3	2	1	1
CO5	3	3	-	-	-	-	-	-	3	3	1	1

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: 2022-2023							
Course Code	Z020201/NS110	Title of the Course	First Aid and Health	L	T	P	C
Year	First	Semester	Second	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 child birth 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	<ul style="list-style-type: none"> A. Basic First Aid <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Dressings and Bandages. • Fast evacuation techniques (single rescuer). • Transport techniques. C. First aid related with respiratory system <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Basics of The heart and the blood circulation. • Chest discomfort, bleeding. E. First aid related with Wounds and Injuries <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Basics of The skeleton, Joints and Muscles. • Fractures (injuries to bones). 	8	1,2
2	Fundamentals of First Aid-II	<ul style="list-style-type: none"> G. First aid related with Nervous system and Unconsciousness <ul style="list-style-type: none"> • Basics of the nervous system. • Unconsciousness, Stroke, Fits – convulsions – seizures, Epilepsy. H. First aid related with Gastrointestinal Tract <ul style="list-style-type: none"> • Basics of The gastrointestinal system. • Diarrhea, Food poisoning. I. First aid related with Skin, Burns <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Poisoning by swallowing, Gases, Injection, Skin K. First aid related with Bites and Stings <ul style="list-style-type: none"> • Animal bites, Snake bites, Insect stings and bites L. First aid related with Sense organs <ul style="list-style-type: none"> • Basic of Sense organ. • Foreign objects in the eye, ear, nose or skin. • Swallowed foreign objects. M. Specific emergency satiation and disaster management <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> Basic Sex Education <ul style="list-style-type: none"> • 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

		<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 Manual-<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>

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
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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
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