



DEPARTMENT OF CHEMISTRY

Bachelor of Science

(Physics, Chemistry, Mathematics)

1st Semester

Syllabi



Integral University, Lucknow

Effective from Session: 2022-23

Course Code	B030101T/MT136	Title of the Course	Differential Calculus & Integral Calculus	L	T	P	C
Year	First	Semester	First	3	1	0	4
Pre-Requisite	10+2 with Mathematics	Co-requisite					
Course Objectives	The purpose of this undergraduate course is to impart details and key knowledge of Differential Calculus & Integral Calculus. After successfully completion of course, the student will able to explore subject into their respective dimensions.						
Course Outcomes							
CO1	The students will be able to know about Indian Ancient Mathematics and Mathematicians. The students also will be able to know about sequences and their convergences/divergences.						
CO2	The students will be able to define Limit, continuity and differentiability of function of single variable. Also, they will be able to prove some theorem e.g. Borel's theorem, boundedness theorem, Bolzano's theorem, Intermediate value theorem, extreme value theorem, Darboux's intermediate value theorem, Rolle's theorem, Lagrange and Cauchy Mean value theorems, Leibnitz theorem, Maclaurin's and Taylor's series, Partial differentiation, Euler's theorem on homogeneous function.						
CO3	The students will be able to find about Tangent and normals, Asymptotes, Curvature, Envelops and evolutes. They will be able o trace tracing of curves in Cartesian and Polar forms.						
CO4	The students will be able to solve finite integrals as limit of the sum, Riemann integral, Fundamental theorem of integral calculus, Mean value theorems of integral calculus., Also they will be able to find Volumes and Surfaces of Solid of revolution, Pappus theorem, and Multiple integrals.						
CO5	The students will be able to solve/find Vector Differentiation, Gradient, Divergence and Curl, Normal on a surface, Directional Derivative, Vector Integration, Theorems of Gauss, Green, Stokes and related problems.						

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Indian Ancient Mathematics and Mathematicians: Aryabhata, Brahmagupt, Mahavir Acharya, Varahmihir, Bhaskaracharya, Madhavan, Parmeshvaran, Baudhayana Definition of a sequence, theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion, Cauchy sequence, limit superior and limit inferior of a sequence, subsequence, Series of non-negative terms, convergence and divergence, Comparison tests, Cauchy's integral test, Ratio tests, Root test, Raabe's logarithmic test, de Morgan and Bertrand's tests, alternating series, Leibnitz's theorem, absolute and conditional convergence.	9	1
2		Limit, continuity and differentiability of function of single variable, Cauchy's definition, Heine's definition, equivalence of definition of Cauchy and Heine, Uniform continuity, Borel's theorem, boundedness theorem, Bolzano's theorem, Intermediate value theorem, extreme value theorem, Darboux's intermediate value theorem for derivatives, Chain rule, indeterminate forms.	7	2
3		Rolle's theorem, Lagrange and Cauchy Mean value theorems, mean value theorems of higher order, Taylor's theorem with various forms of remainders, Successive differentiation, Leibnitz theorem, Maclaurin's and Taylor's series, Partial differentiation, Euler's theorem on homogeneous function.	7	2
4		Tangent and normals, Asymptotes, Curvature, Envelops and evolutes, Tests for concavity and convexity, Points of inflexion, Multiple points, Parametric representation of curves and tracing of parametric curves, Tracing of curves in Cartesian and Polar forms.	7	3
5		Definite integrals as limit of the sum, Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of integral calculus, Mean value theorems of integral calculus, Differentiation under the sign of Integration.	9	4
6		Improper integrals, their classification and convergence, Comparison test, μ -test, Abel's test, Dirichlet's test, quotient test, Beta and Gamma functions.	7	4
7		Rectification, Volumes and Surfaces of Solid of revolution, Pappus theorem, Multiple integrals, change of order of double integration, Dirichlet's theorem, Liouville's theorem for multiple integrals.	7	5
8		Vector Differentiation, Gradient, Divergence and Curl, Normal on a surface, Directional Derivative, Vector Integration, Theorems of Gauss, Green, Stokes and related problems.	7	5

Reference Books:

- R.G. Bartle & D.R. Sherbert, Introduction to Real Analysis, John Wiley & Sons
- T.M. Apostol, Calculus Vol. I, John Wiley & Sons Inc.
- S. Balachandra Rao & C. K. Shantha, Differential Calculus, New Age Publication.
- H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
- G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
- Bhartiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi.
- T.M. Apostol, Calculus Vol. II, John Wiley Publication
- Shanti Narayan & Dr. P.K. Mittal, Integral Calculus, S.Chand

e-Learning Source:

Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCs

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	3	3	3	2
CO2	3						3	3	3	2	2	3
CO3	3						3	3	2	3	3	3
CO4	3						3	3	2	2	3	2
CO5	3						1	2	1	3	2	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	B010101T/PY113	Title of the Course	Mathematical Physics and Newtonian Mechanics	L	T	P	C
Year	First	Semester	First	4	0	0	4
Pre-Requisite	10+2 with Physics	Co-requisite					
Course Objectives	This course aims to give students the competence in the methods and techniques of mathematical physics and Newtonian Mechanics. At the end of the course the students are expected to have hands on experience in modeling, implementation and calculation of physical quantities of relevance.						

Course Outcomes	
CO1	Recognize the difference between types of scalars and vectors, pseudo-scalars and understand the physical interpretation of gradient, divergence and curl.
CO2	Comprehend the difference and connection between different coordinate systems and know the meaning of 4-vectors, Kronecker delta and Epsilon (Levi Civita) tensors.
CO3	Study the origin of pseudo forces in rotating frame and study the response of the classical systems to external forces and their elastic deformation.
CO4	Understand the dynamics of planetary motion and the working of Global Positioning System (GPS).
CO5	Comprehend the different features of Simple Harmonic Motion (SHM) and wave propagation.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Vector Algebra	Coordinate rotation, reflection and inversion as the basis for defining scalars, vectors, pseudo-scalars and pseudo-vectors (include physical examples). Component form in 2D and 3D. Geometrical and physical interpretation of addition, subtraction, dot product, wedge product, cross product and triple product of vectors. Position, separation and displacement vectors.	7	1
2	Vector Calculus	Geometrical and physical interpretation of vector differentiation, Gradient, Divergence and Curl and their significance. Vector integration, Line, Surface (flux) and Volume integrals of vector fields. Gradient theorem, Gauss-divergence theorem, Stoke-curl theorem, Greens theorem and Helmholtz theorem (statement only). Introduction to Dirac delta function.	8	2
3	Coordinate Systems	2D and 3D Cartesian, Spherical and Cylindrical coordinate systems, basis vectors, transformation equations. Expressions for displacement vector, arc length, area element, volume element, gradient, divergence and curl in different coordinate systems. Components of velocity and acceleration in different coordinate systems. Examples of non-inertial coordinate system and pseudo-acceleration.	8	3
4	Introduction to Tensors	Principle of invariance of physical laws w.r.t. different coordinate systems as the basis for defining tensors. Coordinate transformations for general spaces of nD, contravariant, covariant and mixed tensors and their ranks, 4-vectors. Index notation and summation convention. Symmetric and skew-symmetric tensors. Invariant tensors, Kronecker delta and Epsilon (Levi Civita) tensors. Examples of tensors in physics..	7	4
5	Dynamics of a System of Particles	Review of historical development of mechanics up to Newton. Background, statement and critical analysis of Newton's axioms of motion. Dynamics of a system of particles, centre of mass motion, and conservation laws and their deductions. Rotating frames of reference, general derivation of origin of pseudo forces (Euler, Coriolis and centrifugal) in rotating frame, and effects of Coriolis force.	8	5
6	Dynamics of a Rigid Body	Angular momentum, Torque, Rotational energy and the inertia tensor. Rotational inertia for simple bodies (ring, disk, rod, solid and hollow sphere, solid and hollow cylinder, rectangular lamina). The combined translational and rotational motion of a rigid body on horizontal and inclined planes. Elasticity, relations between elastic constants, bending of beam and torsion of cylinder.	8	6
7	Motion of Planets and Satellites	Two particle central force problem, reduced mass, relative and centre of mass motion. Newton's law of gravitation, gravitational field and gravitational potential. Kepler's laws of planetary motion and their deductions. Motions of geo-synchronous and geo-stationary satellites and basic idea of Global Positioning System (GPS).	7	7
8	Wave Motion	Differential equation of simple harmonic motion and its solution, use of complex notation, damped and forced oscillations, Quality factor. Composition of simple harmonic motion, Lissajous figures. Differential equation of wave motion. Plane progressive waves in fluid media, reflection of waves and phase change, pressure and energy distribution. Principle of superposition of waves, stationary waves, phase and group velocity.	7	8

Reference Books:

Units 1-4

- Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: Vector Analysis", McGraw Hill, 2017, 2e
- A.W. Joshi, "Matrices and Tensors in Physics", New Age International Private Limited, 1995, 3e

Units 5-8

- Charles Kittel, Walter D. Knight, Malvin A. Ruderman, Carl A. Helmholtz, Burton J. Moyer, "Mechanics (In SI Units): Berkeley Physics Course Vol 1", McGraw Hill, 2017, 2e
- Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 1", Pearson Education Limited, 2012
- Hugh D. Young and Roger A. Freedman, "Sears and Zemansky's University Physics with Modern Physics", Pearson Education Limited, 2017, 14e
- D.S. Mathur, P.S. Hemne, "Mechanics", S. Chand Publishing, 1981, 3e

e-Learning Source:

MIT Open Learning - Massachusetts Institute of Technology, <https://openlearning.mit.edu/>

National Programme on Technology Enhanced Learning (NPTEL), <https://www.youtube.com/user/nptelhrd>

Uttar Pradesh Higher Education Digital Library, <http://heecontent.upsdc.gov.in/SearchContent.aspx>

Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

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	-	-	-	-	-	1	2	-	1	-	-
CO2	3	-	-	-	-	-	2	3	-	1	-	-
CO3	3	-	-	-	-	-	3	3	-	2	-	-
CO4	3	-	-	-	-	-	3	3	-	3	-	-
CO5	3	-	-	-	-	-	3	3	-	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 with Chemistry	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: 2022-23							
Course Code	B030102P/MT137	Title of the Course	Practical Using Mathematica/MATLAB	L	T	P	C
Year	First	Semester	First	0	0	4	2
Pre-Requisite	10+2 with Mathematics	Co-requisite					
Course Objectives	The main objective of the course is to equip the student to plot the different graph and solve the different types of equations by plotting the graph using different computer software such as Mathematica/MATLAB /Maple/Scilab/Maxima etc.						

Course Outcomes	
CO1	The students will be able to plot the different graphs of the functions: ax , $[x]$, x^{2n} , $x = e^x$, $x^2 + 1 = e^x$, $1 - x^2 = e^x$, $x = \log_{10}(x)$, $\cos(x) = x$, $\sin(x) = x$, $\cos(y) = \cos(x)$, $\sin(y) = \sin(x)$ etc. Also they will be able to plot the graphs of polynomial of degree 2,3, 4 and 5, and their first and second derivatives and tracing of conic in Cartesian coordinates.
CO2	After completion of this course student would be able to know the convergence of sequences through plotting, verify Bolzano-Weierstrass theorem through plotting the sequence, Cauchy's root test by plotting n^{th} roots and Ratio test by plotting the ratio of n^{th} and $(n + 1)^{\text{th}}$ term.
CO3	Student would be able to plot Complex numbers and their representations, Operations like addition, subtraction, Multiplication, Division, Modulus and Graphical representation of polar form.
CO4	Student would be able to perform following task of matrix as Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigenvectors, Eigen values, Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations.
CO5	The students will be able to know about study the convergence/divergence of infinite series by plotting their sequences of partial sum.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Plotting the graphs of the following functions: i. ax , $[x]$ (greatest integer function), x^{2n} ; $n \in \mathbb{N}$, x^{2n-1} ; $n \in \mathbb{N}$, $c \pm ax + b $, $c \pm \sqrt{ax + b}$, ii. $\sin(ax + b)$, $\cos(ax + b)$, $ \sin(ax + b) $, $ \cos(ax + b) $, for e^{ax+b} , $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $ \sin(ax + b) $, $ \cos(ax + b) $. Observe and discuss the effect of changes in the real constants a and b on the graphs	4	1
2		By plotting the graph find the solution of the equations $x = e^x$, $x^2 + 1 = e^x$, $1 - x^2 = e^x$, $x = \log_{10}(x)$, $\cos(x) = x$, $\sin(x) = x$, $\cos(y) = \cos(x)$, $\sin(y) = \sin(x)$ etc	4	1
3		Plotting the graphs of polynomial of degree 2,3, 4 and 5, and their first and second derivatives.	4	1
4		Sketching parametric curves, e.g., Trochoid, Cycloid, Epicycloid and Hypocycloid etc.	4	1
5		Tracing of conic in Cartesian coordinates.	4	1
6		Graph of circular and hyperbolic functions.	4	1
7		Obtaining surface of revolution of curves	4	1
8		Complex numbers and their representations, Operations like addition, Multiplication, Division, Modulus. Graphical representation of polar form.	4	3
9		Find numbers between two real numbers and plotting of finite and infinite subset of \mathbb{R} .	4	3
10		Matrix Operations: Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigen vectors, Eigen values, Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations.	4	4
11		Study the convergence of sequences through plotting.	4	5
12		Verify Bolzano-Weierstrass's theorem through plotting of sequences and hence identify convergent subsequences from the plot.	4	2
13		Study the convergence/divergence of infinite series by plotting their sequences of partial sum.	4	5
14		Cauchy's root test by plotting n -th roots.	4	5
15		Ratio test by plotting the ratio of n -th and $(n + 1)$ -th term.	4	5

Reference Books:
Suggested Readings: A Guide to MATLAB®: For Beginners and Experienced Users 3rd Edition, Kindle Edition by Brian R. Hunt

e-Learning Source:
[Teaching Calculus with MATLAB - MATLAB & Simulink \(mathworks.com\)](http://mathworks.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						2	3	2	3	3	3
CO2	3						3	3	3	2	2	2
CO3	3						3	3	3	2	3	3
CO4	3						3	3	3	3	3	3
CO5	3						2	3	2	3	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: 2022-23							
Course Code	B010102P/PY114	Title of the Course	Mechanical Properties of Matter	L	T	P	C
Year	First	Semester	First	0	0	4	2
Pre-Requisite	10+2 with Physics	Co-requisite					
Course Objectives	The purpose of this undergraduate course is to impart practical knowledge/measurements in mechanics through different experiments related to its theoretical course.						

Course Outcomes	
CO1	Understand the Moment of Inertia and find the MI of an irregular body.
CO2	Determine elastic properties of rigid materials.
CO3	Understand the surface tension and viscosity of fluid.
CO4	Analyse waves and oscillations and understand the dynamics and gravitation
CO5	Demonstrate uses of Sextant by measuring dimensions of a given object.

Unit No.	Title of the Unit	Content of Unit (*Offline)	Contact Hrs.	Mapped CO
1	Exp. No. 1	Moment of inertia of a flywheel	6	1
2	Exp. No. 2	Moment of inertia of an irregular body by inertia table	6	1
3	Exp. No. 3	Modulus of rigidity by statistical method (Barton's apparatus)	6	2
4	Exp. No. 4	Modulus of rigidity by dynamical method (sphere / disc / Maxwell's needle)	6	2
5	Exp. No. 5	Young's modulus by bending of beam	6	2
6	Exp. No. 6	Young's modulus and Poisson's ratio by Searle's method	6	2
7	Exp. No. 7	Poisson's ratio of rubber-by-rubber tubing	6	2
8	Exp. No. 8	Surface tension of water by capillary rise method	6	3
9	Exp. No. 9	Surface tension of water by Jaeger's method	6	3
10	Exp. No. 10	Coefficient of viscosity of water by Poiseuille's method	6	3
11	Exp. No. 11	Acceleration due to gravity by bar pendulum	6	4
12	Exp. No. 12	Frequency of AC mains by Sonometer	6	4
13	Exp. No. 13	Height of a building by Sextant	6	5
14	Exp. No. 14	Study the waveform of an electrically maintained tuning fork / alternating current source with the help of cathode ray oscilloscope.	6	4

Unit No.	Title of the Unit	Content of Unit (*Online Virtual Lab)	Contact Hrs.	Mapped CO
1	Exp. No. 1	Torque and angular acceleration of a fly wheel	6	1
2	Exp. No. 2	Torsional oscillations in different liquids.	6	4
3	Exp. No. 3	Moment of inertia of flywheel.	6	1
4	Exp. No. 4	Newton's second law of motion.	6	4
5	Exp. No. 5	Ballistic pendulum.	6	4
6	Exp. No. 6	Collision balls.	6	2
7	Exp. No. 7	Projectile motion.	6	4
8	Exp. No. 8	Elastic and inelastic collision.	6	2

Reference Books:

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e
3. R.K. Agrawal, G. Jain, R. Sharma, "Practical Physics", Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019
4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014, 2e

e-Learning Source:

1. Virtual Labs at Amrita Vishwa Vidyapeetham, <https://vlab.amrita.edu/?sub=1&brch=74>
2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities.

*** A student has to perform at least 7 experiments from the Offline Experiment List and 3 from the Online Virtual Lab Experiment List / Link.**

Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2						3	3			3
CO2	2						3	3			3
CO3	3						2	3			3
CO4	2						3	3			3
CO5	3						2	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	B020102P/CH134	Title of the Course	Quantitative Analysis	L	T	P	C
Year	First	Semester	First	0	0	4	2
Pre-Requisite	10+2 with Chemistry	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: 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 with Chemistry	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	

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	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

(Physics, Chemistry, Mathematics)

2nd Semester

Syllabi



Integral University, Lucknow

Effective from Session: 2022-23

Course Code	B030201T/MT138	Title of the Course	Matrices and Differential Equations & Geometry	L	T	P	C
Year	First	Semester	First	6	0	0	6
Pre-Requisite	10+2 with Mathematics	Co-requisite					
Course Objectives	The purpose of this undergraduate course is to impart details and key knowledge of Matrices and Differential Equations & Geometry. After successfully completion of course, the student will able to explore subject into their respective dimensions.						

Course Outcomes

CO1	The students will be able to define types of Matrices, Rank of a Matrix, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a system of linear equations. Also, students will be able to find Eigen values, Eigen vectors, Cayley-Hamilton theorem, real and imaginary parts, Exponential and Logarithmic functions Inverse trigonometric and hyperbolic functions.
CO2	The student will be able to learn and visualize the fundamental ideas about formation of differential equations, Geometrical meaning of a differential equation
CO3	The students will be to learn and visualize first order higher degree equations solvable for x, y, p, Clairaut's equation and singular solutions, orthogonal trajectories, Linear differential equation of order greater than one with constant coefficients.
CO4	On successful completion of the course students have gained knowledge about to trace of conics, Confocal conics, Polar equation of conics and its properties, Three-Dimensional Coordinates system.
CO5	The student will be able to describe Sphere, Cone and Cylinder, Central conicoids, Paraboloids, lines, Confocal conicoids, Reduction of second degree equations.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Types of Matrices, Elementary operations on Matrices, Rank of a Matrix, Echelon form of a Matrix, Normal form of a Matrix, Inverse of a Matrix by elementary operations, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a system of linear equations.	12	1
2		Eigen values, Eigen vectors and characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding inverse of a matrix, Complex functions and separation into real and imaginary parts, Exponential and Logarithmic functions Inverse trigonometric and hyperbolic functions.	11	1
3		Formation of differential equations, Geometrical meaning of a differential equation, Equation of first order and first degree, Equation in which the variables are separable, Homogeneous equations, Exact differential equations and equations reducible to the exact form, Linear equations.	11	2
4		First order higher degree equations solvable for x, y, p, Clairaut's equation and singular solutions, orthogonal trajectories, Linear differential equation of order greater than one with constant coefficients, Cauchy- Euler form.	11	3
5		General equation of second degree, System of conics, Tracing of conics, Confocal conics, Polar equation of conics and its properties.	12	4
6		Three-Dimensional Coordinates, Projection and Direction Cosine, Plane (Cartesian and vector form), Straight line in three dimension (Cartesian and vector form).	11	4
7		Sphere, Cone and Cylinder.	11	5
8		Central conicoids, Paraboloids, Plane section of conicoids, Generating lines, Confocal conicoids, Reduction of second degree equations.	11	5

Reference Books:

Stephen H. Friedberg, A.J Insel & L.E. Spence, Linear Algebra, Person
 B. Rai, D.P. Choudhary & H. J. Freedman, A Course in Differential Equations, Narosa
 D.A. Murray, Introductory Course in Differential Equations, Orient Longman
 Robert J.T Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Macmillan India Ltd.

e-Learning Source:

Suggestive digital platforms web links/platform: NPTEL/SWAYAM/MOOCs

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	3	2	3	3
CO2	3						3	3	2	3	3	2
CO3	3						3	2	2	3	3	2
CO4	3						3	3	3	2	3	3
CO5	3						2	3	2	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: 2022-23							
Course Code	B010201T/PY115	Title of the Course	Thermal Physics and Semiconductor Devices	L	T	P	C
Year	First	Semester	Second	4	0	0	4
Pre-Requisite	10+2 with Physics	Co-requisite					
Course Objectives	The objective of this undergraduate course is to impart the knowledge of basic and advance concepts of thermodynamics, circuit fundamentals and basic electronics.						

Course Outcomes	
CO1	Recognize the difference between reversible and irreversible processes and understand the physical significance of thermodynamical potentials.
CO2	Comprehend the kinetic model of gases w.r.t. various gas laws.
CO3	Study the implementations and limitations of fundamental radiation laws.
CO4	Understand the utility of AC bridges and recognize the basic components of electronic devices.
CO5	Design simple electronic circuits and understand the applications of various electronic instruments.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	0th & 1st Law of Thermodynamics	State functions and terminology of thermodynamics. Zeroth law and temperature. First law, internal energy, heat and work done. Work done in various thermodynamical processes. Enthalpy, relation between CP and CV. Carnot's engine, efficiency and Carnot's theorem. Efficiency of internal combustion engines (Otto and diesel).	8	1
2	2nd & 3rd Law of Thermodynamics	Different statements of second law, Clausius inequality, entropy and its physical significance. Entropy changes in various thermodynamical processes. Third law of thermodynamics and unattainability of absolute zero. Thermodynamical potentials, Maxwell's relations, conditions for feasibility of a process and equilibrium of a system. Clausius- Clapeyron equation, Joule-Thompson effect.	8	2
3	Kinetic Theory of Gases	Kinetic model and deduction of gas laws. Derivation of Maxwell's law of distribution of velocities and its experimental verification. Degrees of freedom, law of equipartition of energy (no derivation) and its application to specific heat of gases (mono, di and poly atomic).	7	3
4	Theory of Radiation	Blackbody radiation, spectral distribution, concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan- Boltzmann law and Wien's displacement law from Planck's law.	7	4
5	DC & AC Circuits	Growth and decay of currents in RL circuit. Charging and discharging of capacitor in RC, LC and RCL circuits. Network Analysis - Superposition, Reciprocity, Thevenin's and Norton's theorems. AC Bridges - measurement of inductance (Maxwell's, Owen's and Anderson's bridges) and measurement of capacitance (Schering's, Wein's and de Sauty's bridges).	7	5
6	Semiconductors & Diodes	P and N type semiconductors, qualitative idea of Fermi level. Formation of depletion layer in PN junction diode, field & potential at the depletion layer. Qualitative idea of current flow mechanism in forward & reverse biased diode. Diode fabrication. PN junction diode and its characteristics, static and dynamic resistance. Principle, structure, characteristics and applications of Zener, Tunnel, Light Emitting, Point Contact and Photo diodes. Half and Full wave rectifiers, calculation of ripple factor, rectification efficiency and voltage regulation. Basic idea about filter circuits and voltage regulated power supply.	8	6
7	Transistors	Bipolar Junction PNP and NPN transistors. Study of CB, CE & CC configurations w.r.t. active, cutoff & saturation regions; characteristics; current, voltage & power gains; transistor currents & relations between them. Idea of base width modulation, base spreading resistance & transition time. DC Load Line analysis and Q-point stabilisation. Voltage Divider Bias circuit for CE amplifier. Qualitative discussion of RC coupled amplifier (frequency response not included).	7	7
8	Electronic Instrumentation	Multimeter: Principles of measurement of dc voltage, dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, electron gun, electrostatic focusing and acceleration (no mathematical treatment). Front panel controls, special features of dual trace CRO, specifications of a CRO and their significance. Applications of CRO to study the waveform and measurement of voltage, current, frequency & phase difference.	8	8

Reference Books:

M.W. Zemansky, R. Dittman, "Heat and Thermodynamics", McGraw Hill, 1997, 7e
F.W. Sears, G.L. Salinger, "Thermodynamics, Kinetic theory & Statistical thermodynamics", Narosa Publishing House, 1998
Enrico Fermi, "Thermodynamics", Dover Publications, 1956
S. Garg, R. Bansal, C. Ghosh, "Thermal Physics", McGraw Hill, 2012, 2e
Meghnad Saha, B.N. Srivastava, "A Treatise on Heat", Indian Press, 1973, 5e
R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e
A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e
S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e

e-Learning Source:Swayam - Government of India, <https://swayam.gov.in/explorer?category=Physics>National Programme on Technology Enhanced Learning (NPTEL), <https://nptel.ac.in/course.html>Coursera, <https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy>edX, <https://www.edx.org/course/subject/physics>MIT Open Course Ware - Massachusetts Institute of Technology, <https://ocw.mit.edu/courses/physics/>**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			2	3	3		1		
CO2	3						3	3		1		
CO3	3		2			2	3	3		1		
CO4	3		1				3	3		2		
CO5	3		2				3	3		2		

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

Name & Sign of Program Coordinator

Sign & Seal of HoD



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 Chemistry	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/>

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	-	-	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: 2022-23							
Course Code	B010202P/PY116	Title of the Course	Thermal Properties of Matter & Electronic Circuits	L	T	P	C
Year	First	Semester	Second	0	0	4	2
Pre-Requisite	10+2 with Physics	Co-requisite					
Course Objectives	The purpose of this undergraduate course is to impart practical knowledge/measurements in mechanics through different experiments related to its theoretical course.						

Course Outcomes	
CO1	Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the thermal properties.
CO2	Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the electronic properties.
CO3	Measurement precision and perfection is achieved through Lab Experiments.
CO4	Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Unit No.	Title of the Unit	Content of Unit (*Offline)	Contact Hrs.	Mapped CO
1	Exp. No. 1	Mechanical Equivalent of Heat by Callender and Barne's method	6	1/3
2	Exp. No. 2	Coefficient of thermal conductivity of copper by Searle's apparatus	6	1/3
3	Exp. No. 3	Coefficient of thermal conductivity of rubber	6	1/3
4	Exp. No. 4	Coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method	6	1/3
5	Exp. No. 5	Value of Stefan's constant	6	1/3
6	Exp. No. 6	Verification of Stefan's law	6	1/3
7	Exp. No. 7	Variation of thermo-emf across two junctions of a thermocouple with temperature	6	2/3
8	Exp. No. 8	Temperature coefficient of resistance by Platinum resistance thermometer	6	2/3
9	Exp. No. 9	Charging and discharging in RC and RCL circuits	6	2/3
10	Exp. No. 10	A.C. Bridges: Various experiments based on measurement of L and C	6	2/3
11	Exp. No. 11	Resonance in series and parallel RCL circuit	6	2/3
12	Exp. No. 12	Characteristics of PN Junction, Zener, Tunnel, Light Emitting and Photo diode	6	2/3
13	Exp. No. 13	Characteristics of a transistor (PNP and NPN) in CE, CB and CC configurations	6	2/3
14	Exp. No. 14	Half wave & full wave rectifiers and Filter circuits	6	2/3
15	Exp. No. 15	Unregulated and Regulated power supply	6	2/3
16	Exp. No. 16	Various measurements with Cathode Ray Oscilloscope (CRO)	6	2/3
Unit No.	Title of the Unit	Content of Unit (*Online Virtual Lab)	Contact Hrs.	Mapped CO
1	Exp. No. 1	Heat transfer by radiation	6	1/3/4
2	Exp. No. 2	Heat transfer by conduction	6	1/3/4
3	Exp. No. 3	Heat transfer by natural convection	6	1/3/4
4	Exp. No. 4	The study of phase change	6	1/3/4
5	Exp. No. 5	Black body radiation: Determination of Stefan's constant	6	1/3/4
6	Exp. No. 6	Newton's law of cooling	6	1/3/4
7	Exp. No. 7	Lee's disc apparatus	6	1/3/4
8	Exp. No. 8	Thermo-couple: Seebeck effects	6	1/3/4
9	Exp. No. 9	Familiarisation with resistor	6	2/3/4
10	Exp. No. 10	Familiarisation with capacitor	6	2/3/4
11	Exp. No. 11	Familiarisation with inductor	6	2/3/4
12	Exp. No. 12	Ohm's Law	6	2/3/4
13	Exp. No. 13	RC Differentiator and integrator	6	2/3/4
14	Exp. No. 14	VI characteristics of a diode	6	2/3/4
15	Exp. No. 15	Half & Full wave rectification	6	2/3/4
16	Exp. No. 16	Capacitative rectification	6	2/3/4
17	Exp. No. 17	Zener Diode voltage regulator	6	2/3/4
18	Exp. No. 18	BJT common emitter characteristics	6	2/3/4
19	Exp. No. 19	BJT common base characteristics	6	2/3/4
20	Exp. No. 20	Studies on BJT CE amplifier	6	2/3/4

Reference Books:

- B. L. Worsnop, H. T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e
 S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e
 R. L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
 A. Sudhakar, S. S. Palli, "Circuits and Networks: Analysis and Synthesis", McGrawHill, 2015, 5e

e-Learning Source:

Virtual Labs at Amrita Vishwa Vidyapeetham, <https://vlab.amrita.edu/?sub=1&brch=194>

Virtual Labs an initiative of MHRD Govt. of India, <http://vlabs.iitkgp.ac.in/be/#>

Digital Platforms/Web Links of other virtual labs may be suggested/added to this list by individual Universities.

*** A student has to perform at least 7 experiments from the Offline Experiment List and 3 from the Online Virtual Lab Experiment List / Link.**

Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2						3	3			3
CO2	2						3	3			3
CO3	3						2	3			2
CO4	2						3	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	B020102P/CH141	Title of the Course	Biochemical Analysis	L	T	P	C
Year	First	Semester	Second	0	0	4	2
Pre-Requisite	10+2 Chemistry	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	

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: 2022-2023							
Course Code	B150101T/ES125	Title of the Course	Basics of Environmental Science	L	T	P	C
Year	First	Semester	First	3	1	0	4
Pre-Requisite	10+2	Co-requisite					
Course Objectives	This course provides students with a working knowledge of concept of environment and the relation between human and its relation with the environment.						

Course Outcomes

CO1	Gain knowledge about origin of life and related theories.
CO2	Learn fundamental concept of environmental science.
CO3	Develop the understanding about environmental education and able to understand the relationship between human and environment.
CO4	Understand the concept of sustainable development and SDG and also able to understand the current scenario of environmental degradation.
CO5	Learn the significance and importance of environmental management and have the practical knowledge about the affected areas of environment.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Evolution	Origin of life and speciation, Darwinism and modern synthetic theory of evolution, Natural Selection; Biochemical basis of origin of life; Hardy Weinberg Equilibrium; Genetic drift.	5	1
2	Concept of Environment	Definition, Principles and Scope of Environmental Science; Environment, its components and segments; Moral and Aesthetic Nature of Environmental Science; Objectives and Historic roots of the subject; for Public Awareness.	5	2
3	Environmental	Goals of environmental education; Environmental Literacy, Environmental Careers, Environmental Justice, Individual Organisms, Environmentalism, Environmental Education at Primary, Secondary level.	5	3
4	Man and Environment	Man-Environment relationships; Impacts of human activity on environment (Agriculture, transportation, mining, urbanization, industrialization); Environmental Degradation and Conservation Issues, Modern concept of environmental conservation	5	3
5	Sustainable development	Concept and Significance of sustainable development, Core elements of sustainable development, Over-view of SDG (Sustainable Development Goals).	5	4
6	Current Environmental Issues	All effects of fireworks and environmental degradation, Climate change and its effects on human health, Deforestation and its impacts on human communities and flora and fauna of the Environment.	5	4
7	Environmental Management	Significance of Environment Management, Resettlement and rehabilitation of project affected areas, Environmental ethics: Role of Indian's religions and cultures in environmental conservation, Communication and public awareness programmes for environment management.	5	5
8	Field Survey	Assessment of impacts of anthropogenic activities in the surrounding environment; Evaluation of the consequences rising from agricultural and commercial logging practices to preserve environment, case study, Reclamation and monitoring of the affected area by developmental activities: case study.	5	5

Reference Books:

- Environmental Science by William P. Cunningham and Mary Ann Cunningham; McGraw-Hill Publications.
- Environmental Science: Earth as a Living Planet by Botkin and Keller; JOHN WILEY & SONS, INC
- A text Book of Environment Studies, Asthana, D. K. and Asthana, M. 2006, S. Chand & Co.
- Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
- Atmosphere, Weather and Climate, Barry, R. G. 2003, Routledge Press, UK.
- Environmental Science: S. C. Santra, New Central Book Agency.

e-Learning Source:

- Environmental Science, Dr. Y. K. Singh, <https://www.hzu.edu.in/bed/E%20V%20S.pdf>
- Textbook for Environmental Studies, Erach Bharucha, <https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf>
- Fundamentals of Environmental Studies, <https://www.jkcprl.ac.in/download/11567250727.pdf>

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	3	2											2	2		
CO2	3	3											3	2			
CO3	2	2											2	3			
CO4	3	3											2	2			
CO5	2	1											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	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: 2022-23							
Course Code	MT144	Title of the Course	LaTeX – Scientific Writing	L	T	P	C
Year	First	Semester	Second	2	0	2	3
Pre-Requisite	Basic knowledge of LaTeX	Co-requisite					
Course Objectives	The course aims to teach the basic features. By attending the course students should acquire all necessary skills to be able to prepare a moderate scientific paper and a short mathematical presentation using LaTeX.						
Course Outcomes							
CO1	Create and interpret the mathematical notations, mathematical operators, mathematical expressions.						
CO2	Create and interpret the bibliography, citing bibliographic, BIBTEX, natbib package.						
CO3	Create and interpret the list of Contents and Index, rules, dots, hyperlinking, watermarking.						
CO4	Create and interpret the letter writing, article preparation, preparation of book, report writing.						
CO5	Create and interpret frames in presentation, presentation structure, environments in Beamer class.						
CO6	Understand and interpret the Error messages, removal of errors, warning messages, tips for debugging						

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Equation Writing	Basic mathematical notations and delimiters, mathematical operators, mathematical expressions, simple equations, equation numbering, array equations, left aligning, sub – numbering, texts and blank spaces, splitting an equation, vector and matrix, overlining and underlining, stacking terms, side by side equations.	9	1
2	Bibliography	Preparation of bibliography, citing bibliographic reference, bibliography with the BIBTEX program, BIBTEX compatible reference database, standard bibliography styles, natbib package, multiple bibliography.	7	2
3	List of Contents and Index	Lists of contents; Information to the list of contents, formatting list of contents, multiple list of contents, making index, rotated items, rules, dots, hyperlinking, current date and time, highlighted texts, verbatim, watermarking, logo in header and footer, paragraph in different forms.	7	2
4	Letter, Article, Books and Report	Letter writing, Article preparation, list of authors, title and abstract, left aligned title, article in multiple columns, section wise numbering, dividing an article, template of a book, preparation of book, dividing a book into parts, report writing.	8	3
5	Slide Preparation	Frames in presentation, sectional units, presentation structure; title page, appearance of a presentation, themes, frame customization, piece wise presentation, environments in Beamer class, table and figures, dividing frame column wise, repeating slides, jumping to other slides.	8	5
6	Error and Warning Messages	Error messages, removal of errors, warning messages, error without any message, tips for debugging, commonly generated errors, errors due to packages, errors in equation environment.	6	6

Reference Books:

Stefen Kottwitz, LaTeX – Beginner’s Guide, Packt Publishing, Birmingham (2011).

H. Kopka and P. W. Daly, A Guide to LaTeX, Addison Wesley Publishing.

Dilip Dutta: LaTeX in 24 Hours, Springer.

e-Learning Source:

1. [https://www.overleaf.com/learn/latex/Free_online_introduction_to_LaTeX_\(part_1\)](https://www.overleaf.com/learn/latex/Free_online_introduction_to_LaTeX_(part_1))
2. https://spoken-tutorial.org/tutorial-search/?search_foss=LaTeX&search_language=English
3. <https://swayam.gov.in/explorer?searchText=LaTeX>

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	3	3	3	2
CO2	3						3	3	3	2	2	3
CO3	3						3	3	2	3	3	3
CO4	3						3	3	2	2	3	2
CO5	3						1	2	1	3	2	1
CO6	3						1	2	1	3	2	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	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 Chemistry	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	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	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	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
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

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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