DEPARTMENT OF CHEMISTRY

Bachelor of Science

(Physics, Chemistry, Mathematics)

3rd Semester

Syllabi

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	PY201	**Title of the Course**	Circuit Fundamentals and Basic Electronics	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 with Physics	**Co-requisite**					
Course Objectives	1. To understand the basic concepts of Growth and decay of currents through inductive resistances,RC and RLC and explain principle of operation for various AC bridges. 2. To understand the basic concepts of various semi-conductor material. 3. To learn the concept of BJT and feedback amplifier. 4. To understand the basic concepts of oscillators and op-amp. **5.** To understand the basic concepts of modulation and learn the working of electronic instruments.						

Course Outcomes	
CO1	Student will be able to solve complex circuit using theorems. Student will be able to measure the passive component through bridges.
CO2	Student will be able to design power supply. Student will be able to differentiate the semiconductor.
CO3	Learn the signal amplification through BJT and how to increase the gain.
CO4	Design the different oscillator circuits for various frequencies Student will be able to design the mathematical operation using op-amp
CO5	Student will be able to 1. Use of different modulation and demodulation techniques used in analog communication 2. Identify and solve basic communication problems 3. Measure the voltage, phase and frequency using CRO 4. Measure the voltage, resistance, current and capacitance using multimeter.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Circuit Fundamentals	Growth and decay of currents through inductive resistances, charging and discharging in R.C. and R.L.C. circuits, Time constant, measurement of high resistance, A.C. Bridges, Maxwell's and Scherings Bridges, Wien Bridge, Thevenin, Norton and superposition theorems and their applications.	8	1
2	Theory of Semiconductor	Semiconductors, intrinsic and extrinsic semiconductors, n-type and p-type semiconductors, unbiased diode forward bias and reverse bias diodes, diode as a rectifier, diode characteristics, zener diode, avalanche and zener breakdown, power supplies, rectifier, bridge rectifier, capacitor input filter, voltage regulation, zener regulator.	8	2
3	Transistor Basics	Bipolar transistors, three doped regions, forward and reverse bias, DC alpha, DC beta transistor curves. Transistor biasing circuits: base bias, emitter bias and voltage divider bias, DC load line, Basic AC equivalent circuits, low frequency model, small signal amplifiers, common collector amplifiers, and common base amplifiers, current and voltage gain, R.C. coupled amplifier, gain, frequency response, equivalent circuit at low, medium, and high frequencies, feedback principles.	8	3
4	Oscillators and OPAMP	Input and output impedance, transistor as an oscillator, general discussion, and theory of Hartley oscillator only. Operational amplifier (black box approach) and its ideal characteristics, virtual ground, inverting and non-inverting amplifiers, adder, integrator, and differentiator	8	4
5	Modulation and Instrumentation	Elements of transmission and reception, basic principles of amplitude and frequency modulation and demodulation. Principle and design of linear multimeters and their application, cathode ray oscillograph and its simple applications.	8	5

Reference Books:

B. G. Streetman; "Solid State Electronic Devices", IInd Edition (Prentice Hall of India, New Delhi, 1986).

W.D. Stanley: "Electronic Devices, Circuits and Applications" (Prentice-Hall).

J.D. Ryder, "Electronics Fundamentals and Applications" 2nd Edition (Prentice-Hall of India, New Delhi, 1986).

Millman and A. Grabel, "Microelectronics", International Edition (McGraw Hill Book Company, New York, 1988).

e-Learning Source:

https://nptel.ac.in

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

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

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	PY202	**Title of the Course**	Kinetic Theory and Thermodynamics	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 with Physics	**Co-requisite**	-				
Course Objectives	To provide the basic knowledge of ideal and real gases, thermodynamics of a system, basic principles and their applications. Thermodynamic potentials, heat engine and theory of radiation and to give the students a thorough understanding of the kinetic theory of gases.						

Course Outcomes	
CO1	Students will gain an understanding of the basic properties of ideal and real gases like equation of state related to these gases.
CO2	Students will be able to develop a deep understanding of various transport phenomena in ideal and real gases and temperature dependence properties.
CO3	Students will be able to understand basic laws of thermodynamics methods and their effects, working of ideal and real engine.
CO4	Students will be able to develop a deep understanding of various thermodynamic potentials, effect and heat equation of various thermodynamic systems.
CO5	Students will be able to gain knowledge of theory of Radiation and basic laws of radiation.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Ideal and Real Gases	Kinetic model, deduction of Boyle's law, interpretation of temperature, estimation of r.m.s. speeds of molecules, Brownian motion, estimate of the Avogadro number, equipartition of energy, specific heat of monatomic gas, extension to di- and triatomic gases, adiabatic expansion of an ideal gas. Vander Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves, Joule expansion of ideal gas and of a Vander Waals gas, Joule coefficient.	8	1
2	Liquefaction of Gases and Transport phenomenon	Boyle temperature and inversion temperature, principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium gas, Refrigeration cycles, meaning of efficiency. Molecular collisions mean free path and collision cross sections. Transport of mass, momentum and energyandinterrelationship.	8	2
3	The Laws of Thermodynamics	The zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function and other applications, Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, different versions of the second law, Entropy, principle of increase of entropy, third law of thermodynamics, impossibility of attaining the absolute zero, Seebeck, Peltier and Thomson effect.	8	3
4	Thermodynamic Potentials	Extensive and intensive, Enthalpy, Gibbs, Helmholtz and internal energy functions. Maxwell's thermo dynamical relations & applications - Joule-Thompson Effect, Clausius-Clapeyron heat Equation, Expression for $(C_P - C_V)$, C_P/C_V,TdSequations.	8	4
5	Theory of Radiation	Blackbody radiation, pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, spectral distribution of Black body radiation. Wien's displacement law, Rayleigh-Jean's law, Planck's law theultra-violetcatastrophy.	8	5

Reference Books:

G. G. Agarwal and H.P. Sinha "Thermal Physics".

S. K. Agarwal and B.K. Agarwal "Thermal Physics".

M.W. Zemansky, "Heat and thermodynamics (6th Edition McGraw Hill).

e-Learning Source:

https://www.youtube.com/watch?v=AKyJwI5jkjs

https://www.youtube.com/watch?v=ju7akwzEmAw

https://www.youtube.com/watch?v=4G_dLx4M76A

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

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

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CH221	**Title of the Course**	Inorganic and Physical Chemistry-I	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**2**	**1**	**0**	**3**
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	This course aims to provide fundamental knowledge of elements of block s and p, noble gas chemistry, heat, and thermodynamics. This course would play a significant role in higher studies.						

Course Outcomes	
CO1	Explain the properties of alkali and alkaline earth metals, and their oxides, hydrides etc. Diagonal relationship
CO2	Discuss the structure of diborane, Lewis acid nature of boron trihalides, preparation of carbides & silicones, preparation & industrial applications of nitride, hydrazine & hydroxylamine.
CO3	Explain types of oxides and oxyacids, their structure and of inter-halogen compounds, pseudo halogens & clatherate compounds
CO4	Use thermochemical equations to relate the amount of heat energy transferred in reactions in reactions at constant pressure (ΔH) to the amount of substance involved in the reaction
CO5	Demonstrate understanding of key concepts related to the second law of thermodynamics, including alternative statements of the second law, the internally reversible process, and the Kelvin temperature scale

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Chemistry of s Block Elements	General characteristics: melting point, flame colour, reducing nature, diagonal relationships and anomalous behavior of first member of each group. Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogen and water. solvation and complex formation by S- block.	7	1
2	Chemistry of p Block Elements	Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like oxides, oxyacids and of group 13-16, hydrides of boron-diborane and higher boranes, borazine, fluorocarbons, silicates (structural principle), tetrasulphur tetra nitride, basic properties of halogens, interhalogens and polyhalides.	7	2
3	Chemistry of Noble Gasses	Chemical properties of the noble gases, discovery of O^{2+} PtF^{6-} and O_2XeF_6.Chemistry of xenon, structure and bonding in xenon compounds.	7	3
4	Thermochemistry	Standard state, standard enthalpy of formation – Hess's Law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy,Kirchhoff's equation.	7	4
5	Second Law of Thermodynamics	Need for the law, different statements of the law, Cornot's cycle and its efficiency, Carnot's theorem. Thermodynamic scale of temperature. Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, clausius inequality, entropy as a criteria of spontaneity and equilibrium. Gibbs and Helmholtz functions: Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities.	7	5

Reference Books:

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

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

Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry,Oxford, 1970.

Castellan, G. W. Physical Chemistry, Published by Narosa.

Physical Chemistry, Puri Sharma &Pathania. Peter, A. & Paula, J. de. Physical Chemistry 9th Ed., Oxford University Press

e-Learning Source:

https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/104101090/lec1.pdf

https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/104106096/lec9.pdf

https://ocw.mit.edu/high-school/chemistry/exam-prep/structure-of-matter/chemical-bonding/

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

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

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CH222	**Title of the Course**	Organic and Physical Chemistry-I	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	Students will be able to understand the about the chemistry of aliphatic hydrocarbons, properties, mechanism of addition and elimination reactions, conformational analysis of alkanes and cycloalkanes, stability and reactivity, aromaticity and substitution reactions of homocyclic& heterocyclic compounds,solutions and colligative properties and chemicalEquilibrium.						

CourseOutcomes	
CO1	Understanding of mechanism of eliminations, oxymercuration-demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation, Allylic and benzylicbromination.
CO2	Comprehension of conformational analysis, Relative stability and energy diagrams of alkanes, Chair, Boat and Twist boat forms ofcyclohexane with energy diagrams, analyse and compare relative stability of mono substituted cycloalkanes.
CO3	To create basics for the aromaticity, Hückel's rule, of homocyclic& heterocyclic compounds, electrophillic and substitution reactions & theirmechanism, directing effects of the groups.
CO4	Able to evaluate different types colligative properties like relative lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure and amount of solute.Know about lowering of vapour pressure, Raoult's and Henry's Laws and theirapplications,
CO5	Analyze the criteria of thermodynamic equilibrium, chemical equilibria in ideal gases, Le Chatelier Principle, equilibrium between ideal gases and a pure condensed phase.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Chemistry of aliphatic hydrocarbons	General methods of preparation, physical and chemical properties of alkenes and alkynes, Mechanism of E1, E2, E1CB reactions. Saytzeff and Hofmann eliminations. Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2 and 1,4-addition reactions in conjugated dienes and Diels-Alder reaction; Allylic and benzylicbromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.	8	1
2	Conformational analysis of alkanes and cycloalkanes	Conformational analysis of alkanes: Relative stability and Energy diagrams. Types of cycloalkanes and their relative stability, Baeyer strain theory: Chair, Boat and Twist boat forms of cyclohexane with energy diagrams; Relative stability of mono substituted cycloalkanes, cyclopropane ring, banana bonds.	8	2
3	Aromatic hydrocarbons	Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups: Activating and deactivating substituents, orientation and ortho/para ratio, Side chain reactions of benzene derivatives, Birch reduction; Methods of formation and chemical reactions ofalkylbenzenes, alkynylbenzenes and biphenyl, naphthalene and Anthracene..	8	3
4	Solutions and colligative properties	Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Thermodynamic derivation using chemical potential to derive relations between the four colligative properties (i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) depression of freezing point, (iv) osmotic pressure and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.	8	4
5	Chemical equilibrium	Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration (Le Chatelier Principle, Quantitatively). Free energy of mixing and spontaneity. equilibrium between ideal gases and a pure condensed phase	8	5

Reference Books:

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

Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. Published by Pearson Education.

Francis Carey Organic Chemistry, Published by McGraw-Hill Education.

Physical Chemistry, Puri Sharma &Pathania.

Peter, A. & Paula, J. de. Physical Chemistry 9th Ed., Oxford University Press.

e-Learning Source:

https://study.com/academy/lesson/unsaturated-hydrocarbon-definition-examples.html

https://mymedia.ou.edu/media/Lecture+13+-+Conformations+of+Alkanes+and+Cycloalkanes+%5BCHEM3053-001%5D/0_rmpfppnb

https://www.google.com/search?q=solutions+and+colligative+properties

https://onlinecourses.nptel.ac.in/noc22_cy39/preview

https://www.google.com/search?q=chemical+equilibrium+with+applications

	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	1	-	-	2	3	3	2	-	2	2
CO2	3	1	1	-	-	2	3	3	2	-	2	2
CO3	3	1	-	-	-	2	3	3	2	-	2	2
CO4	3	-	-	-	-	2	3	3	2	3	2	2
CO5	3	-	1	-	-	2	3	3	2	3	2	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: 2020-21							
Course Code	MT211	**Title of the Course**	Numerical Computing	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 with Mathematics	**Co-requisite**					
Course Objectives	The course is aimed to develop the skills in mathematics especially in Numerical Computing which is necessary for grooming them into successful science graduate. The topics introduced will serve as basic tools for specialized studies in science field.						

Course Outcomes	
CO1	Apply numerical methods to find the solution of algebraic and transcendental equations using different methods under different conditions, and numerical solution of system of algebraic equations
CO2	Apply different interpolation methods and finite difference concepts
CO3	Apply central interpolation methods and interpolation techniques for unequal intervals
CO4	Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
CO5	Work numerically on the ordinary differential equations using different method through the theory of finite differences.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Solution of Algebraic & Transcendental Equations and Linear System of Equations	Bisection Method, Method of False Position, Iteration Method, Secant Method, Newton-Raphson's Method and their convergence. LU decomposition Method, Gauss- Seidel Method.	8	1
2	Finite Differences and Interpolation	Forward and Backward Difference Operators, Difference Table, Shift and Averaging operators, Relation between Operators, Factorial polynomials. Polynomial interpolation, Newton-Gregory forward and backward interpolation formulae.	8	2
3	Central Interpolation and Interpolation for Unequal Intervals	Gauss forward and backward formula, Stirling's, Bessel's and Laplace-Everett's formulae. Lagrange's interpolation formula, divided differences and Newton's divided difference interpolation formula.	8	3
4	Numerical Differentiation & Integration	Numerical differentiation and errors in Numerical differentiation, Newton-Cotes formula, Trapezoidal rule, Simpson's rule, Boole's, Weddle's and Euler Maclaurin's formulae.	8	4
5	Numerical Solutions of Ordinary Differential Equations	Picard's and Taylor's Series, Euler's Method, Runge-Kutta fourth order Method, Solution of Boundary value problem by finite difference Method .	8	5

Reference Books:

Qazi Shoeb Ahmad, Zubair Khan and Shadab Ahmad Khan, Numerical and Statistical Techniques, Ane Books India, 2015**.**

M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 7th Ed., New Age International Publishers, 2007.

Numerical Methods by P. Kandasamy, S. Chand Publication, New Delhi.

Introduction to Numerical Analysis, by S.S. Sastry, Prentice Hall of India.

e-Learning Source:

https://www.youtube.com/watch?v=_f_Pu7t9eP8

https://www.youtube.com/watch?v=3B3lGO7wERE

https://www.youtube.com/watch?v=1g0G_kjA560&list=PLq-Gm0yRYwTguDcfylj1ZicXxzdZCAr5S&index=4

https://www.youtube.com/watch?v=K193avJMCd4&list=PLq-Gm0yRYwTguDcfylj1ZicXxzdZCAr5S&index=5

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

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

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	PY203	**Title of the Course**	Electronics and Thermal Physics Lab	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**0**	**0**	**6**	**3**
Pre-Requisite	10+2 with Physics	**Co-requisite**					
Course Objectives	The purpose of this undergraduate course is to impart practical knowledge of the electronics and thermal physics through different experiments related to its theoretical course.						

Course Outcomes	
CO1	To analyze the two basic semiconductor devices (PN Junction and Zener Diode) graphically.
CO2	To Study the characteristics of transistor in different configurations and its application as an amplifier and oscillator in a circuit.
CO3	To understand the functioning of different components used in a regulated power supply.
CO4	To evaluate the value of Stefan's constant for a body and also analyze the behaviour of a thermocouple.
CO5	To practically calculate the mechanical equivalent of heat of a substance in liquid state.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Exp-01	To study the frequency response of RC coupled amplifier.	6	2
2	Exp-02	To draw the characteristic of PN junction diode.	6	1
3	Exp-03	To study the characteristics of a transistor in CE, CB and CC configurations.	6	2
4	Exp-04	To study of Regulated Power Supply.	6	3
5	Exp-05	To calibrate an oscillator (Hartley/Phase shift) using CRO	6	2
6	Exp-06	To draw the characteristic of a Zener diode.	6	1
7	Exp-07	Determination of Stefan's constant.	6	4
8	Exp-08	To study the characteristics of a thermocouple.	6	4
9	Exp-09	To determine the mechanical equivalent of heat by Callender and Barne's constant flow method.	6	5
10	Exp-10	To find the mechanical equivalent of heat using Joule's calorimeter.	6	5

Reference Books:

Practical Physics. by R. K. Shukla, New Age International Private Limited; Third edition.

B.Sc. Practical Physics by Harnam Singh and Hemme, S. Chand.

B. Sc. Practical Physics by CL Arora, S Chand & Company.

Practical Physics by Kumar P.R.S., Prentice Hall India Learning Private Limited

e-Learning Source:

https://youtu.be/SsR-MlQBqCg

https://youtu.be/3l0uZwxjRV4

https://youtu.be/0hJ2Hpm8oj8

https://youtu.be/00_lbv2LDS8

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PS04	PS05
CO1	3	3	2	-	2	1	1	1	2	1	3	-
CO2	2	2	3	-	3	2	2	2	3	1	1	-
CO3	3	3	2	-	2	1	1	3	1	2	2	-
CO4	1	2	3	-	1	2	2	3	2	3	1	-
CO5	3	1	1	1	2	3	2	2	3	1	1	-

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

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CH223	**Title of the Course**	Chemistry Practical-III	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 with Chemistry	**Co-requisite**					
Course Objectives	In addition to practical, technical, and communication skills, concepts to address qualitative and quantitative problems, and transferrable abilities (capacity to work alone and in teams), students will be able to work productively and safely in a laboratory setting. Students can also estimate the presence of different metals, identify equilibrium, quantify the amount of acid or alkali in a sample, and measure its molecular weight.						

Course Outcomes	
CO1	To become proficient in procedural knowledge and be able to measure the alkali and acid content.
CO2	Must develop the skill to carefully operate the equipment and estimate calcium, iron, and copper levels in the given sample.
CO3	To build a respect for logic, reason, and intellectual integrity, as well as to analyze copper and nickel and identify the functional group (carboxylic acid and phenol).
CO4	To ascertain equilibrium and neutralization energy.
CO5	Analyze equilibrium's significance and concentration's influence on it, as well as determine the molecular weight of given sample.

Exp. No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Experiment-01	Determination of acetic acid in commercial vinegar using NaOH.	4	1
2	Experiment-02	Determination of alkali content – antacid tablet using HCl.	4	1
3	Experiment-03	Estimation of calcium content in chalk as calcium oxalate by permanganometry. Estimation of ferrous and ferric by dichromate method.	4	2
4	Experiment-04	Estimation of copper using thiosulphate.	4	2
5	Experiment-05	Analysis of Cu as CuSCN and Ni as Ni (dimethylglyoxime).	4	3
6	Experiment-06	Detection of following functional groups present in the given mono-functional organic compounds, a) Carboxylic acid, b) Phenol	4	3
7	Experiment-07	To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/ strong acid and determine the enthalpy of ionization of the weak acid/weak base.	4	4
8	Experiment-08	The equilibrium between Fe^{3+} and $Fe(CNS)^{2+.}$	4	4
9	Experiment-09	To study the effect of concentration on equilibrium.	4	5
10	Experiment-10	Determination of molecular weight of a non-volatile solute by Rast method/ Beckmann freezing point method.	4	5

Reference Books:

Advance Practical Chemistry: Jagdamba Singh, L.D.S Yadav, Jaya Singh, I.R. Siddiqui, PragatiEdition.

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

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	-	1	3	3	3	3	2	2	2	1
CO2	3	1	-	-	3	3	3	3	2	2	2	1
CO3	1	1	-	1	3	3	3	3	2	2	2	1
CO4	3	1	-	1	3	3	3	3	2	2	2	3
CO5	3	1	-	1	3	3	3	3	2	2	2	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: 2020-21							
Course Code	MT212	**Title of the Course**	Numerical Technique Lab	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 with Mathematics	**Co-requisite**	-				
Course Objectives	The aim of this course is to introduce and develop basic concepts of C to apply in the programming for Numerical methods. Moreover, this course is aimed to provide an understanding to write a program of the numerical solutions of algebraic and transcendental equations, Interpolation, Solution of differential equations and numerical Integration in C.						

Course Outcomes	
CO1	Understand the basic concepts of C- language for computer programming.
CO2	Able to write a program in C for numerical solutions of algebraic and transcendental equations.
CO3	Able to write a program in C for interpolation.
CO4	Able to write a program in C for numerical solution of ODE.
CO5	Able to write a program in C for numerical integration.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1		Write a program in C for numerical solutions of algebraic and transcendental equations using Bisection Method.	4	1
2		Write a program in C for numerical solutions of algebraic and transcendental equations using False Position Method.	4	1
3		Write a program in C for numerical solutions of algebraic and transcendental equations using Iteration Method.	4	2
4		Write a program in C for numerical solutions of algebraic and transcendental equations using Iteration Method.	4	2
5		Write a program in C for numerical solutions of algebraic and transcendental equations using Newton Raphson Method.	4	3
6		Write a program in C for interpolation by Newton-Gregory Forward interpolation formula.	4	3
7		Write a program in C for interpolation by Lagrange's interpolation formula.	4	4
8		Write a program in C for numerical integration using Trapezoidal rule.	4	4
9		Write a program in C for numerical integration using Simpson's rules.	4	5
10		Write a program in C for numerical solution of O.D.E. using Euler's Method.	4	5

Reference Books:

Programming in ANSI C fifth edition by E. Balagurusamy, Tata Mc Graw Hill, Education private limited, New Delhi.

TComputer Based Numerical Techniques by Santosh Kumar, S. Chand & company, NewDelhi.

Computer Based Numerical & Statistical Techniques by Dr. Manish Goyal, University Science Press, New Delhi.

Programming in ANSI C fifth edition by E. Balagurusamy, Tata Mc Graw Hill, Education private limited, New Delhi.

e-Learning Source:

https://www.youtube.com/watch?v=3j0c_FhOt5U
https://www.youtube.com/watch?v=FliKUWUVrEI
https://www.youtube.com/watch?v=7eHuQXMCOvA
https://www.youtube.com/watch?v=3j0c_FhOt5U

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

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

DEPARTMENT OF CHEMISTRY

Bachelor of Science

(Physics, Chemistry, Mathematics)

4th Semester

Syllabi

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	PY204	**Title of the Course**	Electricity and Magnetism	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Fourth	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 with Physics	**Co-requisite**	-				
Course Objectives	The purpose of this undergraduate course is to impart basic and key knowledge of electricity and magnetism. By using the principles of physics and mathematics, student will be able to obtain quantitative relations which are very important for higher studies. After successful completion, of course, the student will able explore subject into their respective dimensions.						

Course Outcomes	
CO1	To learn basic mathematical tools with their physical significance as a prerequisite for the course.
CO2	To understand and explain the principles/methods of evaluation of electric field, potential due to charge distribution and apply them to practical systems.
CO3	To learn the principles and methods of evaluation of magnetic field and scalar magnetic potential due to due to current or magnetic dipoles. Thereby apply them to analyse magnetic properties of dia, para and ferromagnetic materials.
CO4	To describe the principles of electromagnetic induction and study the devices based upon, to investigate their experimental working.
CO5	To formulate Maxwell's equations and apply them to investigate the propagation of electromagnetic waves in free space, dielectric and conducting medium.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Vector Analysis & Electrostatics I	Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their physical significance, vector integration, electrostatic field, electric flux, Coulomb's law, electric field and potentials, Field due to a uniform charged sphere, derivations of Poisson and Laplace Equations with applications,Uniqueness theorem.	8	1
2	Electrostatics II	Gauss law and its application: The Field of a conductor, electric dipole, field and potential due to an electric dipole, Dipole approximation for an arbitrary charge distribution, method of electrical images, electric quadruple, field due to a quadruple, electrostatic energy of a charged uniform sphere, energy of a condenser.	8	2
3	Magnetostatics and Magnetic Properties of Materials	Magnetic field and force of a current, Magnetic Induction and Biot-Savart Law, Lorentz Force, Vector and Scalar Magnetic potentials, Magnetic Dipole, Magnetomotive force and Ampere's Circuital theorem and its applications to calculate magnetic field due to wire carrying current and solenoid. Intensity of magnetization and magnetic susceptibility, Properties of Dia, Para and Ferromagnetic materials, Curie temperature, Hysteresis and its experimental determination	8	3
4	Electromagnetic Induction	Faraday's laws of electromagnetic induction, Lenz's law, self-inductance (L) of single coil, mutual inductance (M) of two coils, Energy stored in magnetic field. Motion of electron in changing magnetic field, Betatron, Magnetic energy, induced magnetic field (Time varying electric field), theory and working of moving coil ballistic galvanometer.	8	4
5	Maxwell's Equations and Electromagnetic Waves	Idea of displacement current and Maxwell's modification of Ampere's law, Integral and differential forms of Maxwell's equations and their physical significance, skin effect. The wave:(equation satisfied by E and B, plane electromagnetic waves in vacuum), Poynting vector, reflection at a plane boundary of dielectrics, EM waves in a conducting medium, reflection and refraction by the ionosphere.	8	5

Reference Books:

Berkeley Physics Course; Electricity and Magnetism, Ed. E.M. Purcell (McGraw Hill).

D. J. Griffith; "Introduction to Electrodynamics" (Prentice-Hall ofIndia).

Reitz and Milford; "Electricity and Magnetism (Addison-Wesley).

S. Mahajan and A. A. Rangwala; "Electricity and Magnetism" (Tata McGraw-Hill).

M. Portis; "Electromagnetic Fields".

e-Learning Source:

https://nptel.ac.in/courses/115104088/

http://library.iul.ac.in/ELibrary.aspx

https://www.youtube.com/watch?v=XJYY4jlwZzo

https://www.youtube.com/user/imperialcollegevideo/search?query=eric+laithwaite

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PS04	PS05
CO1	3	2	1		2	1	1	1	2	1	3	
CO2	2	3	1		2	2	3	2	3	1	1	
CO3	3	1	2		2	1	1	3	1	2	2	
CO4	2	2	3		1	3	2	3	2	3	1	
CO5	3	1	2		2	1	1	2	3	1	1	

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

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

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	CH224	**Title of the Course**	Inorganic and Physical Chemistry-II	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Fourth	3	1	0	4
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	The purpose of this course is to develop the deep understanding of general characteristic properties of transition elements, nomenclature and isomerism in coordination compounds, organometallic chemistry of transition elements , chemistry of Lanthanide and actinides, solid state chemistry and to gain the knowledge of basics of electrochemistry and construction of cells for the calculation of EMF/ Gibbs free energy value.						

Course Outcomes	
CO1	Student will be able to understand the approaches to the development of d block fundamental with CFT/VBT/MOT and its widespread applications.
CO2	Students will have a firm foundation in the IUPAC nomenclatures of the complexes and the bonding models, structures, reactivity, and applications of coordination complexes, boron hydrides, metal carbonyls, and organometallics.
CO3	Students will be able to understand about the key concepts of inorganic and organometallic chemistry including those related to synthesis, reaction chemistry, and structure and bonding.
CO4	Students will be able to understand about the key concepts of solid state chemistry, structure elucidation through X ray diffractions methods.
CO5	Students will have a firm foundation in the basic of the electrochemistry, transport phenomenon and conduction approaches to the development of electron transfer process for the cell reactions.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Chemistry of elements of transition series	Chemistry of Elements of First Transition Series: Characteristic properties of d-block elements. Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and complexes with respect to relative stability of their oxidation states, coordination number and geometry. Chemistry of Elements of Second and Third Transition Series: General characteristics, comparative treatment of Zr/Hf, Nb/Ta, Mo/W in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry	8	1
2	Coordination compounds	Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.	8	2
3	Chemistry of elements of inner transition series	Chemistry of Lanthanide Elements: Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, cerie ammonium sulphate and its analytical uses. Chemistry of Actinides: configuration, oxidation states and magnetic properties, chemistry of separation of Np, Pu and Am from U.	8	3
4	Solid states	Definition of space lattice, unit cell. X-ray diffraction by crystals, Derivation of Bragg equation, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method). Defects in crystals.	8	4
5	Electrochemistry-I	Electrical transport - Conduction in metals and in electrolyte solutions, specific conductance, equivalent conductance, variation of equivalent and specific conductance with dilution. Kohlrausch's law, weak and strong electrolyte, Arrhenius theory of electrolyte dissociation and its limitations. Ostwald's dilution law its uses and limitations	8	5

Reference Books:

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

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

Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970.

Castellan, G. W. Physical Chemistry, Published by Narosa.

Peter, A. & Paula, J. de. Physical Chemistry 9th Ed., Oxford University Press.

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

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

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

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

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	CH225	**Title of the Course**	Organic and Physical Chemistry-II	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Fourth	3	1	0	4
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	To develop understanding of Alkyl and Aryl Halides, Alcohols, phenols, Aldehydes and Ketones, Chemical Kinetics, Phase Equilibrium.						

Course Outcomes	
CO1	Comprehension of classification, methods of formation and chemical reactions of alkyl halides, Mechanism of nucleophilic substitution reaction of alkyl halides (SN1 and SN2 reactions) with energy profile diagrams.
CO2	To create basic knowledge of nomenclature, methods of formation, Hydrogen bonding. Acidic nature, Reactions of alcohols, Dihydric alcohols and phenols.
CO3	Able to evaluate different types of Synthesis of aliphatic aldehydes and ketones, alcohols, carboxylic acids and named reactions as Reimer-Tiemann reaction, gattermann-koch reaction and aromatic ketones by Friedel craft acylation.
CO4	Analyze and compare Theories of chemical kinetics, Molecularity and order of reaction, concept of activation energy method of integration, half-life method and isolation method, Thermodynamics aspect of transition state theory.
CO5	Understand the terms-phase, component and degree offreedom, derivation of Gibb's phase rule, one component system-water, two component system solid liquid equilibria simple eutectic – Bi-Cd, Pb-Ag systems, desilverisation of lead

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Alkyl and aryl halides	Methods of formation, chemical reactions. Mechanism of nucleophilic substitution reactions of alkyl halides, SN^2 and SN^1 reactions with energy profile diagrams, Aryl halides - Methods of formation, nuclear and side chain reactions. Mechanisms of nucleophilic aromatic substitutions.	8	1
2	Alcohols and phenols	Monohydric alcohols- nomenclature, methods of formation, reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature, Reactions of alcohols and pinacol-pinacolone rearrangement. Preparation of phenols, physical properties and acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Fries rearrangement, Claisen rearrangement, & Reimer-Tiemann reaction.	8	2
3	Aldehydes and ketones	Synthesis of aliphatic aldehydes and ketones with particular reference to acid chlorides, alcohols, carboxylic acids, Grignard reagent, alkenes and 1, 3-dithianes. Synthesis of aromatic aldehydes by oxidation of alkyl benzene, Reimer-Tiemann reaction, Gattermann-Koch reaction and aromatic ketones by Friedal Craft Acylation, Aldol condensation, Cannizzaro reaction, Clemmensen reduction and Wolff-Kishner reduction.	8	3
4	Chemical kinetics	Molecularity and order of reaction, concentration dependence of rates, integrated rate expression for-zero order, first order, second order, pseudo order reactions, half-life. Determination of the order of reaction: Differential method, method of integration, half-life method and isolation method. Theories of chemical kinetics: Arrhenius theory of reaction rate, effect of temperature on rate of reaction, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis).Thermodynamics aspect of transition state theory.	8	4
5	Phase equilibrium	Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibb's phase rule, phase equilibria of one component system-water, 'CO_2' and 'S' systems. Phase equilibria of two component system – solid liquid equilibria simple eutectic – Bi-Cd, Pb-Ag systems, desilverisation of lead.	8	5

Reference Books:

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

Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. Published by Pearson Education.

Francis Carey Organic Chemistry, Published by McGraw-Hill Education. Physical Chemistry, Puri Sharma & Pathania.

e-Learning Source:

https://study.com/learn/lesson/substitution-reaction-types-examples.html

https://byjus.com/chemistry/alcohol-phenol-ether-questions/

https://www.khanacademy.org/science/organic-chemistry/aldehydes-ketones/nomenclature-aldehyde-ketone/v/reactivity-of-aldehydes-and-ketones

https://nptel.ac.in/courses/104101128

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

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

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	MT213	**Title of the Course**	Tensor Analysis	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 with Mathematics	**Co-requisite**					
Course Objectives	The purpose of this undergraduate course is to impart basic and key knowledge of tensors and their types & properties. Students will also be able to apply addition, subtraction, multiplication on tensors. After successful completion of course, the student will be able to explore subject into their respective dimensions						

Course Outcomes	
CO1	Students will be able to understand Vector Spaces, dual spaces, tensor product of vector spaces, and also about transformation formulae for tensors.
CO2	Students will gain a understand of Tensors and their types: Contravariant and covariant vectors and tensors, mixed tensors, Symmetric and skew symmetric tensors, Associated tensors, Reciprocal tensors.
CO3	Students will be able to learn and implement Algebra of tensors, Contraction and inner product. They will also study about Quotient law & Riemannian metric tensor
CO4	Students will create the own understanding of Christoffel Symbols. They will learn covariant differentiation of tensors and also study about Gradient, divergence and curl in tensor notation.
CO5	Students will gain an understanding of The fundamental theorem of local Riemannian geometry, Differential operators, curvature tensor, Geodesics, geodesics coordinate system, geometrical interpretation of the curvature tensor.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1		Vector Spaces, dual spaces, tensor product of vector spaces, transformation formulae.	8	1
2		Tensor, Contravariant and covariant vectors and tensors, mixed tensors, Symmetric and skewsymmetric tensors, Associated tensors	8	2
3		Algebra of tensors, Contraction and inner product, Quotient law, Reciprocal tensors, Riemannian metric tensor	8	3
4		Christoffel Symbols, covariant differentiation, Gradient, divergence and curl in tensor notation.	8	4
5		The fundamental theorem of local Riemannian geometry, Differential operators, curvature tensor, Geodesics, geodesics coordinate system, geometrical interpretation of the curvature tensor.	8	5

Reference Books:

Tensor Calculus, Zafar Ahsan, Anamaya Publication, New Delhi.

Differential Geometry of manifolds, U.C.De & A.A.Shaikh, Narosa Publishing House Pvt. Ltd, 2007.

Schaum's Outlines of Tensor Calculus.

Tensor Calculus & Riemannian Geometry, D.C. Agarwal, Krishna Publications

e-Learning Source:

https://cosmolearning.org/video-lectures

https://content.kopykitab.com/ebooks/2016/02/5649/sample/sample_5649.pdf

https://www.win.tue.nl/casa/education/AntWiskDict/_3/e.%20Algebra,%20Meetkunde%20en%20Discrete%20Wiskunde/T ENSOR--Dictaat-2004-Partial%20Translation.pdf

https://cosmolearning.org/video-lectures

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

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

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	MT214	**Title of the Course**	Abstract Algebra	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Third	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 with Mathematics	**Co-requisite**	-				
Course Objectives	The objective is to introduce the basic concept to the subject of algebra. The course deals with the some algebraic structures namely groups, rings, fields and some related structures. Abstract algebra enables students to build mathematical thinking and skill.						

Course Outcomes	
CO1	Students will be able to explain the fundamental concept of Group and its well behaved subsets.
CO2	Students will be able to describe fundamental properties of Ring and its related structures.
CO3	Students will be an understanding of Elementary row operations and their applications to solution of a system of linear equations.
CO4	Students will be able to describe Vector spaces and its properties.
CO5	Students will be able to explain Linear transformation and its properties as well as applications.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1		Group, homomorphism, isomorphism, conjugacy relation, normalizer, centre of group.	8	1
2		Ring, ring homomorphism, ideals, integral domain, introduction to field.	8	2
3		Elementary row operations and row-reduced echelon form, inverse of a matrix through elementary row operation, solution of a system of linear equations.	8	3
4		Vector spaces, Subspaces, Span of a set, Linear dependence and independence, Dimension and basis.	8	4
5		Linear transformation and their matrix representation, rank nullity theorem.	8	5

Reference Books:

University Algebra by N.S. Gopalakrishnan,New Age International publishing house, New Delhi.

Modern Algebra by Surjeet Singh, Vikas Publishing House Pvt. Ltd., New Delhi.

An introduction to Linear Algebra by V. Krishnamurthy, V.P. Mainra & J. L. Arora, East West Press Pvt. Ltd., New Delhi.

e-Learning Source:

https://nptel.ac.in/courses/111/105/111105112/

https://nptel.ac.in/courses/111/101/111101115/

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

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

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	PY205	**Title of the Course**	Electricity and Magnetism Lab	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Fourth	**0**	**0**	**6**	**3**
Pre-Requisite	10+2 with Physics	**Co-requisite**					
Course Objectives	The purpose of this undergraduate course is to impart practical knowledge/measurements in electricity and magnetism through different experiments related to its theoretical course.						

Course Outcomes	
CO1	Determine the energy band gap of a given semiconductor.
CO2	Measurement of high and low resistance and capacitance of a capacitor.
CO3	Determine the coefficient of self and mutual inductance between two given coils.
CO4	Study the characteristics of Ballistic Galvanometer.
CO5	Measurement of capacity of capacitor and study the characteristic of a choke

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Exp-01	Study of characteristics of a ballistic Galvanometer.	6	1
2	Exp-02	Measurement of low resistance by Carey-Foster Bridge	6	2
3	Exp-03	Measurement of inductance using impedance at different frequencies.	6	3
4	Exp-04	Determination of energy band gap of a semiconductor using p-n junction diode.	6	1
5	Exp-05	To measure high Resistance by the method of Leakage of a condenser.	6	2
6	Exp-06	To determine the coefficient of Mutual Inductance between two coils.	6	3
7	Exp-07	To determine the coefficient of Self Inductance of a single coil.	6	3
8	Exp-08	To determine the capacity of condenser by absolute method.	6	5
9	Exp-09	To study of characteristic of a choke.	6	5
10	Exp-10	Measurement of inductance by Anderson's bridge.	6	3

Reference Books:

Practical Physics. by R. K. Shukla, New Age International Private Limited; Third edition.

B. Sc . Practical Physics by Harnam Singh and Hemme, S. Chand.

B. Sc. Practical Physics by CL Arora, S Chand & Company.

Practical Physics by Kumar P.R.S., Prentice Hall India Learning Private Limited

e-Learning Source:

https://www.exploratorium.edu/snacks/subject/electricity-and-magnetism

https://ocw.mit.edu/courses/physics/8-02-physics-ii-electricity-and-magnetism-spring-2007/experiments/

www.youtube.com

http://www.rossnazirullah.com/BSc/BSc.htm

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PS04	PS05
CO1	3	2	1		3	3	2	1		1	3	
CO2	2	1	3		1	2	3	2		1	1	
CO3	2	2	2		3	1	3	3		2	2	
CO4	3	1	3		2	2	1	3		3	1	
CO5	3	2	1		3	3	2	2		1	1	

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

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

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	CH226	**Title of the Course**	Chemistry Practical-IV	**L**	**T**	**P**	**C**
Year	Second	**Semester**	Fourth	0	0	4	2
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	Students will be able to work effectively and safely in a laboratory environment, and they will have practical, technical, and communication skills, as well as concepts to solve qualitative and quantitative problems, as well as transferable skills such as the ability to work in teams and independently. Moreover, students are able to prepare and determine the strength of some organic and inorganic chemicals.						

Course Outcomes	
CO1	To get proficient in procedural knowledge to carry out oxidation, benzoylation, and acetylation (salicylic acid, aniline, glucose, and hydroquinone).
CO2	To get skill to perform reduction reactions and concentration affects reaction speed.
CO3	To gain expertise in calculating pKa and critical solution temperature (CST).
CO4	To be able to prepare some inorganic substances (Chrome Alum, Potash Alum, and Sodium Ferrioxalate).
CO5	Being able to make iodoform and measure the concentration of acetic acid in a sample.

Exp. No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Experiment-01	Acetylation of salicylic acid, aniline, glucose and hydroquinone, Benzoylation of aniline and phenol	4	1
2	Experiment-02	Oxidation: Preparation of benzoic acid from toluence	4	1
3	Experiment-03	Reduction: Preparation of aniline from nitrobenzene	4	2
4	Experiment-04	To study the effect of concentration on the rate of reaction between sodium thiosulphate and hydrochloric acid.	4	2
5	Experiment-05	To determine the pKa of acetic acid	4	3
6	Experiment-06	Determination Critical Solution Temperature (CST) for the Phenol – Water System.	4	3
7	Experiment-07	Inorganic Chemistry: Preparation of the following: 1. Chrome Alum 2. Potash Alum 3. Sodium Ferrioxalate	6	4
8	Experiment-08	Aliphatic electrophilic substitution: Preparation of iodoform from ethanol and acetone	6	5
9	Experiment-09	To determine the strength of given acetic acid solution conductometrically by titrating against a standard solution.	4	5

Reference Books:

Advance Practical Chemistry: Jagdamba Singh, L.D.S Yadav, Jaya Singh, I.R. Siddiqui, PragatiEdition.

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

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

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

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