Integral University, Lucknow

Effective from Session: 2020-2021							
Course Code	BS263	**Title of the Course**	Chordata "Agnatha to Mammals"	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	10+2 with Biology	**Co-requisite**					
Course Objectives	The students will acquire the knowledge about the classification of various classes of vertebrates i.e. Pisces, Reptiles, Aves and Mammals.						

Course Outcomes	
CO1	General features of living Agnatha and classification of cyclostome, General features of pisces and classification, fish migration, osmoregulation and locomotion.
CO2	General features and classification of amphibia, parental care, pedogenesis.
CO3	General features and classification of reptiles, poisonous and non-poisonous snakes
CO4	General features and classification of birds, migration, flight adaptations.
CO5	General features and classification of mammals, monotremata, aquatic mammals.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Agnatha	General features of living Agnatha and classification of cyclostomes up to classes; Pisces: General features and Classification (up to orders) with examples; Osmoregulation, locomotion and migration in Fishes.	8	CO1
2	Amphibia	General characters and classification of different classes of Amphibia (upto orders) with examples; Origin of tetrapods, parental care, paedomorphosis.	8	CO2
3	Reptiles	General characters and Classification up to orders; Origin of reptiles, Poisonous and non-poisonous snakes, Biting mechanism in snakes.	8	CO3
4	Aves	General features and Classification up to orders; Origin of birds, Flight adaptations and migration in birds.	8	CO4
5	Mammals	General characters and classification upto orders; general features of egg laying mammals, pouched-mammals and aquatic mammals, Origin of mammals.	8	CO5

Reference Books:

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
4. E.L. Jordan & P.S. Verma, 1998. Chordate zoology. (S. Chand & Co.).
5. R.L.Kotpal, 2000. Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut).
6. G.S. Sandhu, 2005. Objective Chordate Zoology. Campus Books, vii.

e-Learning Source:

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	1				1	2		3	3	1	
CO2	3	1				1	2		3	3	1	
CO3	3	1				1	2		3	3	1	
CO4	3	1				1	2		3	3	1	
CO5	3	1				1	2		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: 2017-18							
Course Code	CH221	**Title of the Course**	Inorganic and Physical Chemistry-I	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	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	CO1
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	CO2
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	CO3
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	CO4
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	CO5

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: 2020-2021							
Course Code	BS222	**Title of the Course**	Angiosperm Morphology and Taxonomy	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	10+2 with Biology	**Co-requisite**					
Course Objectives	The objective of this course is to impart an insight into the habit, vegetative characters and diversity, internal structure and reproduction of the most evolved group of plants, the Angiosperm, to understand the distinguishing features of angiosperm families and get an insight into the fruit, seed development and inflorescence.						

Course Outcomes	
CO1	To have basic understanding of classification and taxonomy of the flowering plants.
CO2	To have an idea about the phylogenetic relationship in angiosperms.
CO3	Comprehend the organization of plant body and important modifications of stems, leaves and roots.
CO4	Describe the important characteristics of dicot families as Brassicaceae, Fabaceae, Euphorbiaceae, Malvaceae, Cucurbitacece
CO5	Describe the important characteristics of dicot and monocot families as Asteraceae, Solanaceae Poaceae, Liliaceae, and Orchidaceae

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Plant systematics	Nomenclature of plants; the international code of botanical nomenclature. Documentation: Herbarium: Functions, preparation and management; important herbaria and botanical gardens of the world and of India; Flora; Keys; Numerical taxonomy and chemotaxonomy	8	CO1
2	Angiosperm taxonomy	Unique features of angiosperms and diversity; identification, brief reference of Angiosperm Phylogeny Group (APG) Classification: Bentham and Hooker; Comparative account of outline of various systems of classification of angiosperms (Bentham & Hooker, Engler & Prantl and Hutchinson); Origin and evolution of angiosperms.	8	CO2
3	Organization of plant body	Important modifications of stems, leaves and roots, Inflorescence: major types, Flower: Floral whorls, Parts, Flower as a modified shoot, Fruits: major types, Seed: Types	8	CO3
4	Angiospermic Families(A)	Study of main characters and economic importance of angiospermic families: Brassicaceae, Fabaceae, Euphorbiaceae, Malvaceae, Cucurbitacece	8	CO4
5	Angiospermic Families(B)	Study of main characters and economic importance of angiospermic families: Asteraceae, Solanaceae Poaceae, Liliaceae, and Orchidaceae	8	CO5

Reference Books:

1. Angiosperm Phylogeny Group An update of the Angiosperm Phylogeny Group classification for the orders and families of the flowering plants: APG II. Botanical Journal of the Linnaean Society 141: 399- 436.
2. Crawford, D.J. Plant Molecular Systematics. Cambridge University Press, Cambridge, UK.
3. Cronquist, A. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
4. Singh, G. Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition

e-Learning Source:

1. https://www.udemy.com/course/plant-anatomy-systematics-and-taxonomy/
2. https://endeavour.kew.org/challenge/ks-5/tree-of-life/taxonomic-categories

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

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	1				1	1		3			
CO2	3	1					1		3			
CO3	3	1					1		3			
CO4	3	1					1		3			
CO5	3	1					1		2			

2- 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	BS113	**Title of the Course**	Fundamentals of Microbiology	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	10+2 with Biology	**Co-requisite**					
Course Objectives	The objective of this course is to develop the understanding of basics of microbiology, classification of microbes, control of microorganisms, microbes in extreme environments and microbial interactions and basics of Recombination in Prokaryotes.						

Course Outcomes	
CO1	Know the basics of microbiology.
CO2	Have knowledge of the general classification of microbes.
CO3	Understand basics of Control of Microorganisms.
CO4	Study bacteriophages and microbes in extreme environments and microbial interactions.
CO5	Know the basics of recombination in Prokaryotes.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	History and classification of microbiology	History and classification of microbiology: Pasteur's experiments, Various forms of microorganisms (bacteria, fungi, viruses, protozoa, PPLOs); Nutritional classification of microorganisms; Nature of the microbial cell surface, gram positive and gram negative bacteria; Growth curve.	8	CO1
2	Control of Microorganisms	Control of Microorganisms: Physical agents (Autoclave, Hot air oven, Laminar airflow and membrane filter.), chemical agents (Alcohol, Halogens and Gaseous agents, antibiotics), Radiation Methods (UV rays). Pathogenesis of microorganisms: Some common pathogenic microorganisms: Bacterial (tuberculosis, gall), viral (SARS, TMV), fungal (red rot of sugar cane, dermatitis) and protozoan (malaria).	8	CO2
3	Microbes in extreme environments and microbial interactions	Microbes in extreme environments and microbial interactions: The thermophiles alkalophiles, acidophiles and symbiosis and antibiosis among microbial population, N2 fixing microbes in agriculture and forestry.	8	CO3
4	Recombination in Prokaryotes	Recombination in Prokaryotes: Transformation, Conjugation and Transduction.	8	CO4
5	Bacteriophage	Bacteriophage: Lytic and lysogenic cycle. Stains and staining techniques: Principles of staining, Types of stains – simple stains, structural stains and Differential stains.	8	CO5

Reference Books:

1. Introduction to Microbiology, Ingraham, 2ed.
2. Brock Biology of Microorganisms, Madigan et al, 9th ed.
3. General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
4. Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hil
5. Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
6. The Microbial World, Roger Y. Stanier, Prentice Hall
7. Howe.C. (1995) Gene Cloning and manipulation, Cambridge University Press, USA
8. Lewin, B., Gene VI New York, Oxford University Press.

e-Learning Source:

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

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	1				2	2					
CO2	3	1				2	2					
CO3	3	1				2	2					
CO4	3	1				3	1					
CO5	3	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: 2017-18							
Course Code	CH222	**Title of the Course**	Organic and Physical Chemistry-I	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	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 chemical Equilibrium.						

Course Outcomes	
CO1	Understanding of mechanism of eliminations, oxymercuration-demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation, Allylic and benzylic bromination.
CO2	Comprehension of conformational analysis, Relative stability and energy diagrams of alkanes, Chair, Boat and Twist boat forms of cyclohexane 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 & their mechanism, 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 their applications,
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 benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.	8	CO1
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, anana bonds.	8	CO2
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 of alkylbenzenes, alkynylbenzenes and biphenyl, naphthalene and Anthracene..	8	CO3
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	CO4
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	CO5

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:							
Course Code	CH223	**Title of the Course**	Chemistry Practical-III	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	0	0	4	2
Pre-Requisite	10+2 with Chemistry	**Co-requisite**					
Course Objectives	Student will be able to work effectively and safely in a laboratory environment, practical/technical/ communication skills, and concepts to solve qualitative and quantitative problems, transferable skills like ability to work in teams as well as independently.						

Course Outcomes	
CO1	To develop the understanding of procedural knowledge
CO2	To develop an ability to handle the apparatus carefully, and use the resources wisely.
CO3	To develop a respect for evidence, rationality and intellectual honesty.
CO4	To develop interest and motivation through laboratory which will lead to development of positive attitude?
CO5	Analyze the importance of personal safety and care of equipment's and chemicals.

Exp. No.	Content of Unit	ContactHrs.	Mapped CO
1	Determination of acetic acid in commercial vinegar using NaOH.	4	CO1-5
2	Determination of alkali content – antacid tablet using HCl.	4	CO1-5
3	Estimation of calcium content in chalk as calcium oxalate by permanganometry. Estimation of ferrous and ferric by dichromate method.	4	CO1-5
4	Estimation of copper using thiosulphate.	4	CO1-5
5	Analysis of Cu as CuSCN and Ni as Ni (dimethylglyoxime).	4	CO1-5
6	Detection of following functional groups present in the given mono-functional organic compounds, a) Carboxylic acid, b) Phenol	4	CO1-5
7	To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/ strong acid and determinethe enthalpy of ionization of the weak acid/weak base.	4	CO1-5
8	The equilibrium between Fe^{3+} and $Fe(CNS)^{2+}$.	4	CO1-5
9	To study the effect of concentration on equilibrium.	4	CO1-5
10	Determination of molecular weight of a non-volatile solute by Rast method/ Beckmann freezing point method.	4	CO1-5

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: 2015-16							
Course Code	BS262	**Title of the Course**	Animal Diversity II Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	0	0	6	4
Pre-Requisite	10+2 with Biology	**Co-requisite**					
Course Objectives	Students will understand about different vertebrate species from different animal group.						

Course Outcomes	
CO1	External characters of Scoliodon,
CO2	Permanent stained preparation of ampullae of Lorenzini, Glycerine and permanent preparation of placoid scales, Study of the permanent histology (various organs) slides
CO3	Dissection: Scoliodon
CO4	Study of the following specimens: *Herdmania, Amphioxus, Anguilla, Acipenser, Ambystoma, Rana, Varanus, Viper, Heloderma, Naja, Pavo, Psittacula, Porcupine, Platypus, Oryctolagus, Armadillo,Manis*
CO5	Embryonic membranes-Whole mount of 72 hr chick embryo, Study of poisonous and non-poisonous snakes, Difference between Crocodile, Alligator, and Gavialis

Experiment No.	**Title of the Experiment**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	External features	External characters of Scoliodon,	6	CO1
2	Slides	Permanent stained preparation of ampullae of Lorenzini, Glycerine and permanent preparation of placoid scales, Study of the permanent histology (various organs) slides	6	CO2
3	Dissections	Dissection: Scoliodon	6	CO3
4	Specimens	Study of the following specimens: *Herdmania, Amphioxus, Anguilla, Acipenser, Ambystoma, Rana, Varanus, Viper, Heloderma, Naja, Pavo, Psittacula, Porcupine, Platypus, Oryctolagus, Armadillo,Manis*	6	CO4
5	Embryology/models	Embryonic membranes-Whole mount of 72 hr chick embryo, Study of poisonous and non-poisonous snakes, Difference between Crocodile, Alligator, and Gavialis	6	CO5

Reference Books:

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press. Pough H. Vertebrate life, VIII Edition, Pearson International.
2. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

e-Learning Source:

	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	PSO4	PSO5	PSO6	PSO7
CO1	1						2	3					1	2				
CO2	1						2	3					1	2				
CO3	1						2	3					1	2				
CO4	1						2	3					1	2				
CO5	1						2	3					1	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: 2020-2021							
Course Code	BS271	**Title of the Course**	Evolutionary Biology and Wildlife	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	3	1	0	4
Pre-Requisite	10+2 with Biology	**Co-requisite**					
Course Objectives	The objective of this course is to have a firm foundation in the evolution of fauna and its habitat.						

Course Outcomes	
CO1	Continental distribution, Aspects and Patterns of animal distribution (Continuous, Discontinuous and Bipolar), Factors affecting distribution, Geological distribution and Geographical distribution with their characteristic fauna, Wallace's line, Animal Diversity: Alpha, Beta and Gamma
CO2	Theories of origin of life, Missing link, Natural selection (Example: Industrial melanism), Types of natural selection (Directional, Stabilizing, Disruptive), Sexual selection, Concept of genetic drift
CO3	Concepts of Evolution, Theories of evolution: Lamarckism, Criticism of Lamarckism, Neo-Lamarckism, Darwinism, Theory of sexual, artificial and natural selection, Objection to Darwinism, Neo-Darwinism, Evidences of evolution
CO4	Speciation, Modes of speciation (Allopatric, Sympatric and Parapatric), Morphological, Genetic and Biological species concept, Monotypic and Polytypic species, Subspecies categories (Clines and Deme)
CO5	Modern Concepts (IUCN categories), endangered species, Different projects launched for the preservation of animal species, Important sanctuaries, national parks of India, in-situ and ex-situ conservation of wildlife

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Animal distribution	Continental distribution, Aspects and Patterns of animal distribution (Continuous, Discontinuous and Bipolar), Factors affecting distribution, Geological distribution and Geographical distribution with their characteristic fauna, Wallace's line, Animal Diversity: Alpha, Beta and Gamma	8	CO1
2	Origin of Life	Theories of origin of life, Missing link, Natural selection (Example: Industrial melanism), Types of natural selection (Directional, Stabilizing, Disruptive), Sexual selection, Concept of genetic drift	8	CO2
3	Evolution	Concepts of Evolution, Theories of evolution: Lamarckism, Criticism of Lamarckism, Neo-Lamarckism, Darwinism, Theory of sexual, artificial and natural selection, Objection to Darwinism, Neo-Darwinism, Evidences of evolution	8	CO3
4	Species Concept	Speciation, Modes of speciation (Allopatric, Sympatric and Parapatric), Morphological, Genetic and Biological species concept, Monotypic and Polytypic species, Subspecies categories (Clines and Deme)	8	CO4
5	Wild life of India	Modern Concepts (IUCN categories), endangered species, Different projects launched for the preservation of animal species, Important sanctuaries, national parks of India, in-situ and ex-situ conservation of wildlife	8	CO5

Reference Books:

1. Biodiversity and Quality of Life. Sengupta. Mc Millan India Pvt. Ltd.
2. Biology: P. H. Raven& G. B. Jhonson
3. Organic Evolution by Veer Bala Rastogi
4. Evolution Paperback: by Douglas J. Futuyma, Mark Kirkpatrick 5. Evolutioary biology: Singh and Tomar

e-Learning Source:

https://drive.google.com/file/d/1NTEyuMpqKJv1opmMXy2V5UQLMlritsH/view?usp=sharing

https://drive.google.com/file/d/1z8zXrJWb6GjyUYVocfopFPAmf7TLjicN/view?usp=sharing

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

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO4
CO1	3	1				3	1		2	3	
CO2	3	1				1	1		2	3	
CO3	3	1				1	1		2	3	
CO4	3	1				2	1		2	3	
CO5	3	1				2	1		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	BS322	**Title of the Course**	Comparative anatomy and developmental biology	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	3	1	0	4
Pre-Requisite	10+2 with Biology	**Co-requisite**					
Course Objectives	This course is designed to enable the students to understand the Organizational level of Integumentary, Skeletal, Digestive, Respiratory, Circulatory, Urinogenital and Nervous System in Different Vertebrate Classes and to get an idea of the role played by evolution in their development. The students will also get an in-depth understanding of developmental processes with the help of Chick Embryo development as a model system.						

Course Outcomes	
CO1	The students will learn about the basic organization of integumentary, skeletal and digestive systems. They will also be able to learn about its various modifications and their evolutionary importance.
CO2	The students will learn about the functioning of physiological systems like Respiratory, Circulatory and Urinogenital system.
CO3	The students will get an in-depth knowledge of Nervous system in various classes of vertebrates. They will also learn about the sensory systems present in different vertebrate classes.
CO4	To provide the students an in-depth understanding of various stages involved in development of young ones from a single celled zygote.
CO5	The students will learn about the development of chick embryos as a model system of embryo development.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Integumentary System	Derivatives of integument w.r.t. glands and digital tips, Skeletal System: Evolution of visceral arches, Digestive System: Brief account of alimentary canal and digestive glands.	8	CO1
2	Respiratory System	Gills, lungs and air sacs; Circulatory System: Evolution of heart and aortic arches; Urinogenital System: Succession of kidney, Evolution of urinogenital ducts.	8	CO2
3	Nervous System	Comparative account of brain; Sense Organs: Types of receptors.	8	CO3
4	Gametogenesis,	Gametogenesis, Fertilization, Egg: structure and types. Types and patterns of cleavage structure and types. Types and patterns of cleavage. Stem Cell and Its potency. Cell lineage, Genomic equivalence	8	CO4
5	Embryonic development	Process of Blastulation and Gastrulation Fate Map, Development of Chick up to formation of Primitive streak and mammal (in outline) Extra embryonic membranes of chick. Placentation and types of Placenta.	8	CO5

Reference Books:

Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.

Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.

Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House

Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.

e-Learning Source:

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

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	1					1		3	3	1	
CO2	3	1					1		3	3	1	
CO3	3	1					1		3	3	1	
CO4	3	1					1		3	3	1	
CO5	3	1					1		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: 2017-18							
Course Code	CH224	**Title of the Course**	Inorganic and Physical Chemistry-II	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	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	CO1
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	CO2
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	CO3
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	CO4
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	CO5

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	II	**Semester**	IV	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	CO1
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	CO2
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	CO3
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 rateof reaction, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis).Thermodynamicsaspect of transition state theory.	8	CO4
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	CO5

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.

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

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

https://www.google.com/search?q=phase+equilibrium&rlz=1C1ASVC_enIN966IN966&source=lnms&tbm=vid&sa=X&ved=2ahUKEwj6h-qdj_H7AhXsznMBHbo6CUsQ0pQJegQIBxAG&biw=1024&bih=600&dpr=1#fpstate=ive&vld=cid:b2e2d634,vid:rWbFx0CqSWo

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Principles_of_Modern_Chemistry_(Oxtoby_et_al.)/Unit_3%3A_The_States_of_Matter/10%3A_Solids_Liquids_and_Phase_Transitions/10.4%3A_Phase_Equilibrium

	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**

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	BS232	**Title of the Course**	Plant physiology	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	3	1	0	4
Pre-Requisite	10+2 with Biology	**Co-requisite**					
Course Objectives	The purpose of this course is to develop the deep understanding of plant water relations. The understanding of nutrition in plants, morphology and physiology of plants and plant growth, plant hormones and its relation with plant growth and development.						

Course Outcomes	
CO1	Students will have an understanding of movement of water and solutes in plant, asent of sap and transpiration.
CO2	Have knowledge of Essential elements, their absorption, transport and role in plants and translocation in phloem.
CO3	Know about basics of C assimilation, Photosynthesis, Photorespiration and Nitrogen metabolism specially Biological nitrogen fixation.
CO4	Inculcate basic knowledge about Enzymes and Plant growth regulators, Seed dormancy and germination.
CO5	Comprehend the response of plant to light, temperature and stress, specially Photomorphogenesis, Photoperiodism and Plant movements.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Plant-water relations	Importance of water, Diffusion and water potential, Osmosis, Ascent of sap, Transpiration and its significance; Factors affecting transpiration, guttation.	8	CO1
2	Mineral nutrition and transport	Essential elements, macro and micronutrients, Role of essential elements; Absorption of mineral salts, Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps. Translocation in phloem, Composition of phloem sap.	8	CO2
3	C and N metabolism	Photosynthesis Photosynthetic Pigments (Chl a, b); Photosystem I and II, Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration. Nitrogen metabolism Biological nitrogen fixation; Nitrate and ammonia assimilation.	8	CO3
4	Plant growth regulators	Enzymes: general structure and properties, Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene. role and applications in agri-horticulture. Seed Physiology: Dormancy, Breaking of dormancy, Germination.	8	CO4
5	Growth and Development	Plant response to light and temperature: Photomorphogenesis, Plant movements, Photoperiodism, (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Growth response to temperature, Vernalization. Introduction to Stress physiology.	8	CO5

Reference Books:

1. 1. Taiz, L., Zeiger, E.,. Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. 2. Hopkins, W.G., Huner, N.P.,. Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D.,. Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi..
4. Frank B. Salisbury, Cleon W. Ross: Plant Physiology. Wadsworth Publishing Company

e-Learning Source:

	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	PSO6
CO1	**3**	**1**					**1**						
CO2	**3**	**1**					**1**						
CO3	**3**	**1**				**1**	**1**						
CO4	**3**	**1**					**1**						
CO5	**3**	**1**					**1**						

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

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

Integral University, Lucknow

Effective from Session: 2020-2021							
Course Code	BS272	**Title of the Course**	Cytogenetics and angiosperm taxonomy Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	0	0	6	3
Pre-Requisite	10+2 with Biology	**Co-requisite**					
Course Objectives	The objective of this course is to have a firm foundation in cytogenetics and develop understanding of angiosperms and their economic importance.						

Course Outcomes	
CO1	Learn to measure cell size in micrometer scale with the help of a microscope, know about polytene chromosomes and Barr bodies.
CO2	Learn, understand and demonstrate mitotic and meiotic cell division in plants, and understand the structure of chromosomes and importance of karyotyping.
CO3	Learn, understand and demonstrate vegetative and floral characters of different families of angiosperm.
CO4	Understand the structure and importance of different reproductive parts of plants including flowers, fruits and seeds.
CO5	To recognize different kinds of plant based on their vegetative and floral characters.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Exp. 1**	Use of Micrometer and calibration, measurement of onion epidermal cells and yeast	3	CO1
2	**Exp. 2**	Cell division: Mitotic and meiotic studies onion root tips and flower bud	3	CO2
3	**Exp. 3**	Chromosomes: Study of polytene chromosomes by slides; Barr bodies	3	CO2
4	**Exp. 4**	Karyotype analysis – with the help of slide	3	CO2
5	**Exp. 5**	Study of vegetative and floral characters of any one representative genus of following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e) Brassicaceae, Fabaceae, Euphorbiaceae, Malvaceae, Cucurbitaceae, Asteraceae and Liliaceae	3	CO3
6	**Exp. 6**	Morphology study of flower parts, inflorescence, seed, fruit types	3	CO4
7	**Exp. 7**	Mounting of a properly dried and pressed specimen of any twelve wild plants with herbarium label (to be submitted in the record book).	3	CO5

	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	3	3	1				1				
CO2	3	3	1				1				
CO3	3	3	1			3	1				
CO4	3	3	1			2	1				
CO5	3	3	1			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: 2017-18							
Course Code	CH226	**Title of the Course**	Chemistry Practical-IV	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	0	0	4	2
Pre-Requisite	10+2 with Chemistry	**Co-requisite**					
Course Objectives	Student will be able to work effectively and safely in a laboratory environment, practical/technical/ communication skills,and concepts to solve qualitative and quantitative problems, transferable skills like ability to work in teams as well as independently.						

Course Outcomes	
CO1	To develop the understanding of procedural knowledge
CO2	To develop an ability to handle the apparatus carefully, and use the resources wisely.
CO3	To develop a respect for evidence, rationality and intellectual honesty.
CO4	To develop interest and motivation through laboratory which will lead to development of positive attitude?
CO5	Analyze the importance of personal safety and care of equipment's and chemicals.

Exp. No.	Content of Unit	Contact Hrs.	Mapped CO
1	Acetylation of salicylic acid, aniline, glucose and hydroquinone, Benzoylation of aniline and phenol	4	CO1-5
2	Oxidation: Preparation of benzoic acid from toluence	4	CO1-5
3	Reduction: Preparation of aniline from nitrobenzene	4	CO1-5
4	To study the effect of concentration on the rate of reaction between sodium thiosulphate and hydrochloric acid.	4	CO1-5
5	To determine the pKa of acetic acid	4	CO1-5
6	Determination Critical Solution Temperature (CST) for the Phenol – Water System.	4	CO1-5
7	Inorganic Chemistry: Preparation of the following: 1. Chrome Alum, 2.Potash Alum , 3.Sodium Ferrioxalate 1. Chrome Alum 2. Potash Alum	6	CO1-5
8	Aliphatic electrophlic substitution: Preparation of iodoform from ethanol and acetone	6	CO1-5
9	To determine the strength of given acetic acid solution conductometrically by titrating against a standard solution.	4	CO1-5

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**