Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	BS161	**Title of the Course**	Non Chordates-I "Protozoa to Helminthes"	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	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 general taxonomic rules on animal classification and the complex interactions among animals of different phyla. The students will acquire the knowledge about thedistinguishing features of lower non chordates.						

Course Outcomes	
CO1	The students will learn about the diversity of animals, General characters and classification of Protozoa; structure, life-cycle and control of *Plasmodium, Monocystis*,
CO2	The students learn about the characteristic features and Canal System of Porifera.
CO3	The students learn about the characteristic features of Cnidaria, Morphology of *Obelia* colony, Development Of *Hydra* and Polymorphism in Hydrozoa.
CO4	The students learn about the characteristic features of Platyhelminthes, structure, life-cycle and control of *Fasciola hepatica, Taenia solium*
CO5	The students learn about the characteristic features of Nematehelminthes, structure, life-cycle and control of *Ascaris and Ancylostoma*

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Classification of protozoa	Outline of classification of animals (Chordates and non-chordates).Protozoa: General characters and classification up to classes; Locomotory Organelles and Locomotion in Protozoa; *Plasmodium, Monocystis*: - Structure, Life-cycle and Control.	8	CO1
2	Classification of porifera	Porifera: General characters and classification up to classes; *Sycon*: - Morphology, Different types of cells,Canal System in Porifera.	8	CO2
3	Classification of cnidaria	Cnidaria: General characters and classification up to classes; *Obelia*: - Morphology of *Obelia* colony, Development Of *Hydra*, Polymorphism in Hydrozoa.	8	CO3
4	Classification of platyhelminthes	Platyhelminthes: General characters and classification up to classes; *Fasciola hepatica, Taenia solium*: - Structure, Life cycle,Pathogenecity & control measures.	8	CO4
5	Classification of nematehelminthes	Nematehelminthes: *Ascaris and Ancylostoma*: - Structure, Life cycle, Pathogenicity & control measures.	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. Barnes, B.D. (1987). Invertebrate Zoology. 5th Edition, Saunders College Publishing.
4. Kotpal, R. L. (1988). Protozoa. Rastogi Publications
5. Marshall, A.J. and Williams, W.D. (1979). Text Book of Zoology Vol. I-Invertebrates, Macmillan.
6. Noble, E. R. and Noble, G. A. (1982). Parasitology-The Biology of Animal Parasites, Lea and Febiger, Philadelphia.
7. Ruppert, E.E. and Barnes, R.D. (1994). Invertebrate Zoology. 6th Edition, Saunders College Publishing.
8. Webb, J.E., Wallwork, J.A. and Elgood, J. H. (1981). Guide to Invertebrate Animals, English Language Book Society and Macmillan.

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				**3**	**1**	**3**	**3**	**3**			
CO2	3	1				**2**	**1**	**3**	**3**	**3**			
CO3	3	1				**1**	**1**	**2**	**3**	**3**			
CO4	3	1				**1**	**1**	**2**	**3**	**3**			
CO5	3	1				**1**	**1**	**3**	**3**	**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	BS203	**Title of the Course**	**Cell biology and genetics**	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	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 cell structure and its functions, signaltransduction and genetics.						

Course Outcomes	
CO1	Develop an understanding of the cell structure and their functions, cytoskeleton and prokaryotic andeukaryotic cells
CO2	Learn about Cell Division, Membrane transport, transduction, cell senescence and Programmed Cell Death.
CO3	Learn about Chromosomes, Chromosomal Variations, Chromosome mapping, structural and numerical Aberrations
CO4	Learn about basic genetics, epistasis, Concepts of allosomes and autosomes, Linkage and Crossing Over.
CO5	Learn about mutations, human Genetics, DNA damage and repair.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Cell as a Basic unit of Living Systems	Discovery of cell, The Cell theory Ultrastructure of an eukaryotic cell – (both plant and animal cell). Structure and functions of cell organelles, Cytoskeletal structures (Microtubules, Microfilaments); cell motility.	8	CO1
2	Title of the unit: Cell Division	Cell cycle, mitosis and meiosis, Membrane transport: active and passive transport, introduction to signal transduction and its molecular mechanism, cell senescence, Programmed Cell Death.	8	CO2
3	Chromosomes: Structural Organization	Centromere, telomere, chromonema, euchromatin and heterochromatin, chemical composition and karyotype, nucleosomemodel, Special types of chromosomes: Salivary gland and Lampbrush chromosomes, Chromosomal Variations, Chromosome mapping, structural and numerical aberrations.	8	CO3
4	Mendelism	Mendel's laws of heredity, Test cross, Incomplete dominance and simple problems, Interaction of Genes**:** Supplementary factors, Comb pattern in fowls, Complementary genes: Flower color in sweet peas, Multiple factors: Skin color in human beings, Epistasis: Plumage colour in poultry, Multiple allelism: Blood groups in human beings, Concepts of allosomes and autosomes, XX-XY, XX-XO, ZW-ZZ, ZO-ZZ type, Linkage and Crossing Over, Mechanism and importance	8	CO4
5	Mutations	Spontaneous and induced mutations, Physical and chemical mutagens, Mutation at the molecular level, Mutations in plants, animals, and microbes for economic benefit of man. Human Genetics: Karyotype in man, inherited disorders: Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du- Chat syndrome). DNA Damage and Repair: Causes and Types of DNA damage, Major mechanisms of DNA repair: photoreactivation, nucleotide and base excision repairs, mismatch repair, SOS repair.	8	CO5

Reference Books:

1. Molecular Biology of cell – Bruce Alberts et al, Garland publications
2. Animal Cytology & Evolution – MJD, White Cambridge University Publications
3. Molecular Cell Biology – Daniel , Scientific American Books.
4. Cell Biology – Jack D. Burke, The William Twilkins Company.
5. Principles of Gene Manipulations – Old & Primrose, Black Well Scientific Publications.
6. Cell Biology & Molecular Biology – EDP Roberties & EMF Roberties, Sauder College.
7. Principles of Genetics – E.J. Gardener, M.J. Simmons and D.P. Snustad, John Wiley & Sons Publications

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					2	2	2	1			
CO2	3	1					2	3	2	2			
CO3	3	1					2	3	2	3			
CO4	3	1					2	3	2	3			
CO5	3	1					2	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	BS162	**Title of the Course**	Algae, Fungi, Bryophyta	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	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 general characteristics, habit, habitat,anatomy, morphology, thallus organization, reproduction, economic importance and Classification of algae, fungi, Lichens andBryophytes.						

Course Outcomes	
CO1	Have basic knowledge of **c**lassification of algae, Economic importance and life Cycle
CO2	Learn about general features of fungi, Classification, thallus organization, cell wall composition, Reproduction andeconomic importance of fungi, life cycle
CO3	Have basic knowledge of Lichens
CO4	Identify General features of Bryophytes, Classification, Thallus organization, Reproduction and affinities ofbryophytes, Economic importance of bryophytes with special reference to *Sphagnum*
CO5	Study Marchantiophyta – *Marchantia;* Bryophyta - *Pogonatum*; Anthocerotophyta – *Anthoceros*.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Classification of algae	General features of algae, Classification, Range of thallus organization, Reproduction; Classification of algae, Economic importance and life Cycle with special reference to *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Chara and Polysiphonia*.	8	CO1
2	Classification of fungi	General features of fungi, Classification, range of thallus organization, cell wall composition, Reproduction, economic importance of fungi, life cycle with special reference to *Rhizopus* (Zygomycota), *Alternaria* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota)	8	CO2
3	Classification of lichens	Lichens: General account, classification, thallus organization, reproduction, physiology and role in environmentalpollution; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance	8	CO3
4	Classification of Bryophytes	General features of Bryophytes, Classification, Thallus organization, Reproduction and affinities of bryophytes, Economicimportance of bryophytes with special reference to *Sphagnum*	8	CO4
5	Classification of Marchantiophyta	General characters and life cycle with special reference to Marchantiophyta – *Marchantia*; Bryophyta - *Pogonatum*;Anthocerotophyta – *Anthoceros*	8	CO5

Reference Books:

1. Chapman V.J & Chapman D.J, The Algae, Macmillan India Ltd.
2. Fritsch F. B 1945, Structure and Reproduction of Algae Vol.I & II.Cambridge University Press.
3. Smith G.M 1955, Cryptogamic Botany Vol.I and II, McGraw Hill.
4. Vashishta B.R 1990, Botany for Degree Students, Vol 1,2 and 3. S.Chand & Co.
5. Singh V., Pandey P.C and Jain D.K 1998, A Text book of Botany for Undergraduate
6. Alexopoulos C.J & MIMS C.V 1988. Introductory Mycology, John Wiley & Sons.
7. Webster J 1970, Introduction to Fungi, Cambridge University Press.
8. Parihar N.S 1967, An Introduction to Embryophyta Vol I & II, General Book Depot.
9. Prempuri 1973, Bryophytes - A Broad perspective. Atmaram & Sons.

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				2	1						
CO2	3	1				2	1						
CO3	3	1				2	1						
CO4	3	1				2	1						
CO5	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: 2020-21							
Course Code	CH117	**Title of the Course**	General chemistry-I	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	3	1	0	4
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	To learn about simple quantum mechanical treatments of atoms and molecules, atomic structures, periodic properties of elements, various electronic displacement effects in organic compounds, mechanisms of organic reactions. States of matters with an emphasis on the gaseous state.						

Course Outcomes	
CO1	Explain the atomic structures based on quantum mechanics. Can write the electronic configuration of elements.
CO2	Justify the causes of periodicity and periodic properties of the different groups of elements.
CO3	Evaluate the state of hybridization, geometry of atoms, nucleophiles, electrophiles and various electron displacement effects
CO4	Investigate the mechanisms of organic reactions, design syntheses of organic molecules.
CO5	Explain various 'gas laws' governing the physical/chemical behaviour of gases.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Atomic Structure	Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of Ψ and Ψ2,quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d orbitals. Aufbau and Pauli	8	CO1
2	Periodic Properties	Atomic and ionic radii, ionization energy, electron affinity and electronegativity definition, effective nuclear charge, methods ofdetermination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behavior.	8	CO2
3	Basic Concepts of Bonding in Organic Chemistry	Hybridisation, tetravalency of carbon, geometry of molecules; methane, ethane, ethylene, acetylene and benzene, Factors affecting covalent bond; Electron displacement effects, inductive, electromeric, resonance, hyperconjugation and steric effects.	8	CO3
4	Mechanism of Organic reactions	Homolytic and heterolytic bond breaking. Types of reagents-electrophiles and nucleophiles, Types of organic reactions. Energy considerations. Reactive intermediates-carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning	8	CO4
5	Gaseous State	Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state. Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waalsconstants, the law of corresponding states, reduced equation of state. Problems Molecular velocities: Root mean square, average and most	8	CO5

Reference Books:

1. New Concise Inorganic Chemistry by J.D. Lee Edition III Compton Printing Ltd London.
2. Principles of Inorganic Chemistry by HR Puri, R. Sharma & S.P. Jauhar, Vishal Publications Jalandhar.
3. Organic Chemistry, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
4. Modern Organic Chemistry, M. K. Jain and S.C. Sharma, Vishal Publications Jalandhar.
5. Physical Chemistry, P.W. Atkins, Oxford University Press.
6. Principles of Physical Chemistry, B.R. Puri& L.R. Sharma, Shoban Lal Nagin Chand & Co.

e-Learning Source:

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/104101090/lec1.pdf
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/104106096/lec9.pdf
3. https://ocw.mit.edu/high-school/chemistry/exam-prep/structure-of-matter/chemical-bonding/
4. https://www.youtube.com/watch?v=ZNo6gfCAgWEhttps://nptel.ac.in/content/syllabus_pdf/104105033.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	PSO6
CO1	**3**	**1**	**1**		**2**	**1**	**1**						
CO2	**3**	**1**	**1**		**2**	**1**	**1**						
CO3	**3**	**1**	**2**		**2**	**1**	**1**						
CO4	**3**	**1**	**2**		**2**	**1**	**1**						
CO5	**3**	**1**	**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: 2020-21							
Course Code	BS163	**Title of the Course**	Animal diversity Lab-1	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	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 the fundamentals of different animal phyla andto understand the importance of economic zoology.						

Course Outcomes	
CO1	Describe different kinds of Protozoans
CO2	Understand and preparation of permanent slides
CO3	Learn to dissect Prawn and *Pila*
CO4	Understand and preparation of temporary slides
CO5	Understand and identify various animals from different phyla through specimens and slides.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Exp-01**	Examination of pond water for different kinds of protozoans.	3	CO1
2	**Exp-02**	Permanent preparation of gemmule of *Spongilla*	3	CO2
3	**Exp-03**	Permanent preparation of parapodium of *Neries*	3	CO2
4	**Exp-04**	Permanent preparations of Septal nephridia of *Pheretima*	3	CO2
5	**Exp-05**	Permanent preparations of gill lamella of *Pila*	3	CO2
6	**Exp-06**	Dissections: *Palaemon* and *Pila*	6	CO3
7	**Exp-07**	Glycerine preparation of Proboscis of *Musca*	3	CO4
8	**Exp-08**	Mouth parts of male and female *Anopheles* and *Culex*	3	CO4
9	**Exp-09**	Study of the following specimens: *Euplectella, Spongilla, Euspongia, Physalia, Euspongia, Corallium, Fungia,Madrepora, Metridium, Pennatula, Fungia, Neries, Hetroneries, Pheretima*	6	CO5
10	**Exp-10**	Study of the following permanent slides: Different kinds of sponge spicules and sponging fibres of *Euspongia, Amoeba, Euglena, Paramecium, Obelia, Aurelia*, T.S. and L.S. of *Sycon*, Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*.	6	CO5

Reference Books:

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, BlackwellScience
3. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press. Pough H. Vertebrate life, VIII Edition, Pearson International.
4. 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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	1			1	3		2	3	3		
CO2	3	3	1			2	3	3	2	2	3		
CO3	3	3	1			2	3	3	2	1	3		
CO4	3	3	1			1	3	3	2	3	3		
CO5	3	3	1				3	3	2	1	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	CH118	**Title of the Course**	Chemistry Practical-I	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	0	0	6	3
Pre-Requisite	10+2 with Chemistry	**Co-requisite**					
Course Objectives	The purpose of the undergraduate chemistry Lab program at the Integral University is to provide the key knowledge base and laboratory resources to prepare students for careers as professionals in the field of chemistry, and various other industries..						

Course Outcomes	
CO1	Understand the basic analytical and technical skills and technical skills to work effectively in the various fields
CO2	Understand the basic titration methods and technical skills to work in the different fields of chemistry.
CO3	Able to detect presence of elements and functional group in organic compounds.
CO4	Remember to keep records of all performed experiments in the manner which is required in laboratory

10.Syllabus	
Exp-01	Preparation of standard solution related to normality & molarity.
Exp-02	Preparation of buffer solution, pH measurement.
Exp-03	Acid - base titration.
Exp-04	Oxidation-reduction (redox) titrations. a) To determine the strength of oxalic acid.
Exp-05	To determine the strength of potassium permanganate solution by using sodium thiosulphate solution.
Exp-06	To determine the strength of given copper sulphate solution by using sodium thiosulphate solution.
Exp-07	Complexometric titrations. a) To estimate the concentration of calcium ions with EDTA. b) To estimate the
Exp-08	Detection of element present in the given organic compounds.
Exp-09	Detection of functional group present in the given organic compounds. a) Carboxylic b) Phenolic c) Alcoholic
Exp-10	To determine the strength of ferrous ammonium sulphate (Mohr's salt) solution by using external indicator.

Reference Books:

1. Lee, J.D. Concise Inorganic Chemistry, Pearson Education.
2. Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles ofStructure and Reactivity, Pearson Education 2006.
3. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry,Oxford, 1970.
4. 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:

5. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/104101090/lec1.pdf
6. 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	PSO6
CO1	3	1	1	1	2	1	3						
CO2	3	2	1	1	1	1	3						
CO3	3	1	1	1	1	1	2						
CO4	3	1	2	2	2	2	3						
CO5	2	2	2	2	2	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	BS171	**Title of the Course**	Pteridophytes, gymnosperms, palaeobotany	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	3	1	0	4
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	This paper deals to identify and classify the pteridophytes and gymnosperms. Understand the morphology, anatomy and life cycle of various genera of pteridophytes and gymnosperms along with their economic importance. Importance of studying this paper is highlighted reflecting on the elementary palaeobotany and geological time scale.						

Course Outcomes	
CO1	Understand the general features of pteridophytes, their classification, stellar organization and economic importance.
CO2	To understand the morphology, anatomy, development, vegetative and reproductive parts in various genera ofpteridophytes.
CO3	The students will learn about the general characteristics of gymnosperms, classification, resemblances and differences of gymnosperms with pteridophytes and angiosperms. mapping, structural and numerical aberrations
CO4	To understand the morphology, anatomy, development, vegetative and reproductive parts in Coniferales.
CO5	Learn elementary palaeobotany including general account, types of fossils, methods of fossilization and geologicaltime scale.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	General features of Pteridophytes	General features, Classification, Stelar organization; Homospory and Heterospory; Economic importance and life cycle ofpteridophytes with special reference to *Pteris*.	8	CO1
2	Morphology, anatomy, development, vegetative & reproductive	Morphology, anatomy, development, vegetative and reproductive parts in Psilopsida - *Rhynia*; Lycopsida - *Selaginella*;Sphenopsida - *Equisetum*; Filicopsida - *Adiantum*, *Marsilea.*	8	CO2
3	General characterstics of Gymnosperms	General characterstics of Gymnosperms, classification, resemblances and differences of Gymnosperms withPteridophytes and Angiosperms. Economic importance and life Cycle with special reference to *Cycas*.	8	CO3
4	Morphology, anatomy, development, vegetative and reproductive parts in Coniferales –Pinus.	Morphology, anatomy, development, vegetative and reproductive parts in Coniferales – *Pinus*.	8	CO4
5	Elementary Palaeobotany	General account, types of fossils, methods of fossilization and geological time scale.	8	CO5

Reference Books:

1. Smith G.M 1955, Cryptogamic Botany Vol.I and II, McGraw Hill.
2. Vashishta B.R 1990, Botany for Degree Students, Vol 1,2 and 3. S.Chand & Co.
3. Singh V., Pandey P.C and Jain D.K 1998, A Text book of Botany for Undergraduate
4. Parihar N.S 1967, An Introduction to Embryophyta Vol I & II, General Book Depot.
5. Sporne K.R 1976, Morphology of Pteridophytes, B1 Publications.
6. Sharma O.P: Text book of Pteridophyta II edition:McMillan India Ltd.
7. Bhatnagar, S.P. and Moitra1996. Gymnosperms. New Age International Limited, New Delhi.

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	1						
CO2	3	1				1	1						
CO3	3	1				1	1						
CO4	3	1				1	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: 2020-21							
Course Code	CH119	**Title of the Course**	General chemistry-ii	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	3	1	0	4
Pre-Requisite	10+2 with Chemistry	**Co-requisite**					
Course Objectives	The purpose of this course is to learn the structure and properties of ionic solids, shapes & geometries ofmolecules and their stereochemistry. Types and properties of colloids, first law of thermodynamics and related calculations.						

Course Outcomes	
CO1	Analyze the properties, structure of ionic solids by applying Born-Haber cycle, Fajan's rule etc.
CO2	Predict the geometry and shape of molecules by applying VB & VSEPR theories. Predict the properties of moleculesby applying MO theory
CO3	Interpret the reactivity and stability of an organic molecule based on structure, including conformation andstereochemistry.
CO4	Able to prepare different types of colloids.
CO5	Understand the concepts of thermodynamics, different thermodynamic quantities such as heat and work and theirmeasurements.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Ionic Solids	Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rule. Metallic bond-freeelectron, valence bond and band theories.	8	CO1
2	Chemical Bonding	Covalent Bond; Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH3, H3O+, SF4, ClF3, ICl2- and H2O. MO theory, homonuclear and heteronuclear (CO and NO) diatomicmolecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.	8	CO2
3	Introduction to Stereochemistry of organic Compounds	Concept of isomerism. Optical isomers, enantiomers and diastereomers, chiral and achiral molecules with two stereogeniccentres, absolute configuration, sequences rules, D & L and R & S systems of nomenclature. Geometrical isomerism - E & Z system of nomenclature, in alkenes oximes and cyclopropane derivative compounds.	8	CO3
4	Colloidal State	Definition of colloids, classification of colloids. Sols: properties -kinetic, optical and electrical; stability of colloids, protectivecolloids, Hardy-Schulze rule, gold number. Emulsions: types of emulsions, preparation. Gels: classification, preparation and properties	8	CO4
5	Thermodynamics	First law of thermodynamics: statement, definition of internal energy and enthalpy, Heat capacity. Heat capacities at constant volume and pressure and their relationship. Joule-Thomson coefficient and inversion temperature. Calculation of w,q, dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Problems.	8	CO5

Reference Books:

1. New Concise Inorganic Chemistry by J.D. Lee Edition III Compton Printing Ltd London.
2. Principles of Inorganic Chemistry by HR Puri, R. Sharma & S.P. Jauhar, Vishal Publications Jalandhar.
3. Basic Inorganic Chemistry F.A. Cotton and G. Willkinson III Edition.
4. Organic Chemistry, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
5. Modern Organic Chemistry, M. K. Jain and S.C. Sharma, Vishal Publications Jalandhar.
6. Physical Chemistry, P.W. Atkins, Oxford University Press.. K. Ghatak, "Physical Optics" (Tata McGrew Hill).

e-Learning Source:

1. https://www.youtube.com/watch?v=O82d8aiIS5Y
2. https://ocw.mit.edu/high-school/chemistry/exam-prep/structure-of-matter/chemical-bonding/
3. https://nptel.ac.in/courses/104103110/

	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	2	1	1	2	2	3						
CO2	3	1	1	1	2	2							
CO3	3	2	1	1	1	1	3						
CO4	3	1	2	1	1	3	3						
CO5	3	2	2	1	2	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	BS172	**Title of the Course**	Non chordates-ii "annelida to echinodermata	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	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 general taxonomic rules on animal classification and the complex interactions among animals of different phyla. The students will acquire the knowledge about the distinguishing features of higher non chordates.						

Course Outcomes	
CO1	The students will understand General characters and classification up to classes of annelida.
CO2	The students will understand General characters and classification up to classes of arthropoda.
CO3	The students will understand General characters and classification up to classes of mollusc.
CO4	The students will understand General characters and classification up to classes of echinodermata.
CO5	The students will understand the general characters of Protochordata, Urochordata and Cephalochordata.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Annelida	General characters and classification up to classes; Nereis and Hirudinaria: - Habits and Morphology; Metamerism in Annelida.	8	CO1
2	Arthropoda	General characters and classification up to classes; Palaemon:-Habits andMorphology, Apis:- Colony; Metamorphosis inInsects.	8	CO2
3	Mollusca	General characters and classification up to classes; Lamellidens and Pila:-Habits and Morphology, Torsion in Gastropods.	8	CO3
4	Echinodermata	General characters and classification up to classes; Pentaceros: - Habits and Morphology; Water-vascular system in Asteroidea.	8	CO4
5	Protochordates	General features of Protochordata; General Characters of Hemichordata and Affinities of Balanoglossus.	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. Barnes, B.D. (1987). Invertebrate Zoology. 5th Edition, Saunders College Publishing.
4. Kotpal, R. L. (1988). Protozoa. Rastogi Publications
5. Marshall, A.J. and Williams, W.D. (1979). Text Book of Zoology Vol. I-Invertebrates, Macmillan.
6. Noble, E. R. and Noble, G. A. (1982). Parasitology-The Biology of Animal Parasites, Lea and Febiger, Philadelphia.
7. Ruppert, E.E. and Barnes, R.D. (1994). Invertebrate Zoology. 6th Edition, Saunders College Publishing.8.Webb, J.E., Wallwork, J.A. and Elgood, J. H. (1981). Guide to Invertebrate Animals,
8. English Language Book Society and Macmillan.

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

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

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	BS 233	**Title of the Course**	Animal physiology	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	3	1	0	4
Pre-Requisite	10+2 with Biology	**Co-requisite**					
Course Objectives	The students will gain fundamental knowledge of animal physiology.						

Course Outcomes	
CO1	Understand the process of digestion and absorption.
CO2	Understand blood and cardiovascular system.
CO3	Students will gain knowledge of the muscle system, nervous system.
CO4	Students are taught the detailed concepts of respiration, excretion and osmoregulation.
CO5	Students gain fundamental knowledge of reproductive and endocrine systems.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Digestion and absorption	Role of salivary glands, liver, pancreas and intestinal glands. Digestion and absorption of carbohydrates, lipids and	8	CO1
2	Blood	Composition of blood, blood cells, plasma proteins and Rh factor; Blood coagulation – mechanism and regulation.	8	CO2
3	Respiration	Respiratory volumes, Haemoglobin and oxygen transport, carbon dioxide transport, Bohr's effect and chloride shift. Excretion and osmoregulation: Structure of nephron, urine formation and its regulation; excretory product.	8	CO3
4	Muscle system	Muscles and Movement, Skeletal, cardiac and smooth muscle. Nervous system: central and peripheral nervous system, nerve impulse – its conduction and synaptic transmission,neurotransmitters.	8	CO4
5	Endocrine system	Endocrine glands and their functions; Nature of hormones; Regulation of hormone secretion; Mode of action of hormones.Reproductive system: testis, ovary, Spermatogenesis, Oogenesis, Totipotency.	8	CO5

Reference Books:

1. Textbook of Medical Physiology by Guyton. A.C., H. Sanders Philadelphia. 1988.
2. Physiological basis of Medical practice, West J.B., Best and Taylor.
3. Introduction to Physiology by Davidson H and Segal M.B. Academic Press.
4. Fox S I – Human Physiology, (McGraw Hill, 1998, ISBN: 0071157069)
5. Moffett D and Schauf C L – Human Physiology: Foundations & Frontiers, (Mosby, 1993, ISBN: 801669030)
6. Seeley R, Stephens T and Tate P – Anatomy & Physiology, (McGraw-Hill, 1999, ISBN: 0071169881)
7. Sherwood L – Human Physiology: From Cells to Systems, (Wadsworth Publishing, 2000,ISBN: 0534568262)

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					2	2	3	1			
CO2	3	1					2	2	3	1			
CO3	3	1					2	2	3	1			
CO4	3	1					2	2	3	1			
CO5	3	1					2	2	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	BS174	**Title of the Course**	Plant diversity lab-I	**L**	**T**	**P**	**C**
Year	1	**Semester**	II	0	0	6	3
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	This course is designed to enable the students to understand the general characteristics, habit, habitat, anatomy, morphology, thallus organization of algae, fungi, Lichens, Bryophytes, pteridophytes and gymnosperms. Students will also understand the types and Parts of inflorescence and flowers.						

Course Outcomes	
CO1	Identify and analyze dicot and monocot roots, stems and leaves.
CO2	Learn about general features of algae and fungi.
CO3	Identify and Learn basics of bryophytes, pteriodophytes and gymnosperms.
CO4	Identify types of seed and fruit.
CO5	Study morphology of flower parts and inflorescence.

Unit	**Title of the**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Exp-1**	Transverse section of dicot and monocot roots	6	CO1
1	**Exp-2**	Transverse section of dicot and monocot stems	6	CO1
1	**Exp-3**	Transverse section of dicot and monocot leaves	6	CO1
2	**Exp-4**	Study of one example each of algae and fungi	6	CO2
3	**Exp-5**	Study of one example each of bryophyte, pteriodophyte, gymnosperm	6	CO3
4/5	**Exp-6**	Morphology study of flower parts, inflorescence, seed, fruit types	6	CO4/CO5

Reference Books:

1. Bahadur, B., Rajam, M.V., Sahijram, L., Krishnamurthy, K.V. (Eds.). Plant Biology and Biotechnology. Volume I: Plant Diversity, Organization,Function and Improveme
2. James Bidlack, Shelley Jansky, Kingsley R Stern. Laboratory Manual for Stern's Introductory Plant Biology.

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	1						
CO2	3	1				2	1						
CO3	3	1				2	1						
CO4	3	1				1	1						
CO5	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: 2020-21							
Course Code	CH120	**Title of the Course**	Chemistry Practical-II	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	0	0	6	3
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	The purpose of the undergraduate chemistry Lab program at the Integral University is to providethe key knowledge base and laboratory resources to prepare students for careers as professionals in the field of chemistry, and various other industries**.**						

Course Outcomes	
CO1	Remember to keep records of all performed experiments in themanner which is required in laboratory.
CO2	Able to Evaluate water quality parameters like chloride content and alkalinity.
CO3	Understand the basic titration methods and technical skills to work in the different fields of chemistry.
CO4	Know about the principles of qualitative and quantitative analysis of inorganic mixtures.
CO5	Analyze the importance of personal safety and care of equipment's and chemicals.

10.Syllabus	
Exp-01	To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolutionprocess.
Exp-02	To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calciumchloride from its enthalpy data using Born Haber Cycle.
Exp-03	To determine the heat of solution of KNO3 by solubility method.
Exp-04	Estimation of hardness of water by EDTA.
Exp-05	Determination of R*f* values and identification of organic compounds
Exp-06	Separation of green leaf pigments (spinach leaves may be used.
Exp-07	Preparation of separation of 2, 4-dinitrophenylhydrazones of acetone, 2-butanone, hexan-2, and 3-one using toluene and light petroleum (40:60).
Exp-08	Determination of R*f* values and identification of organic compounds:Separation of a mixture of D, L – alanine,glycine, and L-Leucine using nbutanol: acetic acid:water (4:1:5), Spray reagent – ninhydrin.

Reference Books:

1. Advance Practical Chemistry: Jagdamba Singh, L.D.S Yadav, Jaya Singh, I.R. Siddiqui, PragatiEdition.
2. Practical Organic Chemistry, A.I.Vogel.
3. Practical Physical Chemistry: B. Viswanathan and P.S.Raghavan.
4. 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	PSO6
CO1	3	1	2		3	1	2						
CO2	3	1	1		2		2						
CO3	3	1	2		1	1	2						
CO4	3	1	1		1	1	2						
CO5	2	1	1		2	1	2						

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

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