Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	B040101T/ BS166	**Title of the Course**	Microbiology & Plant Pathology	**L**	**T**	**P**	**C**
Year	**1**	**Semester**	1	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	The objective of this course is to foster a comprehensive grasp of fundamental concepts in microbiology, phycology, mycology, plant pathology, and diseases, with a focus on exploring methods for disease control and the practical applications of microbiology in various fields.						

Course Outcomes	
CO1	Students will be able to gain knowledge about ancient Indian botany and various microscopy techniques and other equipment used in the microbiology field.
CO2	Students will be able to develop a comprehensive understanding of the diverse world of microorganisms (bacteria and viruses), their structures, behaviors, and the economic significance.
CO3	Students will be able to explain classification and diversity of Algae and Fungi and their economic importance.
CO4	Students will be able to gain knowledge about mushroom cultivation, lichenology, mycorrhiza, and uses of microbes in various fields.
CO5	Students will be able to learn about plant-pathogen interaction, diseases from their initiation and progression to the various defense mechanisms employed by plants and the methods used for disease control.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**A. Botanical Legacies: Ancient India to Modern Science** **B. Microbial Techniques & Instrumentation**	**A**. Introduction to Indian ancient, Vedic and heritage Botany and contribution of Indian Botanists (in all branches), in context with the holistic development of modern science and technology, has to be taught, practiced and assessed via class interaction/ assignments / self-study mentioned under Continuous Internal Evaluation (CIE). **B.** Microscopy – Elementary knowledge of Light, phase contrast, electron, scanning and transmission electron microscopy, staining techniques for light microscopy. Common equipment of microbiology lab and principle of their working – autoclave, oven, laminar air flow, centrifuge. spectrophotometer, fermenters.	6	CO1
2	**Microbial world**	Eukaryotic and prokaryotic cells, Gram positive and Gram-negative bacteria, Structure of a bacteria, Bacterial Growth curve, factors affecting growth of microbes; Batch culture, fed batch culture and continuous culture; Synchronous growth of microbes; Sporulation and reproduction in bacteria. Viruses, general characteristics, Structure of viruses: Structure of T4; Lytic and Lysogenic cycles, viroid, Prions & mycoplasma & phytoplasma.	8	CO2
3	**Phycology**	Range of thallus organization in Algae, Pigments, Reserve food –Reproduction, Classification and life cycle of –Chlorella, Oedogonium, Chara, Polysiphonia. Economic importance of algae - Role of algae in soil fertility- biofertilizer; Commercial products of algae –biofuel, Agar.	8	CO3
4	**Mycology**	General characteristics, nutrition, life cycle, Economic importance of Fungi, Classification upto class. General characters of Mastigomycotina: Synchytrium, Zygomycotina: Rhizopus, Ascomycotina: Saccharomyces Basidiomycotina: Puccinia, Agaricus; Deuteromycotina: Alternaria. Heterothallism, Physiological specialization, Heterokaryosis & Parasexuality,	8	CO3
5	**Mushroom Cultivation, Lichenology & Mycorrhiza**	Mushroom cultivation. General account of lichens, reproduction, and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.	6	CO4
6	**Plant Pathology**	Disease concept, Symptoms, Disease cycle, Primary and secondary inoculum, Pathogenicity and pathogenesis, Koch's Postulates. Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), Defense mechanism with special reference to Phytoalexin, Resistance- Systemic acquired and induced systemic.	8	CO5
7	**Diseases and Control**	Symptoms, Causal organism, Disease cycle and Control measures of – Early & Late Blight of Potato, Black Stem Rust of Wheat, Red Rot of Sugarcane, Wilting of Arhar, Mosaic diseases on tobacco, Citrus Canker, Little leaf of brinjal, Damping off seedlings; Disease management: Quarantine, Chemical, Biological, Integrated pest disease management.	8	CO5
8	**Applied Microbiology**	Food fermentations and food produced by microbes, microbial products, Production of antibiotics, alcoholic beverages & genetic recombinant vaccines. Biofertilizers and Plant growth promoting rhizobacteria & biopesticides, Microbiology of water, Single cell proteins, bioplymers, bioindicators, biosensors, bioremediation.	8	CO4

Reference Books:

1. Hardy G and Totelin L (2015) Ancient Botany (Sciences of Antiquity)
2. Pelczar Jr. MJ, Chan ECS, Krieg NR (1993). Microbiology – Mc Graw Hill. Inc, New York
3. Fritsch F. B 1945, Structure and Reproduction of Algae Vol.I & II.Cambridge University Press.
4. Singh V., Pandey P.C and Jain D.K 1998, A Textbook of Botany for Undergraduate

5.	Vashishta B. R 1990, Botany for Degree Students, Vol 1,2 and 3. S.Chand & Co.
6.	Alexopoulos C.J & MIMS C.V 1988. Introductory Mycology, John Wiley & Sons.
7.	Agriose, G.N. (2005). Plant Pathology, 5th edition Academic Press, Inc., Ainsworth, G.C. and Sussman, A.A. (Eds).
8.	Mehrotra R.S. (1983) Plant Pathology, Tata-McGraw-Hill Education

e-Learning Source:

Unit IA

i. https://indianculture.gov.in/rarebooks/economic-botany-india

https://www.infinityfoundation.com/mandala/t_es/t_es_tiwar_botany_frameset.htm

ii.https://www.researchgate.net/publication/335715457_Ancient_Indian_rishi's_Sages_knowledge_of_botany_and_medicinal_plants_since_Vedic_period_was_much_older_than_the_period_of_Theophrastus_A_case_study-_who_was_the_actual_father_of_botany

iii. https://www.scribd.com/presentation/81269920/Botany-of-Ancient-India

iv. https://insa.nic.in/writereaddata/UpLoadedFiles/IJHS/Vol17_2_17_PKBhattacharyya.pdf

v. http://wgbis.ces.iisc.ernet.in/biodiversity/sahyadri/wgbis_info/botany_history.pdf

vi. https://www.plantsdiseases.com/p/symptoms.html

vii. https://www.plantsdiseases.com/p/pathogenic-diseases-in-plants.html

Other Units

http://egyankosh.ac.in/handle/123456789/53530

https://www.onlinebiologynotes.com/algae-general-characteristics-classification/

http://ecoursesonline.iasri.res.in/mod/page/view.php?id=11293

	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	1					1	2	2	3	
CO2	3	1					1	2	2		
CO3	3	1					1	2	2	3	
CO4	3	1				2	1	2	2	3	
CO5	3	1					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: 2024-25							
Course Code	B040102P/ BS167	**Title of the Course**	Techniques in Microbiology & Plant Pathology	**L**	**T**	**P**	**C**
Year	**1**	**Semester**	1	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	This course is designed to make students well acquainted with techniques in microbiology and plant pathology.						

Course Outcomes	
CO1	Students will be able to understand the instruments, techniques, lab etiquettes and good lab practices for working in a microbiology laboratory.
CO2	Students will develop skills for identification, and culturing of bacteria
CO3	Students will learn to identify Fungi, Lichens and Algae.
CO4	Students will be able to identify different plant diseases, stages in the life cycle of Puccinia.
CO5	Students will be able to isolate lactic acid bacteria from curd. Additionally, they will learn to produce hydrolytic enzymes from immobilized bacterial cells and conduct enzymatic assays for amylase.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Experiment 1**	• Study of laboratory safety and good laboratory practices • Study of principles and application of Laboratory instruments-microscope, incubator, autoclave, centrifuge, LAF, filtration unit, shaker, pH meter • To carry out the procedure of buffer preparation & titration • To learn the cleaning and sterilization techniques of glass wares • To identify bacteria. • To learn technique of Gram's staining • To study the cultural characteristics of bacteria on NA.	20	CO1 & CO2
2	**Experiment 2**	• To identify fungi by lactophenol cotton blue method. • To study the specimens of button stage and full-grown mushrooms • To study specimens of crustose, foliose, and fruticose lichens. • To study algae: Volvox, Chara, Polysiphonia	15	CO3
3	**Experiment 3**	• Preparation of fungal media (PDA) & Sterilization process. • Identification: Pathological specimens of a bacterial and viral disease. • Slides of uredial, telial, pycnial & aecial stages of Puccinia • Isolation of phyllosphere microflora	15	CO4
4	**Experiment 4**	• Isolation of lactic acid bacteria from curd • Immobilized bacterial cells for production of hydrolytic enzymes. • Enzyme assay of amylase	10	CO5

Reference Books:

1. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.
2. Aneja K.R. Bergey 's Manual of Determinative Bacteriology
3. Cappuccino, J. C. and Sherman, N. (1992). Microbiology: A laboratory manual, Addison Wesley Pub. Co
4. Benson HJ (1994). Microbiological Applications, WmC Brown Publishers, Oxford.
5. Pandey. B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.

e-Learning Source:

https://agrimoon.com/wp-content/uploads/Mashroom-culture.pdf

http://nhb.gov.in/pdf/Cultivation.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
CO1	3	1	1	2		1	1	2	2	2	
CO2	3	1				1	2	2	2	2	
CO3	3	1				1	1	2	2	2	
CO4	3	1				2	1	2	2	3	
CO5	3	1				1	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: 2024-25							
Course Code	B040103V/ BS168	**Title of the Course**	Biofertilizer Technology	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**2**	**1**	**0**	**3**
Pre-Requisite	10+2biology	**Co-requisite**					
Course Objectives	The objective of this course is to develop the understanding of general characters, types and application of biofertilizers						

Course Outcomes	
CO1	Know the types and formulation of biofertilizers.
CO2	Understand the basics and types of algal biofertilizers
CO3	Study the cyanobacterial biofertilizers
CO4	To be familiar with mycorrhizal biofertilizers
CO5	Understand the concept of organic farming

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	General account of biofertilizers	General account about the microbes used as biofertilizer – *Rhizobium* – isolation, identification, mass multiplication, carrier-based inoculants, Actinorrhizal symbiosis. Study of *Rhizobium* nodules in roots.	**6**	**CO1**
2	Algal biofertilizers	*Azospirillum*: isolation and mass multiplication – carrier-based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance, and mass multiplication. Production of carrier based biofertilizer formulation (demo).	**8**	**CO2**
3	Cyanobacterial biofertilizers	Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. Survey of commercial biofertilizers and their active components.	**8**	**CO3**
4	Mycorrhizal biofertilizers	Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth, and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants. Examination of VAM in roots.	**6**	**CO4**
5	Organic farming	Organic farming – Green manuring and organic fertilizers, Recycling of bio- degradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application. Visit/virtual visit to any organic farm /biocomposting unit.	**8**	**CO5**

Reference Books:

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi. 6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

e-Learning Source:

https://vlab.amrita.edu/?sub=3&brch=73

https://www.youtube.com/watch?v=O1FfEbpaiHw

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

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

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

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	B050101T/ BS164	**Title of the Course**	Cytology, Genetics, and Infectious Diseases	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	The objective of this course is to develop the understanding of structure and functions of cell organelles nucleus and chromatin structure, cell cycle, cell division and cell signalling, mendelism and sex determination, extensions of mendelism, genes and environment, human chromosomes and patterns of inheritance, and infectious diseases.						

Course Outcomes	
CO1	Understand the structure and function of cell organelles.
CO2	Understand the basics of chromatin structure and its location, cell cycle and cell signaling.
CO3	Understand the basic principles of genetics, Mendel's laws and the deviations from conventional patterns of inheritance, and to comprehend how the environment plays an important role by interacting with genetic factors.
CO4	Understand how to detect chromosomal aberrations in humans and study the pattern of inheritance by pedigree analysis in families.
CO5	Understand the mechanisms of pathogenic infection in humans.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Structure and Functions of cell organelles-I	Plasma membrane: chemical structure—lipids and proteins, Cell-cell interaction: cell adhesion molecules, cellular junctions. Endomembrane system: protein targeting and sorting, endocytosis, exocytosis. Introduction to national and international Biologists (Zoologists) who have contributed/contributing to Zoological and Life Sciences.	**8**	**CO1**
2	Structure and Function of Cell Organelles II	Cytoskeleton: microtubules, microfilaments, intermediate filaments. Mitochondria: Structure, oxidative phosphorylation. Peroxisome and ribosome: structure and function.	**6**	**CO1**
3	Nucleus and Chromatin Structure	Structure and function of nucleus in eukaryotes. Chemical structure and base composition of DNA and RNA. Chromatin organization: structure of Chromosomes. Types of DNA and RNA	**8**	**CO2**
4	Cell cycle, Cell Division and Cell Signalling	Cell division: mitosis and meiosis. Cell cycle and its regulation, apoptosis. Signal transduction: intracellular signalling and cell surface receptors, via G-protein linked receptors.	**8**	**CO2**
5	Mendelism and Sex Determination	Basic principles of heredity: Mendel's laws, monohybrid and dihybrid crosses. Complete and Incomplete Dominance, Penetrance and expressivity. Sex Determination: XX/XY, XX/XO, ZW/ZZ, & ZW/ZO sex-determination system. Sex-linked characteristics and Dosage compensation.	**6**	**CO3**
6	Extensions of Mendelism, Genes and Environment	Extensions of Mendelism: Multiple Alleles, Gene Interaction. The Interaction Between Sex and Heredity: Sex-Influenced and Sex-Limited Characteristics. Cytoplasmic Inheritance, Genetic Maternal Effects. Interaction Between Genes and Environment: Environmental Effects on Gene Expression.	**8**	**CO3**
7	Human Chromosomes and Patterns of Inheritance	Chromosomal anomalies: Structural and numerical aberrations with examples. Pedigree analysis. Patterns of inheritance: autosomal dominant, autosomal recessive, X-linked recessive, X-linked dominant	**8**	**CO4**
8	Infectious Diseases	Introduction to pathogenic organisms: viruses, bacteria, fungi, protozoa, and worms. Structure, life cycle, pathogenicity, including diseases, causes, symptoms and control of common parasites: Trypanosoma and Giardia.	**8**	**CO5**

Reference Books:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts et al: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman (2004).
5. Lewin B. Genes VIII. Pearson (2004).
6. Watson et al. Molecular Biology of the Gene. Pearson (2004).
7. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis KubyKuby Immunology. W H Freeman (2007).
8. Delves Peter J., Martin Seamus J., Burton Dennis R., Roitt Ivan M. Roitt's Essential Immunology, 13th Edition. Wiley Blackwell (2017).
9. Shetty Nandini Immunology Introductory Textbook. New Age International. (2005)

e-Learning Source:

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					2	3			3
CO2	3	1					2	3			3
CO3	3	1					2	3			3
CO4	3	1					2	3			3
CO5	3	1					2	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: 2024-25							
Course Code	B050102P/ BS165	**Title of the Course**	Cell Biology & Cytogenetics Lab	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**0**	**0**	**4**	**2**
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	The course is designed to train the students in basic experiments of cytogenetics.						

Course Outcomes	
CO1	At the completion of the course students will learn Hands-on to use simple and compound microscopes.
CO2	The students will be able to prepare slides and stain them to see the cell organelles.
CO3	The students will be familiar with the basic principle of life, how a cell divides leading to the growth of organism and reproduces to form new organisms.
CO4	The students will be able to identify the chromosomal aberrations by preparing karyotypes.
CO5	The students will be able to learn how chromosomal aberrations are inherited in humans by pedigree analysis in families.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Experiment 1**	a. To study different cell types such as buccal epithelial cells, neurons, striated muscle cells using Methylene blue. b. To check the permeability of cells using salt solution of different concentrations.	15	CO1
2	**Experiment 2**	a. To study the different stages of Mitosis in root tip of onion. b. To study the different stages of Meiosis in grasshopper testis.	15	CO2
3	**Experiment 3**	a. Study of parasites (eg. Protozoans, helminths etc.) from permanent slides. b. To learn the procedures for preparation of temporary and permanent stained/unstained slides. c. Study of mutant phenotypes of *Drosophila.* d. Preparation of polytene chromosomes.	15	CO3 & CO4
4	**Experiment 4**	a. Study of sex chromatin (Barr bodies) in buccal smear and hair bud cells (Human). b. Preparation of human karyotype and study the chromosomal aberrations with respect to number, translocation, deletion etc. from the pictures provided. c. To prepare family pedigrees.	15	CO5

Reference Books:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).

2. Alberts et al: Molecular Biology of the Cell: Garland (2002).

3. Kesar, Saroj and Vashishta N. (2007). Experimental Physiology: Comprehensive Manual. Heritage Publishers, New Delhi

e-Learning Source:

https://www.vlab.co.in
https://zoologysan.blogspot.com
www.vlab.iitb.ac.in/vlab
www.onlinelabs.in
www.powershow.com
https://vlab.amrita.edu
https://sites.dartmouth.edu

	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	1									
CO2	3	1					1				
CO3	3	1					1				

CO4	3	1					1				
CO5	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: 2024-25							
Course Code	B11010V/BS144	**Title of the Course**	Biomolecules and nutrition	**L**	**T**	**P**	**C**
Year	1	**Semester**	I	**2**	**0**	**1**	**3**
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	**The objective of this course is to develop an understanding of basics of Biomolecules structure and function, role of nutrients in human health.**						

Course Outcomes	
CO1	Develop an understanding of general properties, classification and nomenclature of biomolecules.
CO2	Develop an understanding about importance of food and nutrition.
CO3	Develop an understanding of macronutrients.
CO4	Develop an understanding about micronutrients.
CO5	Develop an understanding of nutritional deficiency diseases.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Biomolecules general aspects**	Theory: Biomolecules general aspects: carbohydrates, proteins, fats, vitamins and minerals. Practical: Tests for carbohydrates.	8	**CO1**
2	**Overview of Food and Nutrition**	Theory: Overview of Food and Nutrition- Classification of food and nutrients, Importance of dietary fibers, Malnutrition, Food Commodities (Cereal millets, pulses, milk & milk products, meat, fish, poultry, fruits & vegetables, fats & oils, beverages). Practical: Tests for proteins & amino acids.	8	**CO2**
3	**Role of macronutrients in nutrition:**	Theory: Role of macronutrients in nutrition- Physiological roles of Carbohydrates, Protein, Lipids. Practical: Virtual labs on quantification of macronutrients	8	**CO3**
4	**Role of micronutrients**	Theory: Role of micronutrients in nutrition- Biochemical and physiological role of Vitamins & Minerals, Bioavailability & Requirements. Practical: Calculation of BMR	8	**CO4**
5	**Nutritional Deficiency Diseases**	Theory: Nutritional Deficiency Diseases- excess and deficiency of vitamins. Source, deficiency and excess of trace elements such as calcium, sodium, potassium, phosphorus, iron, iodine. Practical: Case studies on nutritional deficiency diseases.	8	**CO5**

Reference Books:

Srilakshmi B (2018): Food Science, 7th Colour Ed. New Age International (P) Ltd.

Mann J and TruswellS (2017) : Essentials of Human Nutrition, 5th Ed. Oxford University Press.

SrilakshmiB (2017): Nutrition Science,6th Multicolour Ed. New Age International (P) Ltd.

e-Learning Source:

www.coursera.com

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)												
PO-PSO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	3	1					1	2					
CO2	3	1					1	3					
CO3	3	1					1	3					
CO4	3	1					1	3					
CO5	3	1					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: 2024-25							
Course Code	B040201T/ BS177	**Title of the Course**	Archegoniates and Plant Architecture	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	II	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	This course aims to identify, classify, and explore the morphology, anatomy, and life cycles of bryophytes, pteridophytes, and gymnosperms, emphasizing their economic importance. Additionally, this course also covers the essential topics like elementary paleobotany, the geological time scale, angiosperm morphology, plant anatomy, reproductive botany, and palynology.						

Course Outcomes	
CO1	Students will be able to classify and develop critical understanding on morphology, anatomy, reproduction, and economic importance of bryophytes
CO2	Students will be able to classify and develop critical understanding of morphology, anatomy, reproduction, and economic importance of pteridophytes
CO3	Students will be able to classify and to learn general characters of gymnosperms (morphology, anatomy, reproduction, and economic importance) and elementary paleobotany and evolution of plants.
CO4	Students will be able to gain knowledge about external and internal structures of flowering plants.
CO5	Students will be able to learn about the basics of reproductive biology of plants and fundamentals and applied aspects of palynology.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to Archegoniates & Bryophytes**	Unique features of archegoniates, Bryophytes: General characteristics, adaptations to land habit, Range of thallus organization. Classification (up to family), morphology, anatomy, and reproduction of Marchantia and Sphagnum (Developmental details not to be included), economic importance of bryophytes.	7	CO1
2	**Pteridophytes**	General characteristics, Classification (up to family), life cycle of pteridophytes with special reference to *Pteris*, Heterospory and seed habit, stelar evolution, economic importance of Pteridophytes.	8	CO2
3	**Gymnosperms**	Classification and distribution of gymnosperms; Salient features of Cycadales, Ginkgoales, Coniferales and Gnetales, Morphology, anatomy, and reproduction in *Cycas*; economic importance	8	CO3
4	**Paleobotany**	General account of Cycadofilicales, Bennettitales and Cordaitales; Geological time scale. Brief account of process of fossilization & types of fossils and study techniques; Contribution of Birbal Sahni	8	CO3
5	**Angiosperm Morphology (Stem, Roots, Leaves & Flowers, Inflorescence)**	Morphology and modifications of roots, stem, and leaf. Types of inflorescences; flowers, flower parts, fruits and types of placentation; Definition and types of seeds.	7	CO4
6	**Plant Anatomy**	Meristematic and permanent tissues, Organs (root, stem, and leaf). Apical meristems & theories on apical organization - Apical cell theory, Histogen theory, Tunica-Corpus theory. Secondary growth - Root and stem- cambium (structure and function) annular rings, Anomalous secondary growth in dicot stem: Boerhaavia and monocot stem: Dracaena.	7	CO4
7	**Reproductive Botany**	Plant Embryology, Structure of microsporangium, microsporogenesis, Structure of megasporangium and its types, megasporogenesis, Structure and types of female gametophyte, types of pollination, Methods of pollination, Germination of pollen grain, structure of male gametophyte, Fertilization, structure of dicot and monocot embryo, Endosperm, Double fertilization, Apomixis and polyembryony.	8	CO5
8	**Palynology**	Pollen structure, pollen morphology, pollen allergy, Applied Palynology: Basic concepts, Forensic palynology, Role in taxonomic evidence.	7	CO5

Reference Books:

1. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
2. Vashishtha BR, Sinha AK and Kumar A (2010) Botany for Degree Students – Pteridophyta, S. Chand & Co.
3. Vashishtha BR, Sinha AK and Kumar A (2010) Botany for Degree Students – Gymnosperms, S. Chand and Company
4. Singh V., Pandey P.C and Jain D.K (1998) A Textbook of Botany for Undergraduate
5. Vashishta B. R .1990, Botany for Degree Students, Vol 1,2 and 3. S.Chand & Co.
6. Bhattacharya et. al. 2007. A textbook of Palynology, Central, New Delhi.
7. Bhojwani, S.S. and S. P. Bhatnagar. 2000. The Embryology of Angiosperms (4th Ed.), Vikas Publishing House,.
8. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
9. Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc.

e-Learning Source:

https://www.anbg.gov.au/bryophyte/what-is-bryophyte.html
https://pteridoportal.org/portal/index.php
https://www.conifers.org/zz/gymnosperms.php
https://palynology.org/
https://www.sciencelearn.org.nz/resources/100-plant-reproduction
https://palaeobotany.org/

	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	1				1	1	2	2	2	1
CO2	3	1				1	1	2	2	2	1
CO3	3	1				1	1	2	2	2	1
CO4	3	1				1	1	2	2	2	1
CO5	3	1				1	1	2	2	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: 2024-25							
Course Code	B040202P/ BS178	**Title of the Course**	Land Plant Architecture	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	II	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	**The objective of this course is to develop the understanding of morphology, anatomy, reproduction, and economic importance of bryophytes, pteridophytes, gymnosperms and angiosperms.**						

Course Outcomes	
CO1	Students will be able to classify and develop critical understanding on morphology, anatomy, and reproduction of bryophytes
CO2	Students will be able to classify and develop critical understanding of morphology, anatomy and reproduction of pteridophytes
CO3	Students will be able to classify and to learn general characters of gymnosperms (morphology, anatomy, reproduction, and economic importance) and elementary paleobotany and evolution of plants.
CO4	Students will be able to gain knowledge about external and internal structures of flowering plants.
CO5	Students will be able to learn about the basics of reproductive biology of plants and fundamentals and applied aspects of palynology.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Experiment 1**	Marchantia- morphology of thallus, W.M. rhizoids and scales, V.S. thallus through Gemma cup, W.M. gemmae (all temporary slides), V.S. antheridiophore, archegoniophore, L.S. sporophyte (all permanent slides). Study of habit of ferns, T.S. of leaf, rhizome, W.M. of sori.	15	CO1 & CO2
2	**Experiment 2**	a. Cycas – seedling, coralloid root and coralloid root T. S., T. S. of leaflet and Rachis, micro and megasporophyll, V. S of male cone and female cone, T. S. of entire microsporophyll and V. S. of ovule; Pinus - Branch of indefinite growth, spur shoot, T. S of needle. b. Visit Birbal Sahni Institute of Palaeosciences or a virtual conference with their scientists to learn about fossilization. c. Mark and know about Indian geographical sites rich in plant fossils.	15	CO3
3	**Experiment 3**	a. Study of diversity in leaf shape, size, and other foliar features (preparation of herbarium) b. Study of morphology of Fruits; Flowers- study of different types from fresh/ preserved specimens c. Study of modifications in Roots, stems and leaves d. Study of normal & anomalous secondary thickening – *Dracaena*/ *Boerhaavia diffusa* e. Study of T.S. of stem, leaf and stomata of monocot and dicot.	15	CO4
4	**Experiment 4**	a. Structure of anther and pollen grains b. Study of different stages of embryo development in dicots. c. Vegetative propagation by means of cutting, budding and grafting exercises. d. Study of seed germination.	15	CO5

Reference Books:

1. Bendre and Kumar, A textbook of Practical Botany. Vol I, II., Rastogi Pub. Meerut.
2. James Bidlack, Shelley Jansky, Kingsley R Stern. Laboratory Manual for Stern's Introductory Plant Biology.
3. Santra SC and Chatterjee. 2005. College Botany Practical Vol. I. New Central Book Agency (P) Ltd.
4. Pandey, BP; Misra; Trivedi, P.S. 1997. Botany Vol. II. Vikas Publishing House.

e-Learning Source:

http://arnoldia.arboretum.harvard.edu/pdf/articles/1977-37-1-propagation-manual-of-selected-gymnosperms.p

	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	1				1	1	3	2	3	
CO2	3	1				1	1	3	2	3	
CO3	3	1				1	1	3	2	3	
CO4	3	1				1	1	3	2	3	
CO5	3	1				3	1	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: 2024-25							
Course Code	B050203V/ BS179	**Title of the Course**	Apiculture	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**2**	**1**	**0**	**3**
Pre-Requisite	10+2biology	**Co-requisite**					
Course Objectives	The objective of this course is to develop the understanding of honey bee and its culture.						

Course Outcomes	
CO1	Know the history of beekeeping
CO2	Understand the Honey Bee morphology, Anatomy and Life cycle
CO3	Study the honeybee enemies and diseases
CO4	To be familiar with beekeeping: tools and equipment
CO5	Understand the honey processing and bee hive products

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Apiculture - scope, importance	History of beekeeping: Definition, Beekeeping worldwide and In India. Traditional beekeeping, Modern beekeeping, Urban or backyard beekeeping. Role of Central Honey Bee Research & Training Institute	**6**	**CO1**
2	Honey Bee morphology, Anatomy and Life cycle	Classification and morphology of Honey bees, Types of honey bees- indigenous, exotic, Species of honey bees. Social organization in honey bees: Colony life and social organization – Queen, drone, worker.	**8**	**CO2**
3	Honeybee Enemies and Diseases	Bee enemies – Enemy: Mites, Wax Moths, Ants, Bee Eaters, Garden Lizards, Bears Disease management – Identification, Preventive and control measures of the diseases.	**8**	**CO3**
4	Beekeeping: Tools and Equipment	Basic requirements for beekeeping start up BIS standard Tools used in apiculture. Introduction to types of bee boxes and Their Parts	**6**	**CO4**
5	Bee Economy	Honey extraction & handling - Quality control standards. Products of Apiculture Industry and its Uses: Honey, Bees Wax, Propolis, etc Visit/virtual visit to any apiculturist/unit/farm	**8**	**CO5**

Reference Books:

1. Gupta, J.K., Sharma, H K and Thakur, R K. 2009. Practical Manual on Beekeeping.Department of Entomology and Apiculture, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan,

2. Gatoria, G.S., Gupta, J. K., Thakur, R.K. and Singh, J. 2011. Mass queen bee rearing and multiplication of honey bee colonies. All India Co-ordinated project on honey bees and pollinators, ICAR, HAU, Hisar

3. Graham, J M (1992) The hive and the honey bee. Dadant and Sons, Hamilton, IIlinois.

4. Mishra R.C. (1995) Honey bees and their management in India. ICAR Publication, New Delhi.

5. Singh, S. (1971) Beekeeping in India, ICAR publication.

e-Learning Source:

https://www.google.com/search?q=apiculture+virtual+ab&sourceid=ie7&rls=com.microsoft:en-US&ie=utf8&oe=utf8#fpstate=ive&vld=cid:a2dd87e2,vid:K6-Jv2iRAKU,st:602

https://www.youtube.com/watch?v=xVl3frJRdc4

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

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

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

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	B050201T/ BS175	**Title of the Course**	Biochemistry and Physiology	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 Biology	**Co-requisite**					
Course Objectives	The objective of this course is to develop the understanding of basics of structure, functions and metabolism of biomolecules and fundamental knowledge of animal physiology.						

Course Outcomes	
CO1	To understand the structure function of carbohydrate, lipid and about enzyme catalyzed reaction.
CO2	To understand the basics of metabolism of carbohydrates and catabolism of amino acid and nucleotide.
CO3	To understand the structure, process and regulation of digestion, absorption, and respiratory system.
CO4	To understand blood and cardiovascular system, excretion and osmoregulation.
CO5	To comprehend the regulatory mechanisms for maintenance of function in the body.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Structure and Function of Biomolecules**	Classification, Structure and Biological importance of carbohydrates (Monosaccharides, Disaccharides, Polysaccharides), Lipids (saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids), Classification and General properties of α-amino acids; Essential and non-essential α-amino acids, Levels of organization in proteins, Simple and conjugate proteins.	**8**	**CO1**
2	**Enzyme Action and Regulation**	Classification of enzymes; Mechanism of enzyme action, Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of Km and Vmax, Lineweaver-Burk plot; Enzyme inhibition, Allosteric enzymes.	**8**	**CO1**
3	**Metabolism of Carbohydrates and Lipids**	Metabolism of Carbohydrates: glycolysis, citric acid cycle, gluconeogenesis, Glycogenolysis and Glycogenesis Lipids: Biosynthesis of palmitic acid, β-oxidation.	**8**	**CO2**
4	**Metabolism of Proteins and Nucleotides**	Catabolism of amino acids: Transamination, Deamination, Urea cycle**,** Nucleotides, Review of mitochondrial respiratory chain, Oxidative phosphorylation.	**6**	**CO2**
5	**Digestion and Respiration**	Structural organization and functions of gastrointestinal tract and associated glands, Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins. Histology of trachea and lung, Mechanism of respiration, Transport of oxygen and carbon dioxide in blood Respiratory pigments, Chloride shift, Dissociation curves and the factors influencing it.	**8**	**CO3**
6	**Circulation and Excretion**	Components of blood and their functions, Blood groups: ABO and Rh factor, Structure of mammalian heart, Cardiac cycle; Structure of kidney and its functional unit; Mechanism of urine formation.	**7**	**CO4**
7	**Nervous System and Endocrinology**	Structure of neuron, resting membrane potential, Origin of action potential and its propagation across nerve fibres. Types of synapses. Endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them Classification of hormones; Mechanism of Hormone action.	**8**	**CO5**
8	**Muscular System**	Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction.	**7**	**CO5**

Reference Books:

Nelson & Cox: Lehninger's Principles of Biochemistry: McMillan (2000)

Voet & Voet: Biochemistry Vols 1 & 2: Wiley (2004)

Introduction to Physiology by Davidson H and Segal M.B. Academic Press

Fox S I – Human Physiology, (McGraw Hill, 1998, ISBN: 0071157069)

Textbook of Medical Physiology by Guyton. A.C., H. Sanders Philadelphia. 1988.

e-Learning Source:

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	1					1	3		1	2
CO2	3	1					1	3		2	2
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: 2024-25							
Course Code	B050202P/BS176	**Title of the Course**	Physiological, Biochemical & Hematology Lab	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**0**	**0**	**4**	**2**
Pre-Requisite	10+2	**Co-requisite**					
Course Objectives	The course is designed to train the students in basic understanding of medical diagnostics & public health.						

Course Outcomes	
CO1	The students will be able to qualitatively analyze about the biomolecules
CO2	The students will be able toperform basic hematological tests
CO3	The students will be able toperform basic hematological laboratory tests
CO4	The students will be able to distinguish between normal and abnormal cellsto predict the diagnosis ofhematological disorders and diseases.
CO5	The students will be able to perform blood cell counting using haemocytometer

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Experiment 1**	a. Ninhydrin test for α-amino acids b. Benedict's test for reducing sugar and iodine test for starch	15	CO-1
2	**Experiment 2**	a. Action of salivary amylase under optimum conditions b. Qualitative tests of functional group in carbohydrates, proteins and lipids	15	CO-1
3	**Experiment 3**	a. Recording of blood pressure and glucose level by using a sphygmomanometer and glucometer, respectively b. To study different mammalian blood cell types using Leishman stain.	15	CO2 & CO3
4	**Experiment 4**	a. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal,Thyroid and Parathyroid b. Counting of RBCs and WBCs using Haemocytometer	15	CO4 & CO5

Reference Books:

1. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
2. Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders.
3. Kesar, Saroj and Vashishta N. (2007). Experimental Physiology: Comprehensive Manual. HeritagePublishers, New Delhi

e-Learning Source:

1. https://www.vlab.co.in
2. https://zoologysan.blogspot.com
3. www.vlab.iitb.ac.in/vlab
4. www.onlinelabs.in
5. www.powershow.com
6. https://vlab.amrita.edu
7. https://sites.dartmouth.edu

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

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

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