

<b>Semester: 7</b>	
<b>Course : Minor 3</b>	
<b>Paper Title: Plant and Animal Biotechnology</b>	
<b>Paper code:</b>	<b>Credits: 4</b>
<b>Hours/week : 4</b>	
<b>Category: Core/MDC/SEC/VAC : Minor</b>	
<b>Theory / Practical / Composite : Theory</b>	
<b>No of Modules : 2</b>	
<b>Course Overview:</b>	
<ol style="list-style-type: none"> <li>1. To introduce the principles and practices of modern plant biotechnology, with emphasis on plant tissue culture, genetic transformation, and emerging omics approaches.</li> <li>2. To explore <i>in vitro</i> techniques for plant propagation, regeneration, and synthetic seed production, highlighting their applications in agriculture, conservation, and industry.</li> <li>3. To provide basic understanding of molecular tools and systems-level analyses used to develop improved, stress-tolerant, and climate-resilient crop varieties</li> <li>4. To familiarize students with laboratory techniques for animal cell culture.</li> <li>5. To provide an overview of medical diagnostics and techniques like DNA sequencing and fingerprinting for genome analysis.</li> <li>6. To impart a comprehensive understanding of the techniques for application of biotechnology to animals in order to produce or modify products or processes for human welfare.</li> </ol>	
<b>Course Outcome:</b>	
<b>Module A</b>	
<ol style="list-style-type: none"> <li>1. Demonstrate knowledge of aseptic techniques, culture media composition, and nutritional requirements for successful plant tissue culture.</li> <li>2. Explain the concept of cellular totipotency and evaluate methods of micropropagation, organogenesis, somatic embryogenesis, and artificial seed production.</li> <li>3. Distinguish among different explant types and predict their <i>in vitro</i> responses, including callus formation and suspension culture behaviour.</li> <li>4. Describe the biology of plant transformation systems and assess major techniques used for genetic engineering of plants.</li> <li>5. Analyze the development and significance of transgenic plants for crop improvement, including traits related to productivity and stress tolerance.</li> <li>6. Interpret the scope and applications of plant omics technologies in understanding plant evolution, development, and the creation of climate-resilient crop varieties.</li> </ol>	
<b>Module B</b>	
<ol style="list-style-type: none"> <li>1. Define the basic concepts of animal cell culture, medical diagnosis and genome analysis, and applications in genetic engineering, aquaculture and sericulture practices.</li> <li>2. Discuss principles of aseptic techniques, composition of culture media, maintenance of cell lines, biological basis and treatment of diabetes and malaria, use of ELISA for diagnosis, principles of DNA sequencing and DNA fingerprinting, transgenic animals, animal cloning, aquaculture and sericulture practices.</li> <li>3. Determine various techniques, culture media and equipment for maintenance of cell lines, techniques for diagnosis and treatment of diseases, DNA fingerprinting, DNA sequencing and techniques for cloning, creation of transgenic animals, aquaculture and sericulture.</li> </ol>	

4. Illustrate the roles of aseptic techniques, culture equipment and cell culture media for maintenance of cell lines, applications of DNA fingerprinting, DNA sequencing and ELISA, differentiate between different gene transfer and cloning methods, and associate composite fish culture, induced breeding in carps, fish hybridization and use of sericulture biomaterials with improved aquaculture and sericulture production.
5. Evaluate the importance of aseptic techniques and equipment, cell culture media and maintenance of cell lines for animal cell culture, the advantages and limitations of techniques for diagnosis and treatment of malaria and diabetes, ELISA for diagnosis, transgenic animals, cloning, aquaculture and sericulture technologies.
6. Develop a comprehensive overview of the basic principles of animal biotechnology.

**Prerequisites:** Basic knowledge of plant and animal systems.

**SYLLABUS**

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
<b>Module A</b>	UNIT I: Plant tissue culture: Aseptic techniques; culture media and nutritional requirements; totipotency and micropropagation; explant types; response of explants (callus, organogenesis, embryogenesis); suspension culture and somatic embryogenesis. Development of artificial seeds.	2 classes per week	CO 1- CO3	K1-K4
	UNIT II: Genetic engineering of plants: Biology of <i>Agrobacterium tumefaciens</i> , plant transformation techniques; transgenic plants for crop improvement.		CO4- CO5	K1-K4
	UNIT III: Introduction to plant omics: Introductory concepts on Omics based methods and their applications towards understanding evolutionary tendencies in plants, stress tolerance and development of climate resilient crop varieties.		CO6	K1-K6
<b>Module B</b>	UNIT IV: Animal cell culture: Aseptic techniques and equipment for animal cell culture, cell culture media and its components, maintenance of cell lines. UNIT V: Medical diagnosis and genome analysis: Causes, symptoms, diagnosis and prevention of diabetes and malaria, ELISA and its use in diagnosis, DNA sequencing, DNA fingerprinting.	2 classes per week	CO1- CO6	K1-K6

	UNIT VI: Applications in genetic engineering & animal husbandry: transgenic animals and animal cloning, types of aquaculture practices, composite culture of fish, induced breeding in carps, fish hybridization. overview of sericulture.			
<b>Text Books</b>				
<b>Module A</b>				
1. Plant Tissue Culture: Theory and Practice – Bhojwani and Razdan; TERI Publications				
2. Plant Biotechnology: The genetic manipulation of plants by Adrian Slater, Nigel Scott and Mark Fowler; OUP				
3. Plant Omics: Advances In Big Data Biology - Hajime Ohyanagi, Kentaro Yano, Eiji Yamamoto, Ai Kitazumi (Editors); CABI Publication (2022)				
<b>Module B</b>				
4. G.M. Cooper, R.E. Hausman. The Cell – A Molecular Approach.				
5. T.A. Brown. Genomes 3.				
6. S. Sarkar, G. Kundu, K.K. Chaki. Introduction to Economic Zoology.				
<b>Evaluation:</b> Theory: CIA: 30 marks; Semester Exam: 70 marks				
<b>Paper Structure for Theory Semester Exam Module:</b>				
<b>Module A (35 marks)</b>				
Any four out of five questions: Each of 2 marks				
Any three out of four questions: Each of 9 marks with subparts.				
[No sub-part will be less than 2 marks or more than 6 marks]				
<b>Module B (35 Marks)</b>				
Any four out of five questions: Each of 2 marks				
Any three out of four questions: Each of 9 marks with subparts.				
[No sub-part will be less than 2 marks or more than 6 marks]				

### Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
	<b>Module A</b>	
<b>CO1</b>	Demonstrate knowledge of aseptic techniques, culture media composition, and nutritional requirements for successful plant tissue culture.	K1
<b>CO2</b>	Explain the concept of cellular totipotency and evaluate methods of micropropagation, organogenesis, somatic embryogenesis, and artificial seed production.	K2
<b>CO3</b>	Distinguish among different explant types and predict their in vitro responses, including callus formation and suspension culture behaviour.	K3
<b>CO4</b>	Describe the biology of plant transformation systems and assess major techniques used for genetic engineering of plants.	K4

<b>CO5</b>	Analyze the development and significance of transgenic plants for crop improvement, including traits related to productivity and stress tolerance.	K5
<b>CO6</b>	Interpret the scope and applications of plant omics technologies in understanding plant evolution, development, and the creation of climate-resilient crop varieties.	K6
	<b>Module B</b>	
<b>CO1</b>	Define the basic concepts of animal cell culture, medical diagnosis and genome analysis, and applications in genetic engineering, aquaculture and sericulture practices.	K1
<b>CO2</b>	Discuss principles of aseptic techniques, composition of culture media, maintenance of cell lines, biological basis and treatment of diabetes and malaria, use of ELISA for diagnosis, principles of DNA sequencing and DNA fingerprinting, transgenic animals, animal cloning, aquaculture and sericulture practices.	K2
<b>CO3</b>	Determine various techniques, culture media and equipment for maintenance of cell lines, techniques for diagnosis and treatment of diseases, DNA fingerprinting, DNA sequencing and techniques for cloning, creation of transgenic animals, aquaculture and sericulture.	K3
<b>CO4</b>	Illustrate the roles of aseptic techniques, culture equipment and cell culture media for maintenance of cell lines, applications of DNA fingerprinting, DNA sequencing and ELISA, differentiate between different gene transfer and cloning methods, and associate composite fish culture, induced breeding in carps, fish hybridization and use of sericulture biomaterials with improved aquaculture and sericulture production.	K4
<b>CO5</b>	Evaluate the importance of aseptic techniques and equipment, cell culture media and maintenance of cell lines for animal cell culture, the advantages and limitations of techniques for diagnosis and treatment of malaria and diabetes, ELISA for diagnosis, transgenic animals, cloning, aquaculture and sericulture technologies.	K5
<b>CO6</b>	Develop a comprehensive overview of the basic principles of animal biotechnology.	K6