University of Kerala

University of Kerala - Four Year Under Graduate Programme (UOK-FYUGP)

Syllabus for
Bachelor of Science in
BIOTECHNOLOGY

2024 April

SEMESTER I

Discipline Specific Core 100-199 Level-A1(P)

University of Kerala

Discipline	BIOTECHNOLOGY				
Course Code	UK1DSCBIT100				
Course Title	ESSENTIALS OF BIOTECHNOLOGY				
Type of Course	DSC				
Semester	I				
Academic Level	100 - 199.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	2 hours	1	2 hours	5

Pre-requisites	Basic knowledge in life sciences
Course Summary	This course provides a summary of the essential concepts, methodologies, applications, and implications of biotechnology. Students will comprehend the fundamental principles underlying various domains like plant, animal, environmental, food, and industrial biotechnology and their significance in advancing scientific understanding, technological innovation, and societal progress.

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Overview of Biotechnology**	**5**
	1	Historical perspectives and Milestones, Scope and significance of Biotechnology, Major Areas of Biotechnology (Red, White, Green and Blue Biotechnology),	
	2	Commercial potential of Biotechnology, Biotechnology in India, and its global trends	
	3	Major Biotechnology institutes and companies in India.GenenTech , Bocon case study	
II		**Gene & Genetic Engineering**	**9**
	4	DNA as genetic material, Central dogma, Concept of Gene	
	5	Genetic Engineering: Definition, Steps involved, A brief account on Tools - Restriction Enzymes, DNA Ligases, Plasmid as vectors (pBR 322).prediction of biological phenomena-Alfa fold2 case study	
III		**Plant, Animal and Environmental Biotechnology**	**12**
	6	Transgenic Plants – Agricultural Applications -Herbicide tolerant crops (Glyphosate resistant), Insect resistant crops (Bt cotton), Nutritionally improved crops (Golden Rice), Shelf-life improved crop (Flavr Savr) and Non-agricultural Applications - Bio-Pharming	
	7	Transgenic Animals - Applications - Production of therapeutic proteins (ATryn Cow), Environment friendly Farm animals (Enviro pigs), Production of silk (Spider goat)	
	8	Bioremediation - Bacteria for oil spill clean-up, Heavy metal remediation Bioenergy Production -Biogas, Bioethanol, Biodiesel Bioplastics – PHB and its applications	
	9	Overview – synthetic genome,Biomimetics,Artificial Life,Unconventional Molecular Biology	
	10	Brief- Insilico Biology, SciFi Foods,Cellular agriculture, Artificial Intelligence in Biotechnology,Space exploration biology	
IV		**Food and Industrial Biotechnology**	**10**

	11	Microbial Fermentation in Food Production: Fermented Foods (Yogurt, Cheese) and Beverages (Beer, Wine), SCP-	
	12	Microbial production of Antibiotics (Penicillin), Vitamins (B12), Amino acids (Glutamic acid), Organic acids (Citric acid), Enzymes (Protease and Amylase), Applications of Hybridoma technology	
V	**Ethical issues in Biotechnology**		**9**
	13	Ethical considerations in biotechnological research and applications, Public perception and acceptance of Biotechnology, Regulatory frameworks, and implications, Dark Biotechnology	

Practicum (30 Hours)-[Essential Experiments(15 Hrs), Group/Individual Experiments (15 Hrs)]

Essential Experiments

1) Awareness on safety Precautions and Good Laboratory Practices
2)Introducing Laboratory Instruments: Microscope, pH meter, Colorimeter, Centrifuge, Incubator, Shaker and Stirrer, Autoclave, Water Bath, LAF, Gel Electrophoresis Systems
3)Preparation of agarose gel for gel electrophoresis.
4)Set up small-scale fermentation experiments using yeast cultures and appropriate growth media.
5) Produce fermented food products such as yogurt using starter cultures

Suggested Readings:

1. Introduction to Genetic Engineering & Biotechnology (2008), Nair, A.J., Infinity Science Press.
2. Biotechnology Expanding Horizons (5th edn. 2023), B.D. Singh, MedTech Science Pres
3. Principles of gene manipulation (6th edn.), S.B. Primrose, R.M. Twyman & R.W. Old, Blackwell pub.
4. Gene Cloning & DNA Analysis: An introduction (8th edn), T.A. Brown, Wiley Blackwell pub
5. Advanced Biotechnology (2014), R.C. Dubey, S. Chand Publication
6. Plant Biotechnology: The genetic manipulation of plants (2nd edn), Adrian Slater, Nigel Scott & Mark Fowler, Oxford pub.
7. Biotechnology (2005), U. Satyanarayana & U. Chakrapani, Books & Allied Pub Pvt.Ltd
8. Introduction to Biotechnology & Genetic engineering (2010), Nair, AJ, Johns & Bartlett Pub, Boston USA.
9. Industrial Microbiology (2nd edn.), L.E.J.R. Casida, New Age International P.
10. X) Principles and techniques of Biochemistry & Molecular Biology (7th edn.) edited by Keith Wilson & John Walker, Cambridge University Press.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed

CO-1	Understand the history and scope of biotechnology and differentiate among the classes of biotechnology	U	PSO-1,2
CO-2	Describe the various tools, techniques used in genetic engineering and understand the molecular basis of life	R, U	PSO-1,4
CO-3	Understand the applications of biotechnology in environment, and associate with applications of transgenic plants and animals	U, E	PSO-1,2,3
CO-4	Identify the various tools and techniques used for basic biotechnological studies and applications	U, Ap	PSO-3,5
CO-5	Compare and contrast the various bioprocess technologies in manufacturing of industrial products and understands ethical implications of biotechnology	U	PSO-1,5

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Essentials of Biotechnology
Credits: 2:1:2 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L) /Tutorial (T)	Practical (P)
1	Understand the history and scope of biotechnology and differentiate among the classes of biotechnology	PO-1 PSO-1,2	U	F	L	
2	Describe the various tools, techniques used in genetic engineering and understand the molecular basis of life	PO-3 PSO-1,4	R, U	F, C	T	
3	Understand the applications of biotechnology in environment, and associate with applications of transgenic plants and animals	PO-1,2 PSO-1,2,3	U, E	F, C	L	