DEPARTMENT OF BIOTECHNOLOGY				*CLASS: I B.Sc. Biotechnology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
I	Core-2	20U1LMC2	Basics of Biotechnology	3	3	25	75	100

Course Objectives:

1. To introduce basic concepts of Biotechnology to the students.
2. To make students aware of tools and techniques of Biotechnology.
3. To motivate the students to aspire for research/industrial career in the field of Biotechnology.
4. To make students aware of bioethics and judicial usage of biotechnological applications.

UNIT-I: History and Gene concept

History of Biotechnology – traditional - ghee, butter, fermentation - curd, idli, wine and modern approaches - pasteurization, vaccination, biofuels, and GM crops. Central dogma - gene, RNA, protein-mutability of DNA - types of mutation, mutagens, mutagenesis, Ames test.

UNIT-II:Tools of Biotechnology

Organism of interest in Biotechnology - *Escherichia coli*. Restriction enzymes-types, naming, target sites, cohesive and blunt end, DNA methylases, DNA ligases. Plasmids - origin of replication, copy number, selection markers-antibiotic resistance genes. Types of vectors – Cloning: pBR 322, pUC, Expression Vectors and Shuttle vectors.

UNIT-III: Microbial and animal biotechnology

Experimental models - *Saccharomyces cerevisiae*, zebrafish and mice. Gene transfer methods - transformation, electroporation, gene gun. Engineered microbes - production of alcohol, amino-acids and proteins. Animal cell culture - stem cells - pluripotentcy. Construction of transgenic mice - gene knockout, gene silencing - gene transfer. Construction of genetically engineered sheep - Dolly.

UNIT-IV:Plant and Environmental biotechnology

Plant tissue culture - callus, totipotentcy. *Agarobacterium tumifaciens*- crown gall, Ti-plasmid, T-DNA transfer. Genetically engineered plants-pest resistant plant - *Bacillus thuringiensis*- Bt toxin. Environmental pollution and threat - Xenobiotics, biomagnification. Bioremediation - *In-situ* and *Ex situ*. Heavy metal bioremediation - microbes, phytoremediation - *Brassica juncea* and *Ambrosia* sp.

UNIT-V: Medical Applications and Bio-ethics

In-vitro fertilization - test tube baby. Gene therapy - adenosine deaminase - SCID. Diagnosis of diseases and disorders - FISH. Recombinant vaccines. Patent: definition and form of patent, patent rights, patent filing. Ethics- construction and usage of genetically engineered microbes, plants, animals-drug trials.

Books for Study

1. Satyanarayana. U. 2009. Biotechnology. Books and Allied Pvt. Ltd.
2. Kumaresan. 2015. Biotechnology. Saras Publications.

Books for Reference

1. Brown TA. 2012. Gene Cloning and DNA Analysis- An Introduction. Wiley Blackwell.
2. Balasubramaniam D, CFA Bryce, K Dharmalingam, J Green, Kunthala Jayaraman. Concepts in Biotechnology, University Press Reference Book.
3. Primrose SB and Twyman R. Principles of Gene Manipulation and Genomics**,** Blackwell.
4. Dubey RC. 2012. A textbook of Biotechnology, S. Chand Publications.

Web Resources

1. http://dbtindia.gov.in/
2. http://www.brsi.in/
3. https://www.easybiologyclass.com/topic-biotechnology/

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, assignments, group discussions and quiz.

Course Learning Outcomes:

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Elaborate with the history of biotechnology and understand the gene concept	Up to K-2
CLO-2	Develop knowledge on the principles and applications of essential biotechnological tools and methods	Up to K-3
CLO-3	Dissect the methods and applications of microbial and animal biotechnology	Up to K-4
CLO-4	Identify the applications and values of plant and environmental biotechnology strategies	Up to K-3
CLO-5	Analyze the merits and demerits of biotechnological applications	Up to K-4

Mapping of Course outcomes with Program specific Outcomes:

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	1	2	1	2	1	--	-
CLO-2	3	1	3	2	2	1	--
CLO-3	2	3	2	3	2	--	--
CLO-4	3	2	3	2	2	3	3
CLO-5	1	2	2	3	3	--	2

Advance application-3; Intermediate level-2; Basic level-1

Mapping of Course learning outcomes with Program Outcomes:

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	--	2	2	--
CLO-2	3	3	2	2	3
CLO-3	3	2	2	--	3
CLO-4	3	2	2	3	--
CLO-5	3	3	2	3	--

Advance application-3; Intermediate level-2; Basic level-1

LESSION PLAN

Unit-I	Description	Staff Name	Hours	Mode
I	History of Biotechnology – traditional and modern approaches		3	Chalk & Talk
	Central dogma – gene, RNA, protein		3	Chalk & Talk Discussion
	Types of mutations,types of mutagens, mutagenesis, Ames test		3	Chalk & Talk Discussion
II	Organism of interest in Biotechnology - *Escherichia coli*.		3	Chalk & talk, PPT
	Restriction enzymes-types, naming, target sites, cohesive and blunt end, DNA methylases, DNA ligases.		3	Discussion & PPT
	Types of vectors – Cloning: pBR 322, pUC, Expression Vectors and Shuttle vectors.		3	Chalk & Talk
III	Experimental models - *Saccharomyces cerevisiae*, zebrafishand mice.		1	Chalk & Talk
	Gene transfer methods - transformation, electroporation, gene gun.		2	PPT & Discussion
	Engineered microbes - production of alcohol, amino-acids and proteins. Animal cell culture - stem cells – pluripotentcy.		3	Chalk & Talk
	Construction of transgenic mice - gene knockout, gene silencing - gene transfer. Construction of genetically engineered sheep – Dolly.		3	Chalk & Talk
IV	Plant tissue culture - callus, totipotentcy. *Agarobacteriumtumifaciens*- crown gall, Ti-plasmid, T-DNA transfer.		2	Chalk & Talk
	Genetically engineered plants-pest resistant plant - *Bacillus thuringiensis*- Bt toxin.		2	PPT & Discussion
	Environmental pollution and threat - Xenobiotics, biomagnification.		2	Chalk & Talk & PPT
	Bioremediation - *In-situ* and *Ex situ*. Heavy metal bioremediation - microbes, phytoremediation - *Brassica juncea* and *Ambrosia* sp.		3	Chalk & Talk & PPT
V	*In-vitro* fertilization - test tube baby. Gene therapy - adenosine deaminase - SCID.		3	Chalk & Talk
	Diagnosis of diseases and disorders - FISH. Recombinant vaccines.		3	Chalk & Talk & Discussion
	Patent: definition and form of patent, patent rights, patent filing. Ethics- construction and usage of genetically engineered microbes, plants, animals-drug trials		3	Chalk & Talk & Discussion
			45h	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Basics of Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-IV (K3 Level)	1Question from Unit-IV (K4 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K3 Level)
		2 Questions from Unit-V (K4 Level)	1Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

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