DEPARTMENT OF BIOTECHNOLOGY				*CLASS: II B.Sc. Microbiology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
III	Ancillary-I	20U3LAC1	Concepts in Biotechnology	4	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

1.	To introduce fundamental concepts, tools and techniques of Biotechnology
2.	To make students aware of various types of fermenters
3.	To motivate the students to aspire for researchin Biotechnology
4.	To make students aware of bioethics and patenting process of biological materials

Unit	Description	Hours	K level	CLOs
I	**Introduction to Biotechnology** Biotechnology-introduction and historical perspectives. Tools of genetic engineering: Nucleases, Ligases, Polymerases, alkaline phosphatase. Vectors –types of vectors: Plasmid - pBR322, pUC, lambda bacteriophage vectors & M13 vectors. Gene transfer methods – transformation, transduction, electroporation, particle bombardment, Calcium mediated gene transfer. Screening of clones – Insertional inactivation, Blue white colony selection, replica plating method.	12	Up to K-3	**1**
II	**Industrial & Microbial Biotechnology** Fermentation - definition, process. Bioreactor - types - continuous stirred tank, bubble column,airlift, fluidized and packed bed. Media for industrial fermentation - substrates used as carbon, nitrogen, growth factor sources. Isolation of microbes - enrichment methods, strains from unusual environment, preservation. Genetic improvement of strains-selection of mutants. Regulation of production – feedback, nutrients and induction.	12	Up to K-3	**2**
III	**Plant & animal Biotechnology** Plant tissue culture – Composition of plant tissue culture medium. Culture methods -callus culture, suspension culture, Protoplast culture, organ culture – anther & pollen, embryo. Agrobacterium mediated gene transfer – Ti plasmids. Animal Biotechnology – Primary and Secondary cell culture, culture medium, cloning methods – microinjection, embryonic stem cell transfer.	12	Up to K-4	**3**

IV	**Environmental Biotechnology** Sewage– composition, waste water treatment : Primary, Secondary – Aerobic and Anaerobic treatment, Tertiary Treatment – Solids removal, nitrogen removal, phosphorous removal, bioremediation types–*in situ*, *ex-situ*, Biopesticides – *Bacillus thuringiensis*, *Beauveriabassiana*, *Fusariumpallidoroseum*, Nuclear Polyhedrosis virus, Phytoremediation.	12	Up to K-4	**4**
V	**Intellectual Property Rights & Ethics** Intellectual Property Rights, Intellectual Property Protection, Forms of protection.Patents, Copyrights, Trademarks, Ethics- construction and usage of genetically engineered microbes, plants, animals - drug trials.	12	Up to K-2	**5**

Books for Study

1. Satyanarayana. U. 2009. Biotechnology. Books and Allied Pvt. Ltd.
2. Dubey RC. 2012. A textbook of Biotechnology, S. Chand Publications.

Books for Reference

1. Brown TA. 2012. Gene Cloning and DNA Analysis- An Introduction. Wiley Blackwell.
2. Primrose SB and Twyman R. Principles of Gene Manipulation and Genomics**,** Blackwell.
3. Dubey RC. 2016. Advanced Biotechnology, S. Chand Publications

Web References

http://dbtindia.gov.in/

https://www.easybiologyclass.com/topic-biotechnology/

Rationale for Nature of the course

This ancillary paper enriches the understanding of fundamental concepts, principles and techniques used in biotechnology to microbiology major students. Students can get awareness about bioethics and patenting process which are essential practices in modern biology

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Model/chart making for biotechnological process
- Literature survey on recent trends in biotechnology field
- Individual presentation to improve communicative skills

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments and group discussions and Problem solving.

Course content designer

Dr. P. Vimal
Ms.R.Suguna

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Relate tools and methods used in biotechnology	Up to K-3
CLO-2	Identify various types fermenters and fermentation process	Up to K-3
CLO-3	Dissect strategies and applications of animal and plant biotechnology	Up to K-4
CLO-4	Analyse significance of biotechnological principles in environmental protection	Up to K-4
CLO-5	Explain the patenting process and elaborate ethics related to biotechnology	Up to K-2

Mapping of Course outcomes with Program Outcomes

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

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

Mapping of Course outcomes with Program specific Outcomes

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

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

LESSON PLAN

Unit	Description	Staff Name	Hours	Mode
I	Biotechnology-introduction and historical perspectives. Tools of genetic engineering: Nucleases, Ligases, Polymerases, alkaline phosphatase.		4	Chalk and talk PPT
	Vectors –types of vectors: Plasmid - pBR322, pUC, lambda bacteriophage vectors & M13 vectors		4	Chalk and talk
	Gene transfer methods – transformation, transduction, electroporation, particle bombardment, and Calcium mediated gene transfer. Screening of clones – Insertional inactivation, Blue white colony selection, replica plating method.		4	Chalk and talk PPT
II	Fermentation – process. Bioreactor – types - continuous stirred tank, bubble column,airlift, fluidized and packed bed.		4	Chalk and talk
	Media for industrial fermentation - substrates used as carbon, nitrogen, growth factor sources.		4	Chalk and talk
	Isolation of microbes - enrichment methods, strains from unusual environment, preservation. Genetic improvement of strains-selection of mutants, Regulation of production – feedback, nutrients and induction.		4	Chalk and talk PPT
III	Plant tissue culture – Composition of plant tissue culture medium.		3	Chalk and talk
	Culture methods -callus culture, suspension culture, Protoplast culture, organ culture – anther & pollen, embryo.		5	Chalk and talk PPT
	Agrobacterium mediated gene transfer – Ti plasmids.		2	PPT
	Animal Biotechnology – Primary and Secondary cell culture, culture medium, cloning methods – microinjection, embryonic stem cell transfer.		2	Chalk and talk PPT
IV	Sewage– composition, Waste water Treatment : Primary, Secondary – Aerobic and Anaerobic treatment, Tertiary Treatment		5	Chalk and talk PPT
	bioremediation types–*in situ, ex-situ*, Phytoremediation		2	Chalk and talk
	Biopesticides – *Bacillus thuringiensis*, *Beauveriabassiana*, *Fusariumpallidoroseum*, Nuclear Polyhedrosis virus.		5	Chalk and talk PPT
V	Intellectual Property Rights, Intellectual Property Protection		4	Chalk and talk
	Forms of protection. Patents, Copyrights, Trademarks		4	Chalk and talk
	Ethics- construction and usage of genetically engineered microbes, plants, animals-drug trials.		4	Chalk and talk
			60	

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

BLUE PRINT FOR INTERNAL ASSESSMENT – I

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(K3)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

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 3	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	2	K1 & K2	1	K1	2 (K4&K4)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Concepts in 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(K3)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	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 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
5.	CLO 5	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
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 (NoChoice)	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 (K3 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K4 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K2Level)	1Question from Unit-V (K2 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