EPARTMENT OF BIOTECHNOLOGY				*CLASS: II B.Sc. Microbiology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
IV	Ancillary-II	20U4LAC2	Biotechnology in Human Welfare	4	4	25	75	100

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

Course Objectives

1.	To learn production of biological products at industry level
2.	To understand role of DNA in diagnostic and treatment of diseases
3.	Describe development of transgenic plants and animals and its uses

Unit	**Description**	**Hours**	**K level**	**CLOs**
I	**Industrial products in human welfare** Production of organic solvents - ethanol,organic acids - citric acid, antibiotics - penicillins, aminoacids - glutamic acid, Vitamin - B12. Polysaccharide – production of Xanthan, biomass – composition: cellulose, hemicellulose, lignin, biomass to ethanol production.	12	Up to K-3	**1**
II	**Development of transgenic plants & animals** Germplasm conservation - types - *in-situ* and *ex-situ* and cryopreservation. GM crops: Flavr - Savr tomato, golden Rice, Pest resistant, virus resistant, drought resistant.Animal propagation - *In vitro fertilization* technology, artificial insemination in cattle, embryo transfer technique and superovulation in farm animals - MOET.	12	Up to K-3	**2**
III	**Environmental Biotechnology** Biodegradation – definition, Factors affecting biodegradation, metabolic effects of microbes on xenobiotics, Biodegradation of hydrocarbons, pesticides, genetically engineered bacteria for bioremediation,Biofilters – micro-organisms used in biofilters, mechanisms, Microbial Leaching – copper, uranium, gold, silver and silica.	12	Up to K-4	**3**
IV	**DNA as a diagnostic tool** Nucleic acid hybridization - DNA probes, mechanism of action of DNA probes, PCR and signal amplification, DNA chip - Microarray - techniques and applications. DNA in diagnosis –RFLP and SNP, infectious diseases - Malaria,genetic diseases - sickle cell anemia. DNA sequencing – sanger method	12	Up to K-2	**4**

V	**Medical Biotechnology** Gene therapy - types, treating - ADA deficiency, haemophilia, Cystic Fibrosis.Genedelivery methods. Production of recombinant therapeutic agents-Insulin, hGH, Tissue Plasminogen Activator. RecombinantSubunit vaccines - Hep B, attenuated recombinant vaccine – Cholera vaccine, DNA Vaccines, COVID	12	Up to K-4	**5**

Books for Study

1. Satyanarayana. U. 2009. Biotechnology. Books and Allied Pvt. Ltd.
2. Glick BR, Delovitch TL, Patten CL. 2014. Medical Biotechnology. ASM Press, Washington

Books for Reference

1. Primrose SB and Twyman R. Principles of Gene Manipulation and Genomics**,** Blackwell.
2. Dubey RC. 2016. Advanced Biotechnology, S. Chand Publications.
3. Slater A. 2006. Plant Biotechnology – The Genetic Manipulation of Plants. Oxford press.

Rationale for Nature of the course

In the recent past, many beneficial products such as antibiotics, drugs, amino acids, vaccines and disease diagnostic tools are produced using biotechnology. This course paves a way to understand such process at industries level and students can able to communicate in both verbal & writing.

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 designers

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Dr.N. Arul MuthuKumaran

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Identify biological compounds produced using bioreactors in industries	Up to K-3
CLO-2	Plan strategies for the development of transgenic plants and animals	Up to K-3
CLO-3	Analyse various organisms for degradation waste in the environment	Up to K-4
CLO-4	Describe DNA based technologies for diseases diagnostic and treatment	Up to K-2
CLO-5	Survey new therapy methods and vaccines against various diseases	Up to K-4

Mapping of Course outcomes with Program Outcomes

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

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

LESSON PLAN

Unit	Description	Hours	Mode
I	Production of organic solvents - ethanol,organic acids - citric acid, antibiotics - penicillin, aminoacids - glutamic acid	6	Chalk and talk, PPT
	Vitamin - B12. Polysaccharide – production of Xanthan, biomass – composition: cellulose, hemicellulose, lignin, biomass to ethanol production.	6	Chalk and talk PPT
II	Germplasm conservation - types - *in-situ* and *ex-situ* and cryopreservation. GM crops –FlavrSavr, golden Rice	5	Chalk and talk, PPT
	Pest resistant, virus resistant, drought resistant	2	Chalk and talk
	Animal propagation - In vitro fertilization technology, artificial insemination in cattle, embryo transfer technique and superovulation in farm animals - MOET.	5	Chalk and talk PPT
III	Biodegradation – Factors affecting biodegradation,metabolic effects of microbes on Xenobiotics	3	Chalk and talk, PPT
	Biodegradation of hydrocarbons, pesticides, genetically engineered bacteria for bioremediation	3	Chalk and talk
	Biofilters – micro-organisms used inbiofilters, mechanisms	3	Chalk and talk
	Microbial Leaching - copper, uranium, gold, silver, silica.	3	Chalk and talk PPT
IV	Nucleic acid hybridization - DNA probes, mechanism of action of DNA probes,	3	Chalk and talk PPT
	PCR and signal amplification, DNA chip - Microarray - techniques and applications.	3	Chalk and talk PPT
	DNA in diagnosis - infectious diseases - Malaria, AIDS, genetic diseases - Cystic fibrosis, sickle cell anaemia.	3	Chalk and talk
	DNA fingerprinting, RFLP, VNTR and SNP in diagnosis.	3	Chalk and talk, PPT
V	Gene therapy - types, treating - ADA deficiency, haemophilia, Cystic Fibrosis. Gene delivery methods.	4	Chalk and talk, PPT
	Gene delivery methods. Production of recombinant therapeutic agents-Insulin, hGH, Clotting Factor VIII, Tissue Plasminogen Activator, Interferon.	4	Chalk and talk PPT
	Recombinant Vaccines - Subunit vaccines - Hep B, HIV, DNA Vaccine, RNA vaccines	4	Chalk and talk
		60	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Biotechnology in Human Welfare 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 2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
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 – Biotechnology in Human Welfare 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 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
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 (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)	1 Question from Unit-I (K3 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K2 Level)
		2 Questions from Unit-V (K4 Level)	1 Question 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