

Programme: M.Sc. (Biochemistry)

Course Code: BCO 115

Title of the Course: FRONTIERS IN BIOTECHNOLOGY [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that students have a basic understanding of techniques in microbiology and biotechnology.	
Objective:	The course develops the understanding of the applications of various concepts and techniques of biotechnology in agriculture, medicine, aquaculture, food and space.	
Content:		
1	Introduction	(05)
A.	Biotechnology: concept and principles	
B.	Hybrid technology	
C.	Tissue culture	
D.	Transgenics	
E.	Metabolomics	
F.	Prospects and concerns	
G.	Biosafety management	
H.	Bioethics in application of biotechnology	
2	Agriculture	(05)
A.	Green revolution and Crop yield increase	
B.	Rice – addition of β -carotene (golden rice), iron, amino acids, flavour, pigment	
C.	Plant growth enhancement through use of genetically modified plant growth promoting Rhizobacteria	
D.	Crops/plants –resistance to draught, salinity, cold, pathogens (bacteria, fungi, virus), insects (Bt cotton, Bt brinjal).	
E.	Plants/fruits – delayed ripening	
F.	Plants – tissue culture for obtaining desirable characteristics	
3	Aquaculture	(02)
A.	Transgenic Fish – to increase growth factors and defence against microbial infections.	
4	Animal Husbandry	(04)
A.	White revolution	
B.	Transgenic cows – production of milk: suited for lactose intolerance, or to contain high levels of "healthy" fat found in fish; insertion of human gene so as to produce milk with same properties as human breast milk	
C.	Transgenic poultry for disease resistance and animals with increased levels of growth hormones for higher production of meat	

5	Food Industry	(05)
A.	Genetically modified Foods (GMFs): Benefits and concerns	
B.	Genetically engineered microbes (GEMs) in the food industry for process improvement, enhanced nutritional value and flavour, and increased shelf life	
C.	Role of GEMS in the dairy, bakery and brewery industry	
6	Biotechnology in space – The use of microgravity as a tool for separation processes and techniques (including protein crystal growth), and production of cells for medically significant enzymes, hormones, vaccines	(03)
7	Biotechnology in Medicine	(12)
A.	Edible vaccines and therapeutic proteins, plants as bioreactors for antibodies, polymers, proteins	
B.	Recombinant insulin, human growth hormone	
C.	Microbiome studies through metagenomics in understanding human-microbial interactions towards improved health (probiotics, oncogenic viruses)	
D.	Gene therapy in treatment of genetic diseases – gene targeting and anti-sense therapy, with background of Human genome project	
E.	Proteomics and drug discovery	
F.	Stem cell research: Source of stem cells. Development of tissue and organs	
Pedagogy:	Lectures/ tutorials/ assignments/ students' seminars/ interactive learning/ self-study.	
References/ Readings	Jogdand, S.N., Gene Biotechnology. Himalaya publishing house.	
	Jogdand, S.N., Advances in Biotechnology. Himalaya publishing house.	
	Ravi, I., Baunthiyal, M. & Saxena, J., (Eds.). Advances in Biotechnology. Springer.	
	Satyanarayana. Books & Allied (P) Ltd. Biotechnology.	
	Widholm, J. M., Kumlehn, J. & Nagata, T., Biotechnology in Agriculture and Forestry.	
	Altman, A. & Hasegawa, P., Elsevier Plant Biotechnology and Agriculture.	
	Clark, D. & Pazdernik, N. Biotechnology.	
	Bielecki, S., Tramper, J., & Polak, J. Food Biotechnology.	
	Pongracz, J. & Keen, M., Medical Biotechnology.	
	Fletcher, G. L. & Rise, M. L., (Editors). Aquaculture Biotechnology. Wiley.	
	Shenoy, M. Animal Biotechnology. Laxmi Publication.	
	Verma, A. & Singh, A. Animal Biotechnology Models in Discovery and Translation.	
Learning Outcomes	A better understanding of various techniques of biotechnology (plant and animal tissue culture, metagenomics, proteomics, transgenics) for application in agriculture, medicine, aquaculture, food and space.	