

Course code	Course Name	L-T-P - credits	Year of Introduction
CH364	BIOPROCESS ENGINEERING	3-0-0-3	2016
Prerequisite: Nil			
Course objectives: <ul style="list-style-type: none"> To understand industrial fermentation and design an industrial fermenter. To distinguish between primary and secondary metabolites To know the process technologies for commercial production of products To identify the engineering problems associated with the manufacture of products using bioreactors. To summarize the application of enzymes in industries. To explain the role of microorganisms in bioremediation and biopesticides. 			
Syllabus A historical overview of industrial fermentation process – traditional and modern biotechnology- Isolation, preservation and improvement of industrial micro-organisms- Production and purification of primary metabolites - Production of secondary metabolites- Production and purification of enzymes and other by products- Production of bio-fertilizers- bio-pesticides- Bio-preservatives, biopolymers- Bioremediation- Production modern biotechnology products- Products of plant and animal cell culture- Isolation and purification of commercially important enzymes			
Expected Outcome At the end of the course, students will be able to <ol style="list-style-type: none"> design an industrial fermenter. distinguish between primary and secondary metabolites identify the process technologies for commercial production of products and the engineering problems associated. summarize the application of enzymes in industries. visualise the role of microorganisms in bioremediation and biopesticides.. 			
Reference Books <ul style="list-style-type: none"> Casida Jr, L.E, Industrial Microbiology, New Age International (P) Ltd. Jackson, A.T, Process engineering in biotechnology, Prentice Hall. Murrey Moo and Young, Comprehensive Biotechnology, Pergamon. Palmer T, Enzymes: Biochemistry, Biotechnology, Clinical chemistry, Horwood publishing Colphon. Presscott, Dunn, Industrial Microbiology, Agrobios (India). Wulf Cruger and Anneliese Crueger, Biotechnology: A Textbook of Industrial Microbiology, Panima Publishing Corporation. 			
Course Plan			
Module	Contents	Hours	Sem. Exam marks
I	A historical overview of industrial fermentation process – traditional and modern biotechnology -industrially useful microorganisms. Process flow sheeting – block diagrams with industrial pictorial representation for various equipments.	2	15%

	Isolation, preservation and improvement of industrial micro-organisms for overproduction of primary and secondary metabolites. Medium requirements for fermentation process,. Examples of simple and complex media. Basic design of the fermenter, overview of fermentation processes.	4	
II	Production and purification of primary metabolites : Industrial processes for the manufacture of the following products :Organic acids-citric acid, lactic acid itaconic acid and acetic acid .Production of amino acids - commercially important amino acids; alcohols:- ethanol, acetone and butanol	7	15%
FIRST INTERNAL EXAM			
III	Production of secondary metabolites :- Industrial production processes for various classes of secondary metabolites: antibiotics: beta-lactams-penicillin and cephalosporin; aminoglycosides-streptomycin, kanamycin; macrolideserythromycin, quinines, aromatics; commercially important vitamins and steroids	6	15%
IV	Production and purification of enzymes and other byproducts: Microbial production of industrial enzymes: proteases, amylases, lipases and cellulases. Production of biofertilizers- manufacture, formulation and utilization, biopesticides:-. Important biopesticides- Bt-toxin, Kasugamycin, Beauverin, Devine and Collego	7	15%
SECOND INTERNAL EXAM			
V	Biopreservatives, biopolymers- Xanthan gum and PHB, single cell protein. Beverages:- production of beverages, production of baker's yeast, milk products. Bioremediation-microbes in mining, ore leaching, oil recovery, waste water treatment, biodegradation of non cellulose and cellulosic wastes for environmental conservation. Production of recombinant proteins having therapeutic and diagnostic applications, production of vaccines. Production of monoclonal antibodies.	8	20%
VI	Products of plant and animal cell culture. Enzymes: Isolation and purification of commercially important enzymes. Extraction of enzymes, preparation of crude enzymes, purification and characterization of enzymes from plant, animal and microbial sources. Application of enzymes in industry, analytical purposes and medical therapy.	8	20%
END SEMESTER EXAM			

Question Paper Pattern

Maximum Marks: 100

Exam Duration: 3 Hours

Part A: There shall be **Three questions** uniformly covering Modules 1 and 2, each carrying 15 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in each main question with a total of 15 marks for all the subdivisions put together. (2 x15= 30 Marks)

Part B: There shall be **Three questions** uniformly covering Modules 3 and 4, each carrying 15 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in each main question with a total of 15 marks for all the subdivisions put together. (2 x15= 30 Marks)

Part C: There shall be **Three questions** uniformly covering Module 5 and 6, each carrying 20 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in each main question with a total of 20 marks for all the subdivisions put together. (2 x20= 40 Marks)

