

Course	Discipline Specific Core
Semester	V
Paper Number	MBTCR5112T & MBTCR5112P
Paper Title	BIOPROCESS TECHNOLOGY
No. of Credits	6
Theory/Composite	Composite
No. of periods assigned	4 Theory + 4 Practical
Course description/objective	<p>The course aims to</p> <ol style="list-style-type: none"> 1. acquaint the students with an overall idea of the techniques and methodologies that industries employ for the large-scale fermentative production of beneficial products, using microbes. 2. provide students with information about bioreactors and the usage of microbes in industry. 3. outline the basic principles of water treatment. 4. introduce the principles of fermentation and techniques for microbial production of enzymes, proteins etc. 5. provide the students the hands-on essence of a bioprocess technique by means of a visit to any industrial plant. 6. provide students with hands-on-experience of relevant techniques e.g. isolation of industrially important microorganism and microbial analysis of drinking water supplies relevant in bioprocess technology in the practical module.
Syllabus	<p>Theory Module A: (25 marks)</p> <p>UNIT I: Introduction to Bioprocess Technology: Introduction to bioprocess technology; range of bioprocess technology and its chronological development; basic principle and components of fermentation technology; growth and fermentation kinetics in batch, fed-batch and continuous cultures.</p> <p>UNIT II: Bioreactor designs: Design of bioprocess vessels; introduction to oxygen requirement in bioprocess - significance of impeller, baffles, sparger; mass transfer coefficient; factors affecting K_La; types of culture/production vessels – airlift, cyclone-column, packed-tower and their applications in production processes.</p> <p>UNIT III: Water treatment: Treatment of municipal drinking water supplies; large-scale treatment of waste water by municipalities.</p> <p>UNIT IV: Use of Microbes in Industry: Microbial production of ethanol.</p> <p>No. of Classes: 2 Classes per week</p> <p>Module B: (25 marks)</p> <p>UNIT V: Fermentation: Principles of upstream processing – Media preparation, Inocula development and sterilization; solid substrate fermentation; scale up</p> <p>UNIT VI: Downstream processing: Introduction to downstream processing; Product recovery and purification</p> <p>UNIT VII: Single cell protein: microbial production</p>

	<p>UNIT VIII: Enzymes: Enzyme production involving isolation and purification (outline); screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis.</p> <p>UNIT IX: Productions - lactic and other organic acids</p> <p>No. of Classes: 2 Classes per week</p> <p>[Both the modules would include a <u>COMPULSORY</u> Industrial Visit]</p> <p>Practical</p> <ol style="list-style-type: none"> 1. Bacterial growth curve. 2. Calculation of thermal death point (TDP) of a microbial sample (demonstration). 3. Production of amylase using immobilized cells. 4. Isolation of industrially important microorganism (antibiotic-producing actinomycetes) from natural resource. 5. Microbial analysis of drinking water supplies from municipalities and other sources.
Readings	<p>Theory</p> <ol style="list-style-type: none"> 1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited. 2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi. 3. Das HK. (2005). Text Book of Biotechnology. 2nd edition. Wiley Dreamtech India (P) Ltd. 4. Dubey RC. (2010 Reprint Edition). A Text Book of Biotechnology. S. Chand & Company Ltd. 5. Madigan MT, Martinko JM and Parker J. (2003). Brock Biology of Microorganisms. 10th edition. Pearson / Benjamin Cummings. 6. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited. 7. Salle AJ. (1974). Fundamental Principles of Bacteriology. 7th edition, 2005 27th Reprint. Tata McGraw-Hill. 8. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd. 9. Waites MJ, Morgan NL, Rockey JS, Higton G. (2001). Industrial Microbiology - An Introduction. 2002 Indian Reprint Edition. Blackwell Publishing. 10. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education. <p>Practical</p> <ol style="list-style-type: none"> 11. Experiments in Microbiology, Plant Pathology and Biotechnology – K. R. Aneja. 12. Microbiology: A Laboratory Manual - Cappuccino and Sherman. 13. Practical Microbiology – R. C. Dubey.

Evaluation	<p>Theory: Continuous Internal Assessment (Industrial Visit Assignment): 10 marks End-Semester Theory Examination: 50 marks</p> <p>Practical: Continuous Internal Assessment: 32 marks End-Semester Examination: 8 marks</p>
Paper Structure for End Sem Theory	<p>Module A (25 marks) Answer Q.1 (Compulsory) and any two from the rest (Q.2 – Q.4) Q.1 Compulsory (10 marks) Q.2 – Q.4: Any two out of three questions (7.5 marks each) i.e. 7.5 marks x 2 questions = 15 marks.</p> <p>Module B (25 marks) 1 Compulsory Objective question (5 marks) Two subjective questions: (10 marks each) i.e. 10 x 2 = 20 marks.</p>