Chemical and Biochemical Engineering

Semester VII						
S. No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CL405T	Bioprocess Engineering	3	0	0	6
2		HSS Elective-I	3	0	0	6
3	CL401S	Scientific Presentation	3	0	0	3
4		Program Elective-IV/BTP-I	3	0	0	6
		Total Credits				24

Chemical and Biochemical Engineering

1	**Title of the course** (L-T-P-C)	**Bioprocess Engineering** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	**Introduction to Bioprocess Engineering:** Introduction to bioprocess engineering: Traditional and modern bioprocess engineering overview, integrated bioprocess, upstream and downstream operations, process flow sheets; Material balance and energy balance for different systems; thermodynamic efficiency of growth, Enzyme technology - Enzyme kinetics, immobilization, and industrial production. **Fermentation Processes:** Fermentation processes: Outline, overview & types, design, parameters & construction of fermenter and ancillaries; Application in the biotechnology industry; Kinetic models for microbial growth; Behavior of microbes in different reactors; Requirements for fermentation processes and optimization techniques (Plackett-Burman Design). **Separation Technology:** Solids removal operations - settling, centrifugation and filtration; Product isolation - adsorption and extraction; Purification techniques - precipitation, ultrafiltration, chromatography and electrophoresis; Product polishing operations - crystallization and drying; Integrated bio-reaction and bio-separation processes: Membrane bioreactors, extractive fermentation. **Bioprocess Engineering and Industry:** Environmental biotechnology - wastewater engineering, bioremediation; Bioprocess instrumentation; Biological systems for the production of commercial goods and services.
4	**Texts/References**	1. Michael L. Shuler and Fikret Kargi. Bioprocess Engineering: Basic Concepts. Prentice Hall, third edition, 2002. 2. Michael L. Shuler, Fikret Kargi, Matthew DeLisa. Bioprocess Engineering: Systems, Equipment, and Facilities. Prentice Hall, second edition, 2017. 3. Roger G. Harrison, Paul W. Todd, Scott R. Rudge. Bioseparations Scienceand Engineering. Oxford University Press, second edition, 2015. 4. Carl-Johan Franzén and Christian Larsson. Bioreactors: Design, Operation and Novel Applications. CRC Press, first edition, 2016.