

1.	Title of the course	Bioprocess Intensification and Integration
2.	Course number	CH507L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To CH5028/17
6.	To be offered by	Department of Chemical Engineering
7.	To take effect from	July 2022
8.	Prerequisite	Nil
9.	<b>Course Objective(s):</b> To introduce process intensification principles, and discuss concepts of inter- and intra-integration of unit operations in bioprocessing.	
10.	<b>Course Content:</b> Introduction to bioprocessing; Downstream processing: purity, recovery, differential partitioning and overall productivity; Inter-integration: aqueous two phase extraction and reverse micellar extraction with membrane processes such as microfiltration, ultrafiltration, reverse osmosis; Case studies; Intra-integration: process design interventions; Case studies; Design of bioreactors: solid state fermentation, high viscous submerged fermentations for microbial polysaccharides production, plant cell cultures and hairy root cultures; Design of contactors for product recovery; Life cycle analysis and process economics.	
11.	<b>Textbook(s):</b> 1. Foo D C Y and El-Halwagi M M, <i>Process Intensification and Integration for Sustainable Design</i> , 1st Edition, Wiley (2021). 2. Stiles A R and Liu C Z, <i>Hairy Root Culture: Bioreactor Design and Process Intensification</i> , 1st Edition, Springer (2013).	
12.	<b>Reference(s):</b> 1. Doran P M, <i>Bioprocessing Principles</i> , 1st Edition, Academic Publications (1995). 2. Mitchell D A, Krieger N and Berovic M, <i>Solid-State Fermentation Bioreactors</i> , 1st Edition, Springer (2006). 3. Sun D-W, <i>Emerging Technologies in Food Processing</i> , 1st Edition, Elsevier Academic Press (2005). 4. Walters H, Brooks D E and Fisher D, <i>Partitioning in Aqueous Two Phase System</i> , 1st Edition, Elsevier Academic Press (1985).	