



# MATERIAL AND ENERGY BALANCES

**PROF. VIGNESH MUTHUVIJAYAN**

Department of Biological Sciences  
IIT Madras

**TYPE OF COURSE** : Rerun | Core | UG

**COURSE DURATION** : 12 weeks (24 Jan' 22 - 15 Apr' 22)

**EXAM DATE** : 23 Apr 2022

**INTENDED AUDIENCE** : UG students and course instructors from other colleges

**COURSE OUTLINE :**

This course will introduce the basics of material and energy balances and their applications in chemical and bioprocess industries by using examples primarily based on chemical and biochemical operations, and other biological systems. The course will be geared towards students pursuing a Bachelor's degree in Biotechnology and faculty teaching this course for Biotechnology students. It will also be useful for students pursuing Chemical Engineering.

**ABOUT INSTRUCTOR :**

Prof. Vignesh Muthuvijayan is a Chemical Engineer by training. He received his B.Tech in Chemical Engineering from A. C. Tech, Anna University, India. He went on to pursue his Master degree in Chemical and Biochemical Engineering at University of Maryland, Baltimore County and his PhD in Chemical Engineering at Oklahoma State University. He also worked as a post-doc at Johns Hopkins University. After spending about 8 years in the United States, he moved back to India to join the Department of Biotechnology at IIT Madras in 2011. His research interests are in the area of biomaterials and their applications.

**COURSE PLAN :**

**Week 1:** Introduction; Units and dimensions; Basic terminologies

**Week 2:** Fundamentals of Material Balances; Material Balances for Single Units Without Reactions

**Week 3:** Material Balances for Multiple Units Without Reactions; Material Balances for Reactive Processes

**Week 4:** Material Balances for Reactive Processes; Combustion Reactions

**Week 5:** Material Balances for Systems with Recycle, Bypass, and Purge

**Week 6:** Energy Balance Terminologies; Introduction to Energy Balances

**Week 7:** Mechanical Energy Balances; Objectives and Procedures for Energy Balances

**Week 8:** Energy Balances on Nonreactive Processes without Phase Change

**Week 9:** Energy Balances on Nonreactive Processes with Phase Change

**Week 10:** Mixing and Solutions; Fundamentals for Energy Balances on Reactive Processes

**Week 11:** Energy Balances on Reactive Processes

**Week 12:** Material and Energy Balances for Unsteady State Processes