

**Title: BIODESIGN [3-0-0-6]****Pre-requisites, if any :**

(i) Biochemistry and Bioenergetics, (ii) Molecular Biology, (iii) Genetic Engineering and (iv) Analytical Biochemistry

**Content** (*List of the topics/sub-topics to be covered in the lectures/practicals/assignments*):

- 1) Some science & Engg basics: Stoichiometry: growth, product formation; thermodynamics: biofuels as a case study; kinetics: enzyme and pathway engineering for accumulation of metabolites.
- 2) Making bioproducts: Overview of bioproducts; Prokaryotic platforms; Mammalian cells; Transgenic plants & animals; Reactor types; Media, culture storage; Scale up and scale down; Monitoring & control.
- 3) Purifying bioproducts: Cell lysis; Filtration, Sedimentation; Extraction; Liq. chromatography & adsorption; Precipitation; Crystallization; Evaporation, Drying; Economics
- 4) Characterizing bioproducts: Product quality; Biophysical & Biochemical analysis; Pharmacokinetics & Pharmacodynamics; Immunogenicity; Formulation & dispensing; Process validation; Regulatory approvals.
- 5) Case studies: Illustrative examples include production of citric acid, high-fructose corn syrup (HFCS), fine chemicals, chiral drugs, insulin, biosimilars, monoclonals, interferons, interleukins, vaccines, etc.

**Texts / References:**

- Bioprocess Engineering, Schuler. 2002. Prentice Hall.
- Bioreaction Engineering Principles, Villadsen. 2011. 3rd ed. Springer.
- Bioseparations Science and Engineering, Harrison. 2015, 2nd ed. OUP