LESSON PLAN

Discipline: B.Tech in Biotechnology
Semester: 6th
Subject: BTPC3004 – Bioprocess Engineering–II
Name of the Teaching Faculty: Dr. Smarika Lenka

Week	Class Day	Theory Topics
1st	1st	Introduction to bioprocess engineering: definition, scope, role in biotechnology industries
	2nd	Historical development of bioprocess technology and industrial relevance
	3rd	Overview of integrated bioprocess: upstream and downstream operations
2nd	1st	Detailed study of upstream vs downstream processing with examples
	2nd	Generalized bioprocess flow sheets: block diagrams and interpretation
	3rd	Process flow sheet analysis with industrial case examples
3rd	1st	Fundamentals of mass balance: steady state and unsteady state systems
	2nd	Heat balance concepts: heat generation, heat transfer in bioprocess
	3rd	Numerical problems on mass and heat balance
4th	1st	Fermentation process: definition, requirements and classification
	2nd	Isolation of industrial microorganisms: techniques and sources
	3rd	Preservation of microbial cultures: short-term and long-term methods
5th	1st	Strain improvement methods: mutation, selection and genetic approaches
	2nd	Advanced strain improvement techniques and industrial applications
	3rd	Development of inoculum: stages and scale-up considerations
6th	1st	Types of fermentation: batch, fed-batch and continuous
	2nd	Comparative study of fermentation types with industrial examples
	3rd	Basic design and construction of fermenter and accessories
7th	1st	Aerobic and anaerobic fermentation: principles and applications
	2nd	Solid-state fermentation: concept, advantages and applications
	3rd	Industrial applications of solid-state fermentation
8th	1st	Stoichiometry of microbial growth and product formation
	2nd	Elemental balance and degree of reduction concept

	3rd	Electron balance in bioprocess systems
9th	1st	Yield coefficients: biomass and product yield calculations
	2nd	Maintenance coefficients and their significance
	3rd	Energetics of microbial growth and product formation
10th	1st	Oxygen consumption in aerobic cultures
	2nd	Heat evolution and thermodynamic efficiency of growth
	3rd	Media design principles and components of fermentation media
11th	1st	Types of media: synthetic, complex and industrial media
	2nd	Thermal death kinetics: D-value, Z-value and F-value
	3rd	Applications of thermal death kinetics in sterilization
12th	1st	Batch sterilization of liquid media: principles and operation
	2nd	Continuous sterilization methods and equipment
	3rd	Filter sterilization of air and liquid media
13th	1st	Design of sterilization equipment: principles and components
	2nd	Case studies on industrial sterilization systems
	3rd	Numerical problems related to sterilization kinetics
14th	1st	Phases of microbial growth in batch culture
	2nd	Monod model: derivation, assumptions and limitations
	3rd	Applications of Monod kinetics in bioprocess
15th	1st	Product formation kinetics: growth-associated and non-growth-associated
	2nd	Luedeking–Piret model: derivation and applications
	3rd	Substrate and product inhibition on microbial growth
16th	1st	Comprehensive revision of all modules
	2nd	Problem-solving and numerical practice session
	3rd	Doubt clearing and discussion