17BT006- Plant Design & Economics for Biotechnologists

Hours Per Week:

L	T	P	C
3	-		3

Total Hours:

L	T	P
45	-	-

BS	SA	CS	WA/RA	SSH	S
5	8	1-5	5	40	1-5

Course Description and Objectives:

This course is oriented towards the bioreactor requirements for handling different types of biomass and economics of bioreactor fabrication and plant maintenance. The objective of this course to give immense knowledge on types of bioreactors, design and operation of bioreactors. It also discusses about plant design and economics related to plant construction and operation.

Course Outcomes:

The student will be able to:

- *Gain knowledge on concepts of reactor design.*
- *Design, develop, operation and controlling of bioreactor*
- *Develop flow diagrams for plant design and construction*
- *Estimate product cost and depreciation cost of plant equipement*

SKILLS TO BE ACQUIRED:

- *General plant design considerations*
- *Design considerations for plant and animal cell cultures*
- *Economic issues related to plant construction and operation*
- *Estimate replacement costs and profitability.*

ACTIVITIES:

- *Design of flow sheet for plant construction*
- *Design of bioreactor for plant and animal cell cultures*
- *Feasibility survey for development of new product*
- *Estimation of replacement cost of new equipment.*

UNIT - I **L-9**

INTRODUCTION: Introduction, types of bioreactors: stirred-tank bioreactors, airlift bioreactors. Heat transfer. Scale up: stirred-tank bioreactors, airlift bioreactors. Introduction of airlift bioreactors, design and construction of the airlift-loop reactor. air-lift reactor microgravity, loop reactors and fluid bed reactors. New Bio reactors for aerobic processes.

UNIT - II **L-9**

DESIGN ASPECTS: Agitated vessels, flowpatterns, flownumber, velocity patterns and velocity gradients, power consumptions, power correlations, power consumption in non newtonian liquids, agitator selection and scaleup. **Hydrodynamics:** Two-phase flow, mixing, oxygen transfer, isobaric method, non-isobaric model, oxygen transfer in a three phase flow.

UNIT - III **L-9**

BIOREACTOR DESIGN FOR PLANT & ANIMAL CELLS CULTURE: Introduction, plant cells: plant cell bioreactors, characteristics of plant cell suspensions, plant cell bioreactor requirements, plant cell bioreactor design, plant cell bioreactor operation, alternative cultures for plant cells.Animal cells:Animal cell bioreactors, animal cell bioreactor operation, and animal cell bioreactor design.

UNIT - IV **L-9**

DESIGN AND COST CONSIDERATIONS: General design considerations, Cash flow for industrial operations, capital investments, estimation of capital investments, cost indices, estimation of total product of cost direction, production costs, fixed charges, plant overhead costs, financing. Interest and investment cost, type interest, nominal and effective interest rates, continuous interest, present worth and discount annuities

UNIT - V **L-9**

DEPRECIATION AND PROFITABILITY: Depreciation: types of depreciation, services life, salvage value, present value, methods for determining depreciation, single unit and group depreciation. Profitability: alternative investments and replacements, profitability standards, discounted cash flow, capitalized cost, pay out period alternative investments, analysis with small investments, increments and replacements.

TEXTBOOK:

1. ScraggA.H., “Bioreactors in Biotechnology”, Edited by EllisHorwood Limited, England 1991.
2. M.S. Peters and K.D.Timmerhaus, “Plant Design and Economics for Chemical Engineering”, 4th ed., Mc Graw Hill,.,1991.
3. Mccabe Smith, Harriott, “Unit Operations of Chemical Engineering”, 5th ed., Mc Graw Hill.1992.

REFERENCE BOOKS:

1. Mukhopadhyay S.N., “Process Biotechnology Fundamentals”, 2nd ed., Viva Books Private Limited, Chennai 2004