

(BT532) PLANT DESIGN & ECONOMICS FOR BIOTECHNOLOGISTS

Objectives of the Course:

1. Giving basic concepts of reactor design.
2. Making familiarity with reactor operation and controlling.
3. Brief introduction of plant economics.

UNIT I: 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: Design Aspects:

Agitated vessels, flow patterns, flow number, 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: 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 : 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: 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.

TEXT BOOKS :

1. Scragg A.H., "Bioreactors in Biotechnology", Edited by Ellis Horwood 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 BOOK :

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