GUJARAT TECHNOLOGICAL UNIVERSITY
BIO-TECHNOLOGY
B. E. SEMESTER: VII

Subject Name: **Bio Process Engineering - I**
Subject Code: **170404**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
3	0	0	3	70	-	30	50

Sr. No	Course Content	Total Hrs.
1.	**Fermentors - Desing, Operation and Applications :** Introduction, Basic functions of fermentor for microbial and animal cell culture, Aseptic Operation and Containment, Transport Phenomena in Bioprocess, Body Construction, Aeration system (Sparger Design, Porous sparger, Orifice sparger, Nozzle sparger, Combiner sparger-agitator), The agitator (Stirrer glands and bearings, stuffing box, the mechanical seal, magnetic drives, baffles), Valves and steam traps, Fermentor: types, Design and Scale up, Imperfectly mixed, non mechanically agitated bioreactor systems, Dynamical modeling of Fermentation systems, Achievement of aseptic conditions in fermentor, Other fermentation vessels.	16
2.	**Aeration and Agitation:** Introduction, Oxygen requirements in industrial fermentations, Oxygen supply, Determination of K_La, Fluid rheology, Factors affecting K_La in fermentation vessels, effect of degree of agitation on K_La, Medium rheology, effect of medium and culture rheology on K_La, effect of microbial mass on K_La, effect of foam and antifoam on oxygen supply, balance between oxygen supply and demand, Scale up and scale down, Mixing equipments, flow patterns in agitated tanks, Radial flow impellers, Axial flow impellers, Mechanism of mixing, Power requirements for mixing, Ungassed and gassed fluids, Scale up of mixing sytems, Role of shear in stirred fermentors, Bubble shear.	12
3.	**Fermentation Kinetics:** Introduction, Framework for kinetic models (Stoichiometry, Reaction rates, Yield coefficients and linear rate equations, The black box model) Mass balances for bioreactors (Dynamic mass balances, the batch reactor, the Chemostat, The fed batch reactor), kinetic models (the degree of model	12

	complexity, Unstructured models, Compartment models, Single cell models, Molecular mechanistic models), Population models (Morphologically structured models, population balance equations)	
4.	**Instrumentation Control and Monitoring:** Requirement for control, Nature of control, Control loop strategy, Sensor and control action, Controllers – types of control and Control algorithms, Design of a fermentation control system, Fementor Control specification, Control of incubation, advanced incubation control (Fermentation profiles, event tracking control, Boolean control and rule generation, Event and non stable set point control, Knowledge based systems, Artifical neural networks, Genetic algorithms, Modelling, Adaptive control approach,, Expert control systems and fuzzy logic, Neural Networks, Data analysis.	8

Text Book:

1. Principles of Fermentation Technology by P. F. Stanbury, A. Whitaker, and S. J. Hall, 2nd Edition, Elsevier Publication.

Reference Books:

1. Fermentation Microbiology and Biotechnology by E. M. T. EL Mansi and C. F. A. Bryce
2. Bioprocess Engineering Principles by Pauline M. Doran , 1st Edition, Elsevier Publication.
3. Biosparations Science and Engineering by Roger Harrison, Paul Todd, Scott Rudge and Demetri Petrides, 1st Edition, published by Oxford University Press.
4. Comprehensive Biotechnology by Murrey Moo & Young, Vol II.