



SECOND SEMESTER 2015-16

Course Handout Part II

Date: 05/01/2016

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : BIO G513
Course Title : MICROBIAL & FERMENTATION TECHNOLOGY
Instructor-in-charge : SANDHYA MARATHE
Instructor : PrabhatNathJha and S. N. Mukhopadhyay

1. SCOPE & OBJECTIVES:

The course introduces and delineates various aspects of pure and applied microbiology. It mainly dwells upon the basic principles of Fermentation Technology and Downstream Processing, which involve various strategies for strain selection and improvement, media formulation, sterilization, inoculum development, various fermenter configurations and modes of operation, cell harvesting and product recovery, kinetics of growth and enzyme catalyzed reactions. The course also focuses on the industrial applications of bioprocesses (Industrial Biotechnology) for the commercial manufacture of value-added biotechnological products like solvents, organic acids, antibiotics, enzymes, biopharmaceuticals etc.

2. Study Resources:

A. Text Book: “Fermentation Microbiology and Biotechnology” Edited by E.M.T El-Mansi, C.F.A. Bryce, A.L. Demain & A.R. Allman (2007), Taylor and Francis Grp., London.

B. Reference Books:

I. “Principles of Fermentation Technology” by Stanbury, Whitaker & Hall, (1997) Aditya Books (P) Ltd., New Delhi

II. ‘Bioprocess Engineering: Basic Concepts’ by Michael L. Shuler & F. Kargi (2003) Prentice-Hall.

III. Current research articles, reviews and lecture notes will be made available.

3. Course Plan: TB: Text Book;

RB I, II & III: Reference Books # 1 #2 & #3

Lec.#	Learning Objectives		Chapter #
1	General Introduction	Introduction to the course	Chap 1 (TB, RB I)
2 – 4	Strain isolation, improvement and Inocula Development	Microorganism Screening, Culture preservation, Strain improvement: Mutagenesis, Protoplast fusion and r-DNA technology; Criteria for transfer, development of inocula for yeast, bacterial and mycelial processes	Chap 3, 6 (RB I)
5 – 9	Microbiology of Industrial Fermentation	Growth kinetics of microorganism, Mass balances for bioreactors, kinetic models, Batch, Fed-Batch and continuous cultures, Stoichiometry of growth and product formation. Media design, Formulation & Optimization. Mixed cultures.	Chap 2, 4, 5 (TB), Chap 2, 4 (RB I), Chap 6 (RB-II)





10 – 14	Enzyme Kinetics	Enzyme and Co – factor modifications, Reaction mechanisms, kinetic models. Enzyme inhibition, Inhibition kinetic models, Industrial enzymes.	Chap 8 (TB), Chap 3 (RB II)
15 - 17	Sterilization	Heat Transfer Phenomenon; Media & Air: Batch & Continuous sterilization in fermenter, thermal death kinetics.	Chap 5 (RB I);
18 – 20	Enzyme & Cell Immobilization & Applications	Immobilized enzyme & cell systems, physiology of immobilized microbial cells, design of immobilized reactors.	Chap 10 (TB)
21 – 27	Fermentation Processes and Bioreactors Design and applications	Anaerobic and Aerobic fermentations, Different types of bioreactors, Design, Operation and Applications, Scale up & Scale down. Biosensors, software sensors and controls, Instrumentation and control of bioprocesses. Animal and Plant cell bioreactors.	Chap 11-14 (TB) Chap 7 - 8 (RB I)
28 – 30	Transport Phenomenon	Introduction to Mass Transfer: Agitation and aeration, Rheology and Mixing	Chap 9 (TB)
31 – 35	Downstream processing Basic Concepts on Product Recovery & Purification	Basic principles of Cell Separation: Filtration and Centrifugation; Cell disruption – Mechanical & Non-mechanical methods. Precipitation, Dialysis, Reverse osmosis, Chromatography, Drying, Crystallization.	Chap 10 (RB I)
36 – 40	Illustrations of Industrial Biotechnology: Fermentation & Product recovery steps	Details of the process, parameters and materials for the industrial manufacture of Antibiotics (β -lactam); Solvents (acetone); Amino acid (Lysine); Organic acids (Citric acid); Alcohols (Ethanol); Ind. Enzymes (Protease/Amylase) and Biopharmaceuticals (Insulin/ Interferon etc.)	Seminars (RB III)

4. Evaluation Scheme:

Component	Duration	Weight %	Date & Time	Remarks
Mid-semester test	50 mins	25	14/3 4:00- 5:30 PM	Closed Book
Quizzes (Surprise), Assignments, Seminar & Report	Variable	35		Closed Book/Open Book
Comprehensive Exam	3 hours	40	4/5 AN	Closed and Open Book
	Total	100		





BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
Instruction Division

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5. **Chamber consultancy hour:** To be announced in class room.
 6. **Notices:** Notices will be displayed on Bio Notice Board.
 7. **Make up Policy:** Make up decisions will be made on a case-by-case basis and only genuine cases will be considered. No make ups for quizzes.

Instructor-in-Charge
BIO G513



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