

BITS PILANI - DUBAI CAMPUS

ACADEMIC – UNDERGRADUATE STUDIES DIVISION

FIRST SEMESTER 2023 - 2024

Course Handout (Part II)

Date: 28.08.2023

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 : BIOT F314 (2 2 4)
Course Title : Industrial Microbiology & Bioprocess Engineering
Instructor-in-charge : Dr. S.Ramachandran
Instructors : Dr. S.Ramachandran, Dr. Debostuti Ghoshdastidar

Scope and objective of the course:

The course introduces and delineates the various aspects of pure and applied microbiology with the focus on implication of r-DNA technology in the field of industrial bioprocesses for commercial manufacturing of value added biotechnological products.

Course Pre/Co- requisite (if any) & Catalogue / Bulletin Description: *Given in the Bulletin 2023 – 2024*

Study Material:

Text Books:

- i. Industrial Microbiology: An Introduction. Michael J. Waites, Neil L. Morgan, John S. Rockey and Gary Highton. Blackwell Publishing, 2001.
- ii. Bioprocess Engineering: Basic Concepts, Michael L. Shuler and Fikret Kargi, 2nd Edition, Prentice Hall PHI, 2007.

Reference books:

- R1. Modern Industrial Microbiology and Biotechnology, Nduka Okafor, Benedict C. Okeke, 2nd Ed. CRC Press, 2017.
- R2. Principles of Fermentation Technology, Stanbury, Whitaker & Hall, (1997) Aditya Books (P) Ltd.
- R3. Separation processes in Biotechnology, J M Asenjo, Marcel – Dekker, 1993.
- R4. Product Recovery in Bioprocess Technology, BIOTOL series, Butterworth Heinmann, 1992

Course plan:

Lec. No.	Learning objectives	Topics to be covered	Chapter No.
1-3	Introduction to Industrial Microbiology	Basic concepts, industrial microbes, structure, functions, nutritional requirements, microbial growth	1, 2, 4 TB1 2, 6 TB2
4-6	Microbial metabolism	Biochemical pathways, fermentation, metabolic regulation	3 (TB) 5 TB2
7-9	Microbial fermentation	Media formulation, optimization	5 TB1, 6 TB2
10-12	Bioreactor/Fermenter	Design, control systems, immobilization, methods, optimization	6, (TB1), 9, 10 (TB2)
13-15	Bioprocessing	Upstream and downstream processing, cell disruption methods, product recovery	7 (TB1), 11 (TB2)
16-20	Product development	Product development, regulation, safety, quality control, enzymes	8, 9 TB1 11 TB2
21-23	Fuels and industrial chemicals and health care products	Fuels, bioconversion, acids, industrial chemicals	10, 11 (TB)
24-26	Food and beverages	Fermentation, optimization, quality control, wine, cheese, vinegar, dairy products, food, additives & supplements	12, 13, 14 (TB)
27	Mixed cultures	Applications in bioprocess engineering	16 TB2
28	Genetically Engineered Organisms	Guidelines, processes, applications in fermentation technology	14 TB2
29-30	IPR	Intellectual property rights	Class notes

* Class notes will also be included along with mentioned references.

** The lectures may be slightly diverge from aforesaid plan based on students 'background & interest in the topic, which may perhaps include special lectures and discussions that would be planned and schedule notified accordingly.

Laboratory Experiments: (Lab protocols will be provided):

S. No.	Title	No. of Turns
1	Isolation and characterization of Industrially important Microorganisms	2
2	Cell immobilization using calcium alginate beads	1
3	Determination of enzyme activity using immobilized cells (DNSA method)	1
4	Bioethanol Production from industrial yeast strain and effect of different carbon sources	1
5	Cell lysis methods and Determination of protein content using Lowry's method	1
6	Enzyme Kinetics: Determination of Amylase Activity/ bioproduct formation in fermentations	2
7	Production of lactic acid using lactic acid bacteria and determination of lactic acid content in fermentation broth	2
8	Determination of fat/ oil content	2
9	Isolation and Growth of Photosynthetic Microbes and Biomass production	1
10	Fermenter/ Bioreactor based production of industrially important microbes	1

Course Learning Outcomes (CLOs)

Upon successful completion of this course, students should be able to:

- **CLO1** Describe the role of microbes in industrial bioprocessing
- **CLO2** Apply the fundamental concepts of microbial structures, physiology, and metabolism to their functions
- **CLO3** Demonstrate the methods for industrial bioprocessing in upstream and downstream
- **CLO4** Design industrial fermentations, bioprocessing and optimization
- **CLO5** Analyze how industrial bioprocessing can be applied to real-world applications in healthcare, bioenergy, and food products
- **CLO6** Apply the concepts of applications of genetically modified microbes in industrial fermentation technology and IPR.

Evaluation Scheme:

EC No	Components	Nature of Component	Duration	Weightage	Date & Time	Venue
1	Quizzes	Closed book	20 minutes	5%	To be held periodically	To be announced later
2	Mid Sem Exam	Closed book	90 minutes	25 %	31.10.2023 AN	
3	Assignments/ Homework	Some may be open-book type	variable	10%	Continuous Assessment	
4	Lab Continuous Evaluation			10%	Continuous Assessment	
5	Comprehensive Lab Exam			15%	TBA	
6	Comprehensive Examination	Open/ Closed book	3 hours	35%	04.01.2024 AN	

* Only prescribed text book(s) and hand written notes are permitted.

Mapping of CLOs, PLOs, and CECs

CLOs	PLOs	Evaluation Components (ECs)					
		EC1	EC2	EC3	EC4	EC5	EC6
CLO1	1, 2	✓		✓	✓	✓	✓
CLO2	2, 4	✓	✓	✓	✓	✓	✓
CLO3	2,3,4		✓	✓	✓	✓	✓
CLO4	3,4,5			✓			✓
CLO5	3,4,5			✓	✓	✓	✓
CL06	4,5						✓

* Please refer the [link](#) for the PLOs of the B.E. Biotechnology program.

Quizzes: Three quizzes will be conducted before mid-sem grading out of which best two will be considered for grading. Another three quizzes will be conducted after mid-sem grading out of which best two will be considered for grading.

Assignment/Case studies: The Assignment will be given on either some or all of the above mentioned topics. Case studies, interpretation of data and then analysis, will form a part of all evaluation components. Assignments(s) may include seminar presentation and viva. Details will be intimated through a separate notification or announced in the class and the deadlines would be indicated therein. However, all assignments/reports would be completed by 1st week of

December 2023. It is necessary that all students stick to time schedule and do not postpone submission of assignments/reports. This will prevent extra load during last two weeks of class work. No make-ups would be allowed for submission of assignments / practical reports.

Reading Assignments: Students are advised to read, collect additional information on the above mentioned topics as per given schedule. In addition, awareness w.r.t. latest developments in the area would be an added advantage.

Mid-sem Grading: Mid-sem grading will be displayed after two evaluation components or earlier when- ever about 40 % of evaluation components are completed.

Note: A student will be likely to get "NC", if he / she

- Doesn't appear / appear for the sake of appearing for the evaluation components / scoring zero in pre-compre total.
- Scoring zero in the lab component / Abstaining from lab classes throughout.

Makeup and Attendance policies:

Make-ups are not given as a routine. It is solely dependent upon the genuineness of the circumstances under which a student fails to appear in a scheduled evaluation component. In such circumstances, prior permission should be obtained from the I/C. The decision of the I/C in the above matter will be final.

Attendance: Every student is expected to be responsible for regularity of his/her attendance in classrooms and laboratories, to appear in scheduled tests and examinations and fulfill all other tasks assigned to him/her in every course. A student should have a minimum of 60% of attendance in a course to be eligible to appear for the Comprehensive Examination in that course. For the students under the purview of Academic Counseling Board (ACB), the Board shall prescribe the minimum attendance requirement on a case-to-case basis. Attendance in the course will be a deciding factor in judging the seriousness of a student which may be directly / indirectly related to grading.

General timings for consultation Chamber No: 322; Wednesday 4th hour or any other free time for the on campus and for the live-streaming students time will be decided seeing mutually convenient time for both.

General instructions: Students should come prepared for classes and carry the textbook(s) or material(s) as prescribed by the Course Faculty to the class.

Notices: All notices concerning the course will be displayed on the respective Notice Boards.

Instructor-in-Charge
BIOT F314

<p><u>Contact Details:</u> Dr. S. Ramachandran, Professor, Chamber No:322, Contact No: +971 42753700 Ext: 421 Mobile No: +971-582706578 email: sramachandran@dubai.bits-pilani.ac.in</p> <p>Dr. Debostuti Ghoshdastidar, Assistant Professor, Chamber No:316, Contact No: +971 42753700 Ext: 422 Mob:+971561661433. email: debostuti@dubai.bits-pilani.ac.in</p>
