Biotechnology; Code: PM 705C

A- Basic Information

Programme(s) on which the course is given:	Bachelor of Pharmacy (Pharm D clinical)
Department responsible for offering the course:	Department of Microbiology and Immunology
Department responsible for teaching the course:	Department of Microbiology and Immunology
Academic year:	Level four – fall semester- (2022-2023)
Course title and code:	Biotechnology, PM 705C
Prerequisite:	Pharmaceutical Microbiology
Contact hours (Credit hours):	Lectures: 1 (1), Practical: 2 (1), Total: 3 (1+1)
Course Coordinator:	Dr. Masarra Sakr

B- Professional Information

1- Overall Aim of the Course

The course aims at providing students with fundamentals, scope, and applications of biotechnology. Fermentation industries including isolation, preservation of industrial microorganisms, types and construction of fermenters, fermentation modes, microbial culture media for industrial purposes, different culturing methods for mass growth of microorganisms, upstream, downstream, scaling up and down processes, preparation and conducting a formation process, use of molecular techniques for production of recombinant products like therapeutic proteins, vaccines, major biotechnological products such as production of biomass, antibiotics, amino acids, organic acids, biosensor, biotransformation, bioremediation, bioleaching, bioinsecticides, biosurfactants and biopolymer production will be studied in this course.

2- Course Learning Outcomes

Domain 1: Fundamental knowledge

The students should be able to:

Program key elements	Course learning outcomes
1.1.1.1 Explain the basic knowledge of micro-organisms, infectious/non-infectious diseases, bioinformatics, biotechnology, and epigenetics	**1.1.1.1** Illustrate the basic knowledge of biotechnology
1.1.3.1 Merge knowledge from fundamental sciences to extract synthetic/natural/ toxic materials and products.	**1.1.3.1** Apply knowledge from main sciences to extract biologicals and bioproducts
1.1.3.2 Unite information from basic sciences to handle and identify synthetic/natural/ toxic pharmaceutical materials and products.	**1.1.3.2** Incorporate data from fundamental sciences to handle and identify biologicals and bioproducts
1.1.3.3 Blend knowledge from fundamental sciences to design, prepare and analyze pharmaceutical products.	**1.1.3.3** Utilize information from basic sciences to design, prepare, and analyze biologicals and bioproducts

1.1.3.4 Incorporate information from main sciences to assure quality of pharmaceutical materials/products.	**1.1.3.4** Integrate data from basic sciences to ensure quality of biologicals and bioproducts

Domain 2: Professional and ethical practice

The students should be able to:

Program key elements	Course learning outcomes
2.2.1.1 Isolate, purify and identify synthetic/natural pharmaceutical substances.	**2.2.1.1** Isolate, purify, and identify biologicals and bioproducts.
2.2.1.2 Design, synthesize, analyze, and standardize pharmaceutical materials.	**2.2.1.2** Design, synthesize, analyze, and standardize biologicals and bioproducts.
2.2.2.1 Claim main needs of quality in developing, manufacturing, storing, and distributing pharmaceutical products.	**2.2.2.1** Apply the basic requirements of quality management system in developing, manufacturing, storing, and distributing biologicals and bioproducts.
2.3.1.1 Handle & dispose biologicals, synthetic/natural materials, radio-labeled and biotechnology-based products.	**2.3.1.1** Handle and dispose of biologicals, bioproducts, and biotechnology-based products.
2.3.1.2 Identify different materials and products used in the pharmaceutical field.	**2.3.1.2** Identify biological therapeutics and bioproducts used in the pharmaceutical field.

Domain 4: Personal practice

The students should be able to:

Program key elements	Course learning outcomes
4.1.1 Demonstrate the responsibilities of team members and evaluate their performance considering time management skills.	**4.1.1.** Demonstrate responsibility for team performance and peer evaluation of other team members, and express time management skills.
4.3.2 Develop self-learning skills for continuous professional improvement.	**4.3.2.** Practice independent learning needed for continuous professional development.

3- Course Contents

Week	Lectures		Practical	
	Topic	Credit hrs. (1)	Topics	Credit hrs. (1)
1	Introduction to Industrial Microbiology and Fermentation	1		
2	Modes of Fermentation and Fermentor Design	1	Isolation of bacteria from soil	1

3	Upstream and downstream processing + formative assessment	**1**	Purification	**1**
4	Applications of industrial microbiology part 1	**1**	Casein-starch hydrolysis	**1**
5	**Midterm**			
6	Applications of industrial microbiology part 2	**1**	Preservation	**1**
7	Molecular Biology: an introduction	**1**	Enzymes	**1**
8	Gen-operon regulatory elements	**1**	Fermenter	**1**
9	Gene cloning	**1**	DNA extraction	**1**
10	Applications of genetic engineering 1	**1**	PCR	**1**
11	Applications of genetic engineering 2	**1**	Gel electrophoresis	**1**
12	Applications of genetic engineering 3	**1**	**Practical exam**	
Total hrs	11		9	

4- Teaching and Learning Methods:

. 4.1- Lectures (tools: board, projector).
4.2- Practical sessions (reagents, glassware, lab equipment)
4.3- Written essays (library, internet).
4.4- Team working

5- Student Assessment Methods:

Written Midterm exam	To assess	The ability of students to follow-up the course subjects.
Practical exam and assessment of semester work (class activities)	To assess	The ability of students to apply and practice scientific knowledge
Written final exam	To assess	The overall outcomes.
Oral exam	To assess	The ability of students in expressing and presenting their knowledge clearly and in systematic approach.

Assessment Schedule

Assessment 1	Periodic exams	Week 5
Assessment 2	Practical exam	Week 12
Assessment 3	Oral exam	Week 14
Assessment 4	Final written exam	Week 14

Weighting of Assessments

Periodical examination	15
Final-term Examination	50
Oral Examination	10
Practical Examination	25
Other types of assessment	---
Total	**100**

6- List of References

Course notes

- Lecture notes of Biotechnology prepared by instructors.

Essential books (textbooks)

- Biotechnology and genomics, 1st ed. 2004
- Fermentation industry
- Basic biotechnology, 2nd ed.2001

Recommended books

- Basic Biotechnology; 2nd edition; Eds. Colin Ratledge and Bijorn Kristiansen, Cambridge Press (2001)
- An Introduction to Molecular Biotechnology: Fundamentals, Methods and Applications, 2nd Edition;MichaelWink,Wiley-Blackwell (2011)

Periodicals, Web sites, etc

- Nucleic acids research (SMART; **Letunic*et al.*, 2004;**http://nar.oupjournals.org/cgi/content/full/32/suppl_1/D142),
- Restriction enzyme analysis: Restriction Enzyme Site Mapper version 3
- (http://www.restrictionmapper.org/); Webcutter 2.0 (http://www.firstmarket.com/cutter/cut2.html).
- Praxilabs (https://praxilabs.com/)

7- Facilities Required for Teaching and Learning

Modern libraries, audiovisual tools, chemicals, cooperative assistants, glassware and instruments, equipped laboratories, study halls, overhead projector, data show, and internet (asu2learn platform https://asu2learn.asu.edu.eg/)

Course members: **Prof. Dr. Mahmoud Abdul-Magead Yassien**
Dr. Ahmed Saied Abu Zaid
Dr. Masarra Sakr
Dr. Ann Elshamy

Course Coordinator: **Masarra Sakr** *Masarra Sakr*

Head of Department: Assoc. Prof. Dr. Sarrah Ebrahim Saleh *Sarra Saleh*

Course Plan & Matrices

Course name	Biotechnology
Code	PM 705C

Course Contents		Program Key Elements	Course learning outcomes	Teaching and Learning Methods	Student Assessment Methods
Week # 1	• Introduction to Industrial Microbiology and Fermentation • Isolation of bacteria from soil	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.2.1.1, 2.2.1.2, 2.2.2.1, 4.1.1, 4.3.2	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.2.1.1, 2.2.1.2, 2.2.2.1, 4.1.1, 4.3.2	Lectures	Periodic Written, Oral
Week # 2	• Modes of Fermentation and Fermentor Design -Isolation	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.2.1.1, 2.2.1.2, 2.2.2.1, 4.1.1, 4.3.2	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.2.1.1, 2.2.1.2, 2.2.2.1, 4.1.1, 4.3.2	Lectures Practical training	Periodic Written, Oral Practical report
Week # 3	• Upstream and downstream processing + formative assessment -Purification	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.2.1.1, 2.2.1.2, 2.2.2.1, 4.1.1, 4.3.2	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.2.1.1, 2.2.1.2, 2.2.2.1, 4.1.1, 4.3.2	Lectures, Assignments Practical training	Periodic Written, Oral Practical report
Week # 4	• Applications of industrial microbiology part 1 -Casein-starch hydrolysis	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.2.1.1, 2.2.1.2, 2.2.2.1, 4.1.1, 4.3.2	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.2.1.1, 2.2.1.2, 2.2.2.1, 4.1.1, 4.3.2	Lectures, Open discussion Practical training	Written, Oral Practical report
Week # 5	**Midterm**				
Week # 6	• Applications of industrial microbiology part 2 - Preservation	1.1.1.1, 2.2.1.1, 2.2.1.2, 4.1.1, 4.3.2	1.1.1.1, 2.2.1.1, 2.2.1.2, 4.1.1, 4.3.2	Lectures Practical training	Written, Oral Practical report

Week # 7	• Molecular Biology : an introduction - Enzymes	1.1.1.1, 2.2.1.1, 2.2.1.2, 4.1.1, 4.3.2	1.1.1.1, 2.2.1.1, 2.2.1.2, 4.1.1, 4.3.2	Lectures Practical training	Written, Oral Practical
Week # 8	• Gen-operon regulatory elements - Fermenter	1.1.1.1, 2.2.1.1, 2.2.1.2, 4.3.2	1.1.1.1, 2.2.1.1, 2.2.1.2, 4.3.2	Lectures Open discussion Practical demonstration	Written, Oral Practical
Week # 9	• Gene cloning - DNA extraction	1.1.1.1, 4.3.2	1.1.1.1, 4.3.2	Lectures Practical tutorial	Written, Oral Practical
Week # 10	• Applications of genetic engineering 1 -PCR	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.3.1.1, 2.3.1.2	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.3.1.1, 2.3.1.2	Lectures Brain storming Practical tutorial	Written, Oral Practical
Week # 11	• Applications of genetic engineering 2 - Gel electrophoresis	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.3.1.1, 2.3.1.2	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.3.1.1, 2.3.1.2	Lecture Practical tutorial	Written, Oral
Week # 12	• Applications of genetic engineering 3 - Practical exam	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.3.1.1, 2.3.1.2	1.1.3.1, 1.1.3.2, 1.1.3.3, 1.1.3.4, 2.3.1.1, 2.3.1.2	Lecture, Open discussion	Written, Oral

In case of emergency or necessity, the study will be converted into recorded and interactive lectures.

تم الاعتماد فى محضر مجلس قسم الميكروبيولوجيا والمناعة

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