Biotechnology; Code: PM 905

A- Basic Information

Programme(s) on which the course is given:	Bachelor of Pharmacy (Pharm D)
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 Five – Fall semester- (2023-2024)
Course title and code:	Biotechnology, PM 905
Prerequisite:	Pharmaceutical Microbiology
Contact hours (Credit hours):	Lectures: 2 (2), Practical: 2 (1), Total: 4 (2+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
1.1.1.8 Explain basics of bioinformatics, biotechnology, and epigenetics.	**1.1.1.8** Illustrate the basic knowledge of biotechnology
1.1.3.1 Merge knowledge from fundamental sciences to design, prepare and analyze synthetic/natural pharmaceutical materials/products.	**1.1.3.1** Utilize information from basic sciences to design and prepare biologicals and bioproducts
1.1.3.2 Blend information from basic sciences to handle and identify synthetic/natural pharmaceutical materials/products.	**1.1.3.2** Incorporate data from fundamental sciences to identify and handle biologicals and bioproducts
1.1.3.3 Incorporate knowledge from main sciences to assure quality of synthetic/natural pharmaceutical materials/products	**1.1.3.3** Integrate data from basic sciences to guarantee optimum quality of biologicals and bioproducts
1.1.3.4 Unite information from fundamental sciences to extract synthetic/natural/toxic pharmaceutical materials/products.	**1.1.3.4** Apply knowledge from main sciences to extract 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 & identify synthetic/natural pharmaceutical substances	**2.2.1.1** Isolate, purify, and identify biologicals and bioproducts.
2.2.1.2 Design, synthesize and analyze pharmaceutical materials.	**2.2.1.2** Design, synthesize, and analyze biologicals and bioproducts.
2.2.2.1 Employ fundamental requirements 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 natural/synthetic biologic materials, biotechnology-based & radio-labeled products.	**2.3.1.1** Handle and dispose of biologicals, bioproducts, and biotechnology-based products.
2.3.1.2 Identify synthetic/natural pharmaceutical 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 Reveal healthcare team performance responsibility and evaluate team members showing 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 Apply self-learning required for continuous professional development.	**4.3.2.** Practice independent learning needed for continuous professional development.

3- Course Contents

Week	Lectures		Practical	
	Topic	Credit hrs. (2)	Topics	Credit hrs. (1)
1	Industrial microbiology	**2**		
2	Fermentation types, modes and steps	**2**	Isolation of producer microorganism	**1**
3	Upstream and downstream processing, scale up and down + Formative assessment	**2**	Strain purification	**1**
4	Industrial and environmental applications of fermentation 1	**2**	Screening of strain's activity	**1**
5	Periodic Exam			

6	Industrial and environmental applications of fermentation 2	**2**	Strain preservation and development	**1**
7	Molecular Biology: an introduction	**2**	Enzyme assay	**1**
8	Gen-operon regulatory elements	**2**	Laboratory bioreactor	**1**
9	Gene cloning	**2**	DNA extraction	**1**
10	Applications of genetic engineering 1	**2**	PCR	**1**
11	Applications of genetic engineering 2	**2**	Gel electrophoresis	**1**
12	Applications of genetic engineering 3	**2**	**Practical exam**	
14	**Written exam**			

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 11
Assessment 3	Oral exam	Week 14
Assessment 4	Final written exam	Week 14

Weighting of Assessments

Periodical examination	13.3%
Final-term Examination	50 %
Oral Examination	10 %
Practical Examination	26.7 %
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 (http://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 http://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: Dr. Masarra Sakr *Masarra Sakr*

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

Course name	**Biotechnology**
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Course Plan & Matrices

Course Contents		Program Key Elements	Course learning outcomes	Teaching and Learning Methods	Student Assessment Methods
Week # 1	Industrial microbiology	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,	Written, Oral
Week # 2	Fermentation types, modes and steps -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	Written, Oral, Practical report
Week # 3	Upstream and downstream processing, scale up and down + 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	Written, Oral, Practical report
Week # 4	Industrial and environmental applications of fermentation 1 -Screening of activity	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	Industrial and environmental applications of fermentation 2 - strain preservation	1.1.1.8, 2.2.1.1, 2.2.1.2, 4.1.1, 4.3.2	1.1.1.8, 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 -Enzyme assay	1.1.1.8, 2.2.1.1, 2.2.1.2, 4.1.1, 4.3.2	1.1.1.8, 2.2.1.1, 2.2.1.2, 4.1.1, 4.3.2	Lectures, Practical demonstration	Written, Oral, Practical

Week # 8	Gen-operon regulatory elements - Bioreactor	1.1.1.8, 2.2.1.1, 2.2.1.2, 4.3.2	1.1.1.8, 2.2.1.1, 2.2.1.2, 4.3.2	Lectures, Assignments, Open discussion, Practical tutorial	Written, Oral, Practical
Week # 9	Gene cloning -DNA extraction	1.1.1.8, 4.3.2	1.1.1.8, 4.3.2	Lectures, Practical tutorial	Written, Oral, Practical
Week # 10	Applications of genetic engineering 1 -PCR and -Gel electrophoresis	1.1.1.8, 4.3.2	1.1.1.8, 4.3.2	Lectures, Practical tutorial	Written, Oral, Practical
Week # 11	Applications of genetic engineering 2 -Practical exam	1.1.1.8	1.1.1.8	Lectures Practical tutorial	Written, Oral
Week # 12	Applications of genetic engineering 3	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	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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