

## Bioinformatics; Code: PM E10

### A- Basic Information

|                                                        |                                                   |
|--------------------------------------------------------|---------------------------------------------------|
| <b>Programme(s) on which the course is given:</b>      | Bachelor of Pharmacy (Pharm D)                    |
| <b>Department responsible for offering the course:</b> | Microbiology and Immunology                       |
| <b>Department responsible for teaching the course:</b> | Microbiology and Immunology                       |
| <b>Academic year:</b>                                  | Level four- Fall semester                         |
| <b>Course title and code:</b>                          | Bioinformatics, PM E10                            |
| <b>Prerequisite:</b>                                   | Registration                                      |
| <b>Contact hours (Credit hours):</b>                   | Lectures: 1 (1), Practical: 2 (1), Total: 3 (1+1) |
| <b>Course Coordinator:</b>                             | Dr. Ann Ayman Elshamy                             |

### B- Professional Information

#### 1 - Overall Aim of the Course

The course aims to know all the gene sequences in many organisms and to understand all the genes' functions in all these organisms, and how all the genes interact locally to produce a phenotype, and how they interact globally to explain the similarities and differences observed in the great diversity of life. Bioinformatics fuses biology with mathematics (especially statistics) and computer science (algorithms and their implementations to: find genes within a genomic sequence, align sequences in databases to determine the degree of matching, predict the structure and function of gene products, describe the interactions between genes and gene products at a global level within the cell and between organisms, postulate phylogenetic relationships for sequences, DNA and protein structures, characterization of genomic DNA, genome organization in bacteria, yeasts, & humans, sequences alignments, polymorphisms & gene mapping, genome sequencing, web and internet sites for comparing and identifying protein domains

#### 2 - Course Learning Outcomes

##### Domain 1: Fundamental knowledge

The students should be able to:

| Program key elements                                                                              | Course learning outcomes                                                                                                                                |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1.1.1.8</b> Explain basics of bioinformatics, biotechnology, and epigenetics.                  | <b>1.1.1.8</b> Demonstrate understanding of knowledge of pharmaceutical and biomedical sciences and all about genes and gene sequences                  |
| <b>1.1.2.1</b> Make use of genetic, microbiological & epidemiological terms in pharmacy practice. | <b>1.1.2.1</b> Utilize the proper pharmaceutical and medical terms, abbreviations and symbols in pharmacy practice including gene and protein sequences |

##### Domain 2: Professional and ethical practice

The students should be able to:

| Program key elements                                                                      | Course learning outcomes                                                                 |
|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>2.2.4.3</b> Follow the bases of bioinformatics for proper bioequivalence applications. | <b>2.2.4.3</b> Adopt the principles of bioinformatics using softwares and internet sites |

### Domain 3: Pharmaceutical care

The students should be able to:

| Program key elements                                                                                                            | Course learning outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>3.1.1</b> Integrate the basis of body physiology and genomics in health and disease states for various disorders management. | <b>3.1.1</b> Apply the principles of body function and basis of genomics in health and disease states<br><b>3.1.1.a</b> know all the gene sequences in many organisms and to understand all the genes' functions in all these organisms<br><b>3.1.1.b</b> know how all the genes interact locally to produce a phenotype<br><b>3.1.1.c</b> Learn how genes interact globally to explain the similarities and differences observed in the great diversity of life. |

### Domain 4: Personal practice

The students should be able to:

| Program key elements                                                               | Course learning outcomes                                                                                          |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>4.3.1</b> Apply professional self-assessment to enhance personal competencies.  | <b>4.3.1</b> Perform self-assessment to enhance professional and personal competencies.                           |
| <b>4.3.2</b> Apply self-learning required for continuous professional development. | <b>4.3.2</b> Practice independent learning on different softwares needed for continuous professional development. |

### 3 - Course Contents

| Week | Lectures                                                    |                 | Practical                                                   |                 |
|------|-------------------------------------------------------------|-----------------|-------------------------------------------------------------|-----------------|
|      | Topic                                                       | Credit hrs. (1) | Topics                                                      | Credit hrs. (1) |
| 1    | An introduction to bioinformatics                           | 1               | Introduction to Bioinformatics                              | 1               |
| 2    | Biological databases                                        | 1               | Biological Databases                                        | 1               |
| 3    | Open reading frame (ORF) analysis                           | 1               | Open reading frame (ORF) analysis                           | 1               |
| 4    | BLAST search tools and analysis                             | 1               | BLAST search tools and analysis                             | 1               |
| 5    | <b>Midterm</b>                                              |                 |                                                             |                 |
| 6    | Primer design                                               | 1               | Tutorial 1                                                  | 1               |
| 7    | Multiple sequence alignment and membrane proteins           | 1               | Primer design                                               | 1               |
| 8    | Proteomics; Protein Classification and Structure prediction | 1               | Multiple sequence alignment                                 | 1               |
| 9    | Programs: CDD, PSORT                                        | 1               | Proteomics; Protein Classification and Structure prediction | 1               |
| 10   | Phylogenetic analysis 1                                     | 1               | Tutorial 2                                                  | 1               |
| 11   | Phylogenetic analysis 2                                     | 1               | <b>Practical exam</b>                                       |                 |
| 12   | Formative assessment                                        | 1               | ---                                                         |                 |
| 13   | ---                                                         |                 | ---                                                         |                 |
| 14   | <b>Final Written Exam</b>                                   |                 |                                                             |                 |

#### 4 - Teaching and Learning Methods:

- 4.1- Lectures (tools: board, projector, handouts).
- 4.2- Practical sessions (online interactive sessions, in-lab tutorials)

#### 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 |
| Final written exam                                                | To assess | The overall outcomes                                               |

#### Assessment Schedule

|              |                    |         |
|--------------|--------------------|---------|
| Assessment 1 | Periodic exams     | Week 5  |
| Assessment 2 | Practical exam     | Week 11 |
| Assessment 3 | Final written exam | Week 14 |

| Weighting of Assessments         | marks      |
|----------------------------------|------------|
| Periodical examination           | 15         |
| Final-term Examination           | 60         |
| Oral Examination                 | ---        |
| Practical Examination            | 25         |
| <u>Other types of assessment</u> | ---        |
| <b>Total</b>                     | <b>100</b> |

#### 6 - List of References

- Bishop, O. T. ed. (2014). Bioinformatics and Data Analysis in Microbiology. Caister Academic Press.
- Choudhuri, S. ed. (2014). Bioinformatics For Beginners: Genes, Genomes , Molecular Evolution, Databases and Analytical Tools. Elsevier.
- Christensen, H. ed. (2018). Introduction to Bioinformatics in Microbiology. Cham: Springer International Publishing doi:10.1007/978-3-319-99280-8.
- Singh, D. B., and Pathak, R. K. eds. (2022). Bioinformatics: Methods and Applications. Chennai, India: Elsevier doi:10.1016/C2020-0-03034-3.
- Hasija, Y. ed. (2023). All About Bioinformatics: From Beginner to Expert. Elsevier.

#### 7 - Facilities Required for Teaching and Learning

Modern libraries, audiovisual tools, computers

#### Course Members:

Prof. Dr. Khaled M. Anwar Aboshanab  
Assoc. Prof. Dr. Sarra Ebrahim Saleh  
Dr. Ann Ayman Elshamy

**Course Coordinator:** Dr. Ann Ayman Elshamy

*Ann Elshamy*

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

*Sarra Saleh*

|                    |                       |
|--------------------|-----------------------|
| <b>Course name</b> | <b>Bioinformatics</b> |
| <b>Code</b>        | <b>PM E10</b>         |

Course Plan & Matrices

| Course Contents |                                                                                                  | Program Key Elements                                          | Course learning outcomes                                                                | Teaching and Learning Methods                   | Student Assessment Methods         |
|-----------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------|
| <b>Week # 1</b> | An introduction to bioinformatics<br>P: Introduction to bioinformatics                           | 1.1.1.8,<br>1.1.2.1                                           | 1.1.1.8,<br>1.1.2.1                                                                     | Lectures,<br>Practical training                 | Periodic,<br>Written,<br>Practical |
| <b>Week # 2</b> | Biological databases<br>P: Biological databases                                                  | 1.1.1.8,<br>1.1.2.1,<br>2.2.4.3                               | 1.1.1.8,<br>1.1.2.1,<br>2.2.4.3                                                         | Lectures,<br>Practical training,<br>Assignments | Periodic,<br>Written,<br>Practical |
| <b>Week # 3</b> | Open reading frame (ORF) analysis<br>P: Open reading frame (ORF) analysis                        | 1.1.1.8,<br>1.1.2.1,<br>2.2.4.3,<br>3.1.1,<br>4.3.1,<br>4.3.2 | 1.1.1.8,<br>1.1.2.1,<br>2.2.4.3,<br>3.1.1.a,<br>3.1.1.b,<br>3.1.1.c,<br>4.3.1,<br>4.3.2 | Lectures,<br>Practical training,<br>Assignments | Periodic,<br>Written,<br>Practical |
| <b>Week # 4</b> | BLAST search tools and analysis<br>P: BLAST search tools and analysis                            | 1.1.1.8,<br>1.1.2.1,<br>3.1.1,<br>4.3.1,<br>4.3.2             | 1.1.1.8,<br>1.1.2.1,<br>3.1.1.a,<br>3.1.1.b,<br>3.1.1.c,<br>4.3.1,<br>4.3.2             | Lectures,<br>Practical training,<br>Assignments | Written,<br>Practical              |
| <b>Week # 5</b> | <b>Midterm</b>                                                                                   |                                                               |                                                                                         |                                                 |                                    |
| <b>Week # 6</b> | Primer design<br>P: Tutorial 1                                                                   | 1.1.1.8,<br>1.1.2.1                                           | 1.1.1.8,<br>1.1.2.1                                                                     | Lectures,<br>Open discussion                    | Written,<br>Practical              |
| <b>Week # 7</b> | Multiple sequence alignment and membrane proteins<br>P: Primer design                            | 1.1.1.8,<br>1.1.2.1                                           | 1.1.1.8,<br>1.1.2.1                                                                     | Lectures,<br>Practical training,<br>Assignments | Written,<br>Practical              |
| <b>Week # 8</b> | Proteomics;<br>Protein Classification and Structure prediction<br>P: Multiple sequence alignment | 1.1.1.8,<br>1.1.2.1,<br>2.2.4.3                               | 1.1.1.8,<br>1.1.2.1,<br>2.2.4.3                                                         | Lectures,<br>Practical training,<br>Assignments | Written,<br>Practical              |
| <b>Week # 9</b> | Programs: CDD, PSORT                                                                             | 1.1.1.8,<br>1.1.2.1,                                          | 1.1.1.8,<br>1.1.2.1,                                                                    | Lectures,                                       | Written,<br>Practical              |

|                  |                                                                            |                     |                     |                                       |                       |
|------------------|----------------------------------------------------------------------------|---------------------|---------------------|---------------------------------------|-----------------------|
|                  | P: Proteomics;<br>Protein<br>Classification and<br>Structure<br>prediction | 2.2.4.3             | 2.2.4.3             | Practical<br>training,<br>Assignments |                       |
| <b>Week # 10</b> | Phylogenetic<br>analysis 1<br><br>P: Tutorial 2                            | 1.1.1.8,<br>1.1.2.1 | 1.1.1.8,<br>1.1.2.1 | Lectures,<br>Open<br>discussion       | Written,<br>Practical |
| <b>Week # 11</b> | Phylogenetic<br>analysis 2<br><br>P: Practical exam                        | 1.1.1.8,<br>1.1.2.1 | 1.1.1.8,<br>1.1.2.1 | Lectures                              | Written               |
| <b>Week # 12</b> | Formative<br>assessment                                                    |                     |                     | Brainstorming                         | Written               |

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

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