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|----------------------------------|--------------------------------------------------------|---------------------------------------------|
| <b>Form:<br/>Course Syllabus</b> | <b>Form Number</b>                                     | EXC-01-02-01                                |
|                                  | <b>Issue Number and Date</b>                           | <u>2/3/24/2022/2963</u><br><u>5/12/2022</u> |
|                                  | <b>Number and Date of Revision or Modification</b>     |                                             |
|                                  | <b>Deans Council Approval Decision Number</b>          |                                             |
|                                  | <b>The Date of the Deans Council Approval Decision</b> |                                             |
|                                  | <b>Number of Pages</b>                                 | 11                                          |

|     |                                                             |                                                                                                                                                                                                     |  |
|-----|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 1.  | <b>Course title</b>                                         | 0501220 Cell and molecular biology                                                                                                                                                                  |  |
| 2.  | <b>Course number</b>                                        | 0501220                                                                                                                                                                                             |  |
| 3.  | <b>Credit hours</b>                                         | 3 Theory                                                                                                                                                                                            |  |
|     | <b>Contact hours (theory, practical)</b>                    | 36 Lectures                                                                                                                                                                                         |  |
| 4.  | <b>Prerequisites/Corequisites</b>                           | 0501113                                                                                                                                                                                             |  |
| 5.  | <b>Program title</b>                                        | Doctor of Medicine                                                                                                                                                                                  |  |
| 6.  | <b>Program code</b>                                         | 05                                                                                                                                                                                                  |  |
| 7.  | <b>Awarding institution</b>                                 | The University of Jordan                                                                                                                                                                            |  |
| 8.  | <b>School</b>                                               | School of Medicine                                                                                                                                                                                  |  |
| 9.  | <b>Department</b>                                           | Physiology and biochemistry                                                                                                                                                                         |  |
| 10. | <b>Course level</b>                                         | Bachelor                                                                                                                                                                                            |  |
| 11. | <b>Year of study and semester (s)</b>                       | Second year/ First Semester                                                                                                                                                                         |  |
| 12. | <b>Other department (s) involved in teaching the course</b> | -                                                                                                                                                                                                   |  |
| 13. | <b>Main Learning language</b>                               | English                                                                                                                                                                                             |  |
| 14. | <b>Learning Types</b>                                       | <input type="checkbox"/> Face to face learning <input checked="" type="checkbox"/> Blended <input type="checkbox"/> Fully online                                                                    |  |
| 15. | <b>Online platforms(s)</b>                                  | <input checked="" type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input type="checkbox"/> Zoom<br><input type="checkbox"/> Others..... |  |
| 16. | <b>Issuing/Revision Date</b>                                | 21/12/2023                                                                                                                                                                                          |  |

**17. Course Coordinator:****Name:** Prof. Mamoun Ahram**Contact hours:** Sunday-Thursday 1-2 PM**Office number:** 148**Phone number:** 065355000/23481**Email:** [m.ahram@ju.edu.jo](mailto:m.ahram@ju.edu.jo)**18. Other instructors:****Name:** Prof. Nafez Abu Tarboush**Contact hours:** Sunday-Thursday 1-2 PM**Office number:** 137**Phone number:** 065355000/23414**Email:** [n.abutarboush@ju.edu.jo](mailto:n.abutarboush@ju.edu.jo)**Name:** Dr. Diala Abu Hassan**Contact hours:** Sunday-Thursday 1-2 PM**Office number:****Phone number:****Email:** [d.abuhassan@ju.edu.jo](mailto:d.abuhassan@ju.edu.jo)**19. Course Description and Aims:****A- Course Description:**

This is a mandatory, three-credit hour course for second-year medical students. The course is designed to introduce students to the basics of cellular and molecular biology, which include the study of cell structure and the function of cell components, the chemical structure of the genetic material, molecular processes such as replication, transcription, and translation, in addition to the study of basic molecular biology tools and techniques.

**B- Aims:**

The aim of this course is to allow the students to link the information and concepts of the biology of the cell and the chemistry of its genetic molecules to normal cell function, molecular processes, and human variation, and the development of diseases when perturbed.



**20. Program Intended Learning Outcomes (PLOs) (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program):**

- 1. Demonstrate basic knowledge of normal human structure and function at molecular, genetic, cellular, tissue, organ, system and whole-body levels in terms of growth, development, and health maintenance. Analyze the basic molecular and cellular mechanisms involved in the causation and treatment of human disease and their influence on clinical presentation and therapy.**
- 2. Collect, interpret, document, and communicate accurately a comprehensive medical history, including the psychological and behavioral factors, and a thorough organ-system-specific physical examination inclusive of the mental status of the patient.**
- 3. Integrate and communicate collected clinical information in the construction of appropriate diagnostic and therapeutic management strategies to identify life-threatening conditions ensuring prompt therapy, referral, and consultation with relevant disciplines and skillfully perform basic medical procedures for general practice on patients with common illness, acute and chronic, taking into account environmental, social, cultural and psychological factors.**
- 4. Demonstrate in-depth knowledge of the epidemiology and biostatistics of common diseases, and analyze the impact of ethnicity, culture, socioeconomic factors and other social factors on health, disease and individual patient's health care.**
- 5. Communicate effectively and professionally, both orally and in writing, with patients, their families, and with other healthcare providers utilizing information technology resources in his/her scholarly activities and professional development with the ability to teach others, and to understand and respect other healthcare professionals' roles, and apply the principles of multidisciplinary teamwork dynamics and collaboration.**
- 6. Apply scientific methods including evidence –based approach to the medical practice including problem identification, data collection, hypothesis formulation, etc., and apply inductive reasoning to problem solving and ensure that clinical reasoning and decision making are guided by sound ethical principles.**
- 7. Demonstrate knowledge of scientific research methods and ethical principles of clinical research and be able to write research proposals or research papers.**



8. Demonstrate professionally the skills needed for Quality improvement, lifelong learning, and continuous medical education including the ability to identify and address personal strength and weakness, self-assess knowledge and performance, and develop a self-improvement plan.

21. Intended Learning outcomes of the course (CLOs): Upon completion of the course, the student will be able to achieve the following intended learning outcomes:

1. Understand how cells function as a whole unit.
2. Connect DNA to cell function and anomalies.
3. Appreciate the role of molecular biology in medicine in terms of human phenotypes and diseases.
4. Propose how different molecular techniques can be used in disease diagnosis and treatment.
5. Interpret results of the various molecular techniques.

22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program):

| Program ILOs<br>ILOs of the course | CLO (1) | CLO (2) | CLO (3) | CLO (4) | CLO (5) |
|------------------------------------|---------|---------|---------|---------|---------|
| PLO (1)                            | ✓       | ✓       | ✓       | ✓       | ✓       |
| PLO (2)                            |         |         |         |         |         |
| PLO (3)                            |         |         |         |         |         |
| PLO (4)                            |         |         |         |         |         |
| PLO (5)                            |         |         |         |         |         |
| PLO (6)                            |         |         |         | ✓       | ✓       |
| PLO (7)                            |         |         |         |         |         |
| PLO (8)                            |         |         |         |         |         |

23. Topic Outline and Schedule:

| Week | Lecture | Topic | Student Learning Outcome (SLO) | Descriptors <sup>4,5</sup> | Learning Types (Face to Face/Blended/ Fully Online) | Platform Used | Synchronous / Asynchronous Lecturing | Evaluation Methods | Learning Resources |
|------|---------|-------|--------------------------------|----------------------------|-----------------------------------------------------|---------------|--------------------------------------|--------------------|--------------------|
|      |         |       |                                |                            |                                                     |               |                                      |                    |                    |



|   |     |                                                          |                                                                                                                                                                                                                                                                                                 |                              |              |  |                        |              |       |
|---|-----|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------|--|------------------------|--------------|-------|
| 1 | 1.1 | Introduction into the cell                               | Recall cellular and molecular interactions, and protein and enzyme characteristics and function<br><br>Learn the overall cellular and molecular components of cells.                                                                                                                            | K<br><br>K                   | Face to face |  | Synchronous Lecturing  | Written exam | 26. A |
|   | 1.2 | Biomembranes and membrane proteins                       | Understand the structure of plasma membranes of eukaryotic cells.                                                                                                                                                                                                                               | K                            | Face to face |  | Synchronous Lecturing  | Written exam | 26.A  |
|   | 1.3 | Protein sorting and transport, and endoplasmic reticulum | Know the different types of membrane proteins.<br><br>Recognize the role of membrane proteins in transport.<br><br>Understand the structure and role of the endoplasmic reticulum in protein synthesis and sorting.<br><br>Understand the role of the endoplasmic reticulum in lipid synthesis. | K<br><br>K<br><br>K<br><br>K | Blended      |  | Asynchronous Lecturing | Written exam |       |
| 2 | 2.1 | The Golgi apparatus and                                  | Understand the structure and roles of the Golgi apparatus in the synthesis of cellular molecules.                                                                                                                                                                                               | K                            | Face to face |  | Synchronous Lecturing  | Written exam | 26.A  |
|   | 2.2 | Vesicular transport                                      | Understand the mechanism of vesicular transport.                                                                                                                                                                                                                                                | K                            | Face to face |  | Synchronous Lecturing  | Written exam | 26.A  |
|   | 2.3 | Lysosome, endocytosis, and vesicular transport           | Understand the structure and role of lysosomes and endosomes.<br><br>Understand the mechanism of endocytosis                                                                                                                                                                                    | K<br><br>K                   | Blended      |  | Asynchronous Lecturing | Written exam |       |
| 3 | 3.1 | lysosomal storage diseases                               | Recognize and differentiate the different types of lysosomal storage diseases                                                                                                                                                                                                                   | K                            | Face to face |  | Synchronous Lecturing  | Written exam | 26.A  |
|   | 3.2 | The mitochondria                                         | Understand the structure of the mitochondria.                                                                                                                                                                                                                                                   | K                            | Face to face |  | Synchronous Lecturing  | Written exam | 26.B  |



|   |     |                                         |                                                                                                                                                                                                                                                                                                                           |                              |              |  |                        |              |      |
|---|-----|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------|--|------------------------|--------------|------|
|   | 3.3 | Mitochondrial diseases                  | Discuss some examples of mitochondrial diseases.                                                                                                                                                                                                                                                                          | K                            | Blended      |  | Asynchronous Lecturing | Written exam |      |
| 4 | 4.1 | Peroxisomes                             | Understand the structure and function of peroxisomes.                                                                                                                                                                                                                                                                     | K                            | Face to face |  | Synchronous Lecturing  | Written exam | 26.A |
|   | 4.2 | The actin cytoskeleton<br>Cell movement | Understand the structure and organization of the actin cytoskeleton<br><br>Understand the role of actin and myosin in cell movement and muscle contraction.                                                                                                                                                               | K<br><br>K                   | Blended      |  | Asynchronous Lecturing | Written exam |      |
|   | 4.3 | Microtubules<br>Intermediate filaments  | Understand the structure and organization of microtubules and their role in vesicular transport.<br><br>Understand the structure and role of intermediate filaments.<br><br>Briefly know the association of keratin dysfunction with skin diseases.                                                                       | K<br><br>K<br><br>K          | Face to face |  | Synchronous Lecturing  | Written exam | 26.A |
| 5 | 5.1 | The nucleus                             | Understand the structure of the nucleus and the nuclear membrane<br><br>Discuss some nuclear laminar diseases                                                                                                                                                                                                             | K                            | Face to face |  | Synchronous Lecturing  | Written exam | 26.B |
|   | 5.2 | The extracellular matrix                | Recall the different components of the extracellular matrix.<br><br>Recall the steps involving the synthesis of collagen proteins.<br><br>Know the molecular and cellular changes in a few examples of diseases related to collagen synthesis.<br><br>Understand the mechanisms of cell-matrix and cell-cell interaction. | K<br><br>K<br><br>K<br><br>K | Face to face |  | Synchronous Lecturing  | Written exam | 26.A |
|   | 5.3 | Cell signaling                          | Recall the different modes of cell signaling with emphasis on cell surface receptors and their intracellular signaling                                                                                                                                                                                                    | K                            | Blended      |  | Asynchronous Lecturing | Written exam |      |



|    |      |                                                                               |                                                                                                                                                                                                                     |               |              |  |                        |              |         |
|----|------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|--|------------------------|--------------|---------|
|    |      |                                                                               | molecules and their cellular effects.                                                                                                                                                                               |               |              |  |                        |              |         |
| 6  | 6.1  | The cell cycle                                                                | Understand the phases and molecular control of the cell cycle.                                                                                                                                                      | K             | Face to face |  | Synchronous Lecturing  | Written exam | 26.B    |
|    | 6.2  | Cell proliferation and differentiation                                        | Recognize the signals that determine cell proliferation and differentiation                                                                                                                                         | K             | Face to face |  | Synchronous Lecturing  | Written exam | 26.A, B |
|    | 6.3  | Cell death                                                                    | Understand the molecular regulation of cell death.                                                                                                                                                                  | K             | Blended      |  | Asynchronous Lecturing | Written exam |         |
| 7  | 7.1  | Nucleic acid structure                                                        | Recognize the basic features of DNA/RNA structures.                                                                                                                                                                 | K             | Face to face |  | Synchronous Lecturing  | Written exam | 26.A    |
|    | 7.2  | DNA denaturation/renaturation                                                 | Comprehend the concept of DNA denaturation/renaturation and the determining factors                                                                                                                                 | K, S, C       | Face to face |  | Synchronous Lecturing  | Written exam | 26.B    |
|    | 7.3  | Gel electrophoresis                                                           | Understand the concept and uses of gel electrophoresis                                                                                                                                                              | K, S          | Blended      |  | Asynchronous Lecturing | Written exam |         |
| 8  |      |                                                                               |                                                                                                                                                                                                                     |               |              |  |                        |              |         |
| 9  | 9.1  | Blotting techniques                                                           | Understand the concept of blotting techniques                                                                                                                                                                       | K, S          | Face to face |  | Synchronous Lecturing  | Written exam | 26.A    |
|    | 9.2  | Restriction endonucleases                                                     | Understand the basic function of restriction endonucleases<br><br>Apply the concept of electrophoresis and blotting techniques to the use of restriction endonucleases and restriction fragment length polymorphism | K<br><br>S, K | Face to face |  | Synchronous Lecturing  | Written exam | 26.A    |
|    | 9.3  | Recombinant DNA technology                                                    | Understand the application of restriction endonucleases in recombinant DNA technology                                                                                                                               | K, S, C       | Blended      |  | Asynchronous Lecturing | Written exam |         |
| 10 | 10.1 | Introduction to the molecular dogma of molecular biology and DNA replication; | Discuss the molecular dogma of molecular biology<br><br>Learn the main steps and reactions involved in DNA replication                                                                                              | K<br><br>K    | Face to face |  | Synchronous Lecturing  | Written exam | 26.A    |
|    | 10.2 | PCR and quantitative real-time PCR                                            | Learn about the concepts and applications of polymerase chain reaction and quantitative real-time PCR<br><br>Apply the concepts of electrophoresis to PCR                                                           | K, S<br><br>C | Face to face |  | Synchronous Lecturing  | Written exam | 26.B    |



|    |      |                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                         |               |              |  |                        |              |      |
|----|------|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|--|------------------------|--------------|------|
|    | 10.3 | DNA sequencing                                                      | Know the composition of the human genome and the concepts and applications of DNA sequencing                                                                                                                                                                                                                                                                                                            | K             | Blended      |  | Asynchronous Lecturing | Written exam |      |
| 11 | 11.1 | The human genome                                                    | Recognize the composition of the human genome<br><br>Apply the concepts of electrophoresis, blotting, and PCR to the variation of the human genome                                                                                                                                                                                                                                                      | K<br><br>S, C | Face to face |  | Synchronous Lecturing  | Written exam | 26.A |
|    | 11.2 | Transcription (1)                                                   | Learn the main steps and reactions involved in RNA transcription.                                                                                                                                                                                                                                                                                                                                       | K             | Face to face |  | Synchronous Lecturing  | Written exam | 26.B |
|    | 11.3 | Transcription (2)                                                   |                                                                                                                                                                                                                                                                                                                                                                                                         | K             | Blended      |  | Asynchronous Lecturing | Written exam |      |
| 12 | 12.1 | Regulation of transcription in prokaryotes                          | Understand the mechanisms of regulating gene expression at the transcriptional level in prokaryotes                                                                                                                                                                                                                                                                                                     | K             | Face to face |  | Synchronous Lecturing  | Written exam | 26.A |
|    | 12.2 | Regulation of transcription in eukaryotes and epigenetics           | Understand the mechanisms of regulating gene expression at the transcriptional level in eukaryotes                                                                                                                                                                                                                                                                                                      | K             | Face to face |  | Synchronous Lecturing  | Written exam | 26.A |
|    | 12.3 | Analysis of gene expression                                         | Know the different tools for measuring gene expression at the RNA level starting with single genes (northern blotting and in situ hybridization) to high-throughput technologies (real-time transcriptase quantitative real-time PCR, DNA microarrays), and luciferase reporter assay<br><br>Apply the concepts of denaturation/renaturation, electrophoresis, and blotting to the different techniques | K, S, C       | Face to face |  | Synchronous Lecturing  | Written exam | 26.A |
| 13 | 13.1 | Translation                                                         | Learn the main steps and reactions involved in protein translation.                                                                                                                                                                                                                                                                                                                                     | K             | Blended      |  | Asynchronous Lecturing | Written exam |      |
|    | 13.2 | Regulation of translation                                           | Understand the mechanisms of regulating gene expression at the translational level in prokaryotes and eukaryotes                                                                                                                                                                                                                                                                                        | K             | Face to face |  | Synchronous Lecturing  | Written exam | 26.A |
|    | 13.3 | DNA libraries, protein-protein interaction, yeast two-hybrid system | Understand the concept and uses of the techniques used in determining protein-protein interactions                                                                                                                                                                                                                                                                                                      | K, S, C       | Blended      |  | Asynchronous Lecturing | Written exam |      |





|                                           |      |                                             |                                                                                                                                                 |         |              |  |                        |              |      |
|-------------------------------------------|------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------|--|------------------------|--------------|------|
| 14                                        | 14.1 | Recombinant gene and protein expression     | Learn of different techniques used in studying gene expression and gene manipulation<br>Apply the processes of transcription and its regulation | K, S, C | Face to face |  | Synchronous Lecturing  | Written exam | 26.B |
|                                           | 14.2 | DNA mutations                               | Recognize the type of DNA mutations                                                                                                             | K       | Face to face |  | Synchronous Lecturing  | Written exam | 26.B |
|                                           | 14.3 | DNA repair and CRISPR-Cas9 and gene editing | Know and differentiate the mechanisms of DNA repair                                                                                             | K, S, C | Blended      |  | Asynchronous Lecturing | Written exam |      |
| 15                                        | 15.1 | Revision                                    |                                                                                                                                                 |         | Face to face |  | Synchronous Lecturing  | Written exam |      |
|                                           | 15.2 |                                             |                                                                                                                                                 |         | Face to face |  | Synchronous Lecturing  | Written exam |      |
|                                           | 15.3 |                                             |                                                                                                                                                 |         |              |  |                        |              |      |
| ** K: Knowledge, S: Skills, C: Competency |      |                                             |                                                                                                                                                 |         |              |  |                        |              |      |

## 24. Evaluation Methods:

Opportunities to demonstrate achievement of the SLOs are provided through the following assessment methods and requirements:

| Evaluation Activity                       | Mark | Topic(s)           | SLOs | Descriptors** | Period (Week)                           | Platform         |
|-------------------------------------------|------|--------------------|------|---------------|-----------------------------------------|------------------|
| Midterm exam                              | 50   | Cell biology       | 1-6  | K             | 8 <sup>th</sup> week                    | Paper-based exam |
| Online activities                         | 5    | All blended topics |      | K<br>S        | 1 <sup>st</sup> -14 <sup>th</sup> week  | Moodle           |
| Final exam                                | 50   | Molecular biology  | 7-14 | K<br>S<br>C   | 15 <sup>th</sup> -16 <sup>th</sup> week | Paper-based exam |
| ** K: Knowledge, S: Skills, C: Competency |      |                    |      |               |                                         |                  |

## 25. Course Requirements

- ✓ Classroom Lectures
- ✓ Internet connection



## 26. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

- ✓ **Classroom Lectures**
- ✓ **Interactive Videos and Animations**
- ✓ **Discussion sessions and forums**

## 27. Course Policies:

### A- Attendance policies:

Attendance will be monitored by the course coordinator. Attendance policies will be announced at the beginning of the course.

### B- Absences from exams and handing in assignments on time:

Will be managed according to the University of Jordan regulations. Refer to <http://registration.ju.edu.jo/Documents/daleel.pdf>

### C- Health and safety procedures:

Faculty Members and students must at all times, conform to Health and Safety rules and procedures.

### D- Honesty policy regarding cheating, plagiarism, misbehavior:

As a student in this course (and at this university) you are expected to maintain high degrees of professionalism, commitment to active learning and participation in this course and also integrity in your behavior in and out of the classroom. Students violate this policy would be subjected to disciplinary action according to University of Jordan disciplinary policies

### E- Grading policy:

Grade-point average, Rules are preset by the Faculty and Department Councils

### F- Available university services that support achievement in the course:

Availability of comfortable lecture halls, data show, internet service and E learning website <https://elearning.ju.edu.jo/> .

## 28. References:

### A- Required book (s), assigned reading and audio-visuals:

The Cell: A Molecular Approach, Geoffrey M. Cooper and Kenneth W. Adams, 9th edition, Sinauer Associates, 2023.

### B- Recommended books, materials, and media:

Mark's Basic Medical Biochemistry, Smith, Marks and Lieberman, Lippincott, Williams and Wilkins, 6th ed., 2023.



**28. Additional information:**

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Name of Course Coordinator: ----- Date:----- Signature: -----

Head of Department: ----- Signature: -----

Head of Curriculum Committee/Faculty: ----- Signature: -----

Dean:----- Signature: -----