Philadelphia University	PHILADELPHIA UNIVERSITY THE WAY TO THE FUTURE	**Approval date:**
Faculty of Science		**Issue:**
Department of biotechnology and Genetic Engineering		**Credit hours (3)**
Academic year (2022/2023)	**Course Syllabus**	**Bachelor**

Course information

Course#	Course title		Prerequisite
0240487	Molecular Diagnostics		0240386
Course type		Class time	Room #
☐ University Requirement ☐ Faculty Requirement ☒ Major Requirement ☒ Elective ☐ Compulsory		M&W 9:45-11:00	2-1001

Instructor Information

Name	Office No.	Phone No.	Office Hours	E-mail
Dr. Sameer Masoud	2-1013	2214	S & Tu (12:30-1:30) M & W (11:00-12:00)	smasoud@philadelphia.edu.jo

Course Delivery Method

Course Delivery Method			
☒ Physical	☐ Online	☐ Blended	
Learning Model			
Precentage	Synchronous	Asynchronous	Physical
			100%

Course Description

This course will cover the principles of Molecular Diagnosis which is the process of identifying a condition by studying molecules, such as proteins, DNA, and RNA, in a sample. Molecular diagnostics is a new discipline that captures genomic and proteomic expression patterns and uses the information to distinguish between two or more conditions at the molecular level. The conditions under investigation can be human genetic disease or infectious diseases. Emphasis in this is on molecular of human diseases but few examples will be given for diagnosis in animals or plants.

Course Learning Outcomes

Number	Outcomes	Corresponding Program outcomes
Knowledge		
K1	Understand principle of the molecular techniques used in diagnosis.	**Kp3**
K2	Know the alternative methods of diagnosis	**Kp3**
Skills		
S1	Investigate diagnosis of abnormal inherited or acquired genetic diseases	**Sp2**
Competencies		
C1	Recognize the use of molecular diagnosis to study and monitor diseases	**Cp1**

Learning Resources

Course textbook	Molecular Diagnostics; Fundamentals, Methods, and Clinical Applications (THIRD EDITION, 2019) Lela Buckingham, F. A. Davis Company
Supporting References	
Supporting websites	
Teaching Environment	☒**Classroom** ☐ **laboratory** ☐**Learning platform** ☐**Other**

Meetings and subjects' timetables

Week	Topic	Learning Methods	Tasks	Learning Material
1	Introduction to Molecular Diagnostics	Lectures & collaborative learning		**PPT**
Common Techniques in Molecular Biology (Starting page 77)				
2	**Ch 3: Nucleic Acid Extraction Methods** ➢ ISOLATION OF DNA ➢ ISOLATION OF RNA ➢ MEASUREMENT OF NUCLEIC ACID QUALITY AND QUANTITY	Lectures & collaborative learning		**Pages 78-96**
3	**Ch. 4 Resolution and Detection of Nucleic Acids** ➢ ELECTROPHORESIS OF NUCLEIC ACIDS ➢ CAPILLARY ELECTROPHORESIS ➢ BUFFER SYSTEMS ➢ ELECTROPHORESIS EQUIPMENT ➢ DETECTION SYSTEMS	Lectures & collaborative learning		**Pages 97-111**
4 & 5	**Ch. 5 Analysis and Characterization of Nucleic Acids and Proteins** ➢ RESTRICTION ENZYME MAPPING OF DNA ➢ CRISPR ENZYME SYSTEMS ➢ HYBRIDIZATION TECHNOLOGIES ➢ PROBE HYBRIDIZATION ➢ PROBES ➢ HYBRIDIZATION CONDITIONS, STRINGENCY	Lectures & collaborative learning		**Pages 112-141**

	➢ DETECTION SYSTEMS ➢ INTERPRETATION OF RESULTS ➢ ARRAY-BASED HYBRIDIZATION ➢ SOLUTION HYBRIDIZATION			
6 & 7	**Ch. 6 Nucleic Acid Amplification** ➢ TARGET AMPLIFICATION ➢ PROBE AMPLIFICATION ➢ SIGNAL AMPLIFICATION	Lectures & collaborative learning		**Pages 142-178**
8	**Ch 7 Chromosomal Structure and Chromosomal Mutations** ➢ CHROMOSOMAL STRUCTURE AND ANALYSIS ➢ DETECTION OF GENOME AND CHROMOSOMAL MUTATIONS ➢ COMPARATIVE GENOME HYBRIDIZATION (CGH)	Lectures & collaborative learning		**Pages 179-198**
9	**Ch 8 Gene Mutations** ➢ TYPES OF GENE MUTATIONS ➢ DETECTION OF GENE MUTATIONS ➢ GENE VARIANT NOMENCLATURE ➢ GENE NAMES	Lectures & collaborative learning		**Pages 199-222**
10	**Ch 9 DNA Sequencing** ➢ DIRECT SEQUENCING ➢ PYROSEQUENCING ➢ BISULFITE DNA SEQUENCING ➢ RNA SEQUENCING ➢ NEXT-GENERATION SEQUENCING ➢ BIOINFORMATICS ➢ THE HUMAN GENOME PROJECT	Lectures & collaborative learning		**Pages 223-258**
Techniques in the Clinical Laboratory (Starting page 259)				
11	**Ch 10 DNA Polymorphisms and Human Identification** ➢ TYPES OF POLYMORPHISMS ➢ RFLP TYPING ➢ STR TYPING BY PCR ➢ LINKAGE ANALYSIS ➢ BONE MARROW ENGRAFTMENT TESTING USING DNA ➢ POLYMORPHISMS ➢ QUALITY ASSURANCE FOR SURGICAL SECTIONS ➢ USING STR ➢ SINGLE-NUCLEOTIDE POLYMORPHISMS ➢ MITOCHONDRIAL DNA POLYMORPHISMS ➢ OTHER IDENTIFICATION METHODS	Lectures & collaborative learning		**Pages 260-300**
12	**Ch 11 Detection and Identification of Microorganisms** ➢ SPECIMEN COLLECTION ➢ SAMPLE PREPARATION ➢ QUALITY ASSURANCE ➢ MOLECULAR DETECTION OF MICROORGANISMS ➢ ANTIMICROBIAL AGENTS ➢ MOLECULAR EPIDEMIOLOGY	Lectures & collaborative learning		**Pages 301-343**
13	**Ch 12 Molecular Detection of Inherited Diseases** ➢ THE MOLECULAR BASIS OF INHERITED DISEASES ➢ CHROMOSOMAL ABNORMALITIES ➢ PATTERNS OF INHERITANCE IN SINGLE-GENE DISORDERS ➢ MOLECULAR BASIS OF SINGLE-GENE DISORDERS ➢ SINGLE-GENE DISORDERS WITH NONCLASSICAL PATTERNS OF INHERITANCE ➢ LIMITATIONS OF MOLECULAR TESTING	Lectures & collaborative learning		**Pages 344-368**
14	**Ch 13 Molecular Oncology** ➢ CLASSIFICATION OF NEOPLASMS ➢ MOLECULAR BASIS OF CANCER ➢ ANALYTICAL TARGETS OF MOLECULAR TESTING ➢ GENE AND CHROMOSOMAL MUTATIONS IN SOLID TUMOR	Lectures & collaborative learning		**Pages 369-416**

	➢ MOLECULAR ANALYSIS OF LEUKEMIA AND LYMPHOMA			
15	**Ch 14 DNA-Based Tissue Typing** ➢ THE MHC LOCUS ➢ HLA POLYMORPHISMS 420 ➢ MOLECULAR ANALYSIS OF THE MHC ➢ ADDITIONAL RECOGNITION FACTORS ➢ MHC DISEASE ASSOCIATION ➢ SUMMARY OF LABORATORY TESTING **AND** **Ch 15 Quality Assurance and Quality Control in the Molecular Laboratory** ➢ SPECIMEN HANDLING ➢ TEST PERFORMANCE ➢ QUALITY CONTROL ➢ QUALITY ASSURANCE ➢ INSTRUMENT MAINTENANCE ➢ PROFICIENCY TESTING ➢ DOCUMENTATION OF TEST RESULTS ➢ REPORTING RESULTS	Lectures & collaborative learning		**Pages 417-445** **Pages 446-470**
16	**Final Exam**			

* includes: Lecture, flipped Class, project- based learning, problem solving based learning,

Assessment Methods and Grade Distribution

Assessment Methods	Grade Weight	Assessment Time (Week No.)	Link to Course Outcomes
Mid Term Exam	**% 30**	**Week 7**	
Various Assessments *	**%١٠**	**Term Paper**	
	% 20	**Four Quizzes**	
Final Exam	**% 40**	**Week 16**	
Total	**%100**		

* includes: quiz, in class and out of class assignment, presentations , reports, videotaped assignment, group or individual projects.

Alignment of Course Outcomes with Learning and Assessment Methods

Number	Learning Outcomes	Learning Method*	Assessment Method**
Knowledge			
K1	Understand principle of the molecular techniques used in diagnosis.		
K2	Know the alternative methods of diagnosis		
Skills			
S1	Investigate diagnosis of abnormal inherited or acquired genetic diseases		
Competencies			
C1	Recognize the use of molecular diagnosis to study and monitor diseases		

* includes: Lecture, flipped Class, project- based learning , problem solving based learning, collaborative learning

** includes: quiz, in class and out of class assignment , presentations , reports, videotaped assignment, group or individual projects.

Course Polices

Policy	Policy Requirements
Passing Grade	The minimum passing grade for the course is (50%) and the minimum final mark recorded on transcript is (35%).
Missing Exams	• Missing an exam without a valid excuse will result in a zero grade to be assigned to the exam or assessment. • A Student who misses an exam or scheduled assessment, for a legitimate reason, must submit an official written excuse within a week from the an exam or assessment due date. • A student who has an excuse for missing a final exam should submit the excuse to the dean within three days of the missed exam date.
Attendance	The student is not allowed to be absent more than (15%) of the total hours prescribed for the course, which equates to six lectures days (M, W) and seven lectures (S,T,R). If the student misses more than (15%) of the total hours prescribed for the course without a satisfactory excuse accepted by the dean of the faculty, s/he will be prohibited from taking the final exam and the grade in that course is considered (zero), but if the absence is due to illness or a compulsive excuse accepted by the dean of the college, then withdrawal grade will be recorded.
Academic Honesty	Philadelphia University pays special attention to the issue of academic integrity, and the penalties stipulated in the university's instructions are applied to those who are proven to have committed an act that violates academic integrity, such as: cheating, plagiarism (academic theft), collusion, and violating intellectual property rights.