The University of Jordan

Accreditation & Quality Assurance Center

COURSE Syllabus

1	**Course title**	Molecular Biology
2	**Course number**	0334382
3	**Credit hours (theory, practical)**	3 (2+1)
	Contact hours (theory, practical)	2+3
4	**Prerequisites/corequisites**	General Microbiology course
5	**Program title**	Biological Sciences (BSc) and Medical Analysis Programs (BSc)
6	**Program code**	4
7	**Awarding institution**	The University of Jordan
8	**Faculty**	Faculty of Science
9	**Department**	Department of Biological Sciences
10	**Level of course**	Junior level
11	**Year of study and semester (s)**	Second Semester (2015/2016)
12	**Final Qualification**	Biological Sciences (BSc) and Medical Analysis (BSc) Programs
13	**Other department (s) involved in teaching the course**	_____
14	**Language of Instruction**	English
15	**Date of production/revision**	February 2016

16. Course Coordinator:

Prof. Salwa Bdour
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Office hours: Monday and Wednesday (12-1)

17. Course Description:

This course begins by considering the molecular nature of genes and organization of the prokayotic and eukaryotic chromosomes. This is followed by DNA replication, repair, gene expression and regulation of gene expression in prokaryotes and eukaryotes. Recombinant DNA technology, genomics, bioinformatics and analysis of gene structure and expression are covered in brief. The laboratory covers the following topics in the recombinant DNA technology: isolation of nucleic acids; quantitation and qualification of nucleic acids; DNA amplification by polymerase chain reaction; Southern blot; plasmid isolation, plasmid restriction mapping; gene expression and gene knock out; DNA-cloning, protein purification and bioinformatics.

18. Course aims and outcomes:

A-Aims

This course aims at introducing the student to the basic concepts in molecular Biology including the molecular nature of genes, organization of the chromosome, DNA replication, repair, gene expression and regulation of gene expression, recombinant DNA technology, genomics and bioinformatics.

B- Intended Learning Outcomes (ILOs):
Upon successful completion of this course students will be able to:

B1. deduce the structure of DNA and the mechanism of its replication.
B2. correlate the DNA and RNA structure to their function
B3. correlate the protein-DNA interaction to DNA replication and gene expression.
B4. predict the consequences of various types of mutations on gene expression and organism's viability.
B5. make use of RNAi and miRNA molecules.
B6. isolate, quantitate and qualify the genomic and plasmid DNA
B7. transform bacterial cells
B8. construct recombinant DNA molecules for production of useful product and curative purposes.
B9. express a gene, detect and purify the protein encoded by the gene.
B10. mutate a gene (Knock out and knock in)
B11. perform PCR for gene amplification, detection and diagnosis of some human genetic diseases.
B12. hybridize DNA sequences.
B13. use the GenBank, restriction mapper, expasy and blast tools.
B14. construct genomic library and cDNA library.

19. Topic Outline and Schedule:

Topic	Achieved ILOs	Evaluation Method	Reference No.	Chapter No.	Pages
1. The nature of genetic material The chemical nature of polynucleotides The DNA structure (double helix and A,B, Z-forms DNAs of various sizes and shapes RNA as genes. RNA secondary and tertiary structures Physical chemistry of nucleic acids Organell DNA	**B1**	**21-1** **21-2**	**1** **2** **2** **2**	**2** **2** **4** **10**	**20-35** **40-41** **101-108** **438-443**
2. Chromatin structure Histones Nucleosomes Condensation of chromatin Euchromatin and heterochromatin	**B1**	**21-1**	**1**	**13**	**385-395**
3. Molecular structure of genes Bacterial operons and the production of polycistronic mRNAs Eukaryotic genes and the production of monocistronic mRNAs Simple and complex transcription units in eukaryotic genome Alternative splicing and skipping RNA processing of the complex transcription units.	**B1**	**21-1**	**2**	**4** **10**	**111-115** **405-408**
4. The complexity of the eukaryotic genome Protein-coding genes solitary genes, duplicated and gene families. Repitious DNA: simple and highly repeated DNA sequences:	**B1**	**21-1**	**2**	**10**	**408-424**

satellite, minisatellite, microsatellite. Moderately repeated DNA sequences: transposons, viral and nonviral retrotransposons (LINES and SINES). mechanisms of transpositions. processed pseudogenes Unclassified spacer DNA.						
5. Enzymology of DNA replication DNA polymerases Helicase DNA ligase Primase Telomerases Topoisomerase	**B1** **B2** **B3**		**1** **2**	**20** **4**	**677-691** **106-107**	
6. DNA replication machinery General features of DNA replication Replication in prokaryotes Replication in eukaryotes	**B1** **B2** **B3**		**1**	**21**	**713-717** **721-747**	
7. DNA damage and repair Nucleotide excision repair. Base excision repair. Mismatch repair. Double strand breakage repair.	**B1** **B2** **B3**		**1**	**20**	**692-702**	
8. Transcription RNA polymerase structure in prokaryotes and eukaryotes. Transcription initiation by RNA polymerase I, II, III and organell-specific RNA polymerases. Regulatory sequences in prokaryotes and eukaryotes Activators, repressors and general transcription factors Molecular mechanisms of transcription activation and repressio Modulation of chromatin structure Gene expression silencing Histone deacetylation and hyperacetylation Mediators Activators and co-activators control assembly of the preinitiation complex. Stages of transcription in prokaryotes and eukaryotes: Initiation, Elongation and Termination Techniques: Linker scanning mutations Run-on-transcription assay gel-shift DNase footprinting Hormone-dependent gene expression	**B2** **B3** **B4**		**2**	**4** **4** **11** **11**	**108-114** **115-118** **447-463** **468-491**	
9. Nuclear mechanisms of post-transcriptional control Pre-mRNA processing: Splicing Capping Cleavage/Polyadenylation Pre-rRNA processing: Splicing Cleavage Exonucleolytic digestion Base modification Pre-tRNA processing:	**B2** **B3** **B4**	**21-1**	**2**	**12**	**493-504** **525-531**	

Splicing Cleavage Base modification						
10. Export of mRNPs from the Nucleus	**B3**	**21-1**	**2**	**12**	**514-517**	
11. Cytoplasmic mechanisms of post-transcriptional control Mechanisms of mRNA degradation in the Cytoplasm Surveillance mechanisms prevent translation of improperly processed mRNAs Localization of mRNAs permits production of proteins at specific regions within the cytoplasm Micro RNAs (miRNAs) RNA interference (RNAi)	**B3** **B4** **B5**	**21-1**	**2**	**9** **12**	**393** **518-524**	
12. Translation The genetic code The structure of: t-RNA Prokaryotic and eukaryotic ribosomes Aminoacylation of tRNA Stages of translation in prokaryotes and eukaryotes (initiation, elongation and termination) Post-translational modifications.	**B2** **B3**	**21-1** **21-2**	**2**	**4**	**119-131**	
13. Genomics and Bioinformatics Analysis of gene structure and expression Sequence homology Query sequence Gene/protein identification Evolutionary relationships among proteins Evaluation of expression of many genes at one time and coregulated genes.	**B6-B14**	**21-1** **21-3**	**2**	**9**	**380-387**	
14. Recombinant DNA technology. DNA extraction, restriction endonucleases, restriction map, PCR, Southern blot, DNA sequencing, vectors, cloning of genes, gene-knock out, microarray, genomic library and cDNA library.	**B6-B14**	**21-1** **21-3**	**2**	**9**	**361-393**	

20. Teaching Methods and Assignments:

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

Lectures, Discussions, Homework and Assignments.

21. Evaluation Methods and Course Requirements:

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

1. Exams
2. Assignments.
3. Quizzes in lab.

22. Course Policies:

A- Attendance policies:

According to the university regulations.

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

According to the university regulations.

C- Health and safety procedures:

See the laboratory instructions.

D- Honesty policy regarding cheating, plagiarism, misbehavior:

According to the university regulations.

E- Grading policy:

Evaluation	Point %	Date
Assignments	10%	Wednesday 2/ 3/ 2016
Midterm Exam	30%	Monday 4/ 4/ 2016
Lab. Reports, Homework and Quizzes	10%	Will be announced in due time.
Lab. Final exam	15%	Will be announced in due time.
Final Exam	35%	Will be announced in due time.

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

1. Molecular Biology Lab.

2. The University Computer Lab.

3. The University Main Library.

4. The University e-library.

23. Required equipment:

1. Data show.

2. Laboratory instruments.

24. References:

1. Molecular Biology, by R.F.Weaver, third edition, 2005, McGraw Hill Publisher.
2. Molecular Cell Biology, by H. Lodish, A. Berk, S.L. Zipursky, P. Matsudaira, D. Baltimore, J. Darnell, fifth edition, 2005, W. H. Freeman and Company.

25. Additional information:

A. Intended Grading Scale

0-39	**F**
40-49	**D$^-$**
50-54	**D**
55-59	**D+**
60-64	**C$^-$**
65-69	**C**
70-73	**C+**
74-76	**B$^-$**
77-80	**B**
81-84	**B+**
85-89	**A$^-$**
90-100	**A**

B• Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming, then the issue should be brought to the attention of the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For final complaints, there will be a committee to review grading the final exam.

C• For more details on University regulations please visit:
http://www.ju.edu.jo/rules/index.htm

Name of Course Coordinator: -Prof. Salwa Bdour-----Signature: ---------- Date: --12/6/2016----

Head of curriculum committee/Department: ---------- Signature: ----------

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

Head of curriculum committee/Faculty: ---------- Signature: ----------

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

Copy to:
Head of Department
Assistant Dean for Quality Assurance
Course File