



Course Specification of Genetic and Genetic Engineering

I. Course Identification and General Information:						
1	Course Title:	Genetic and Genetic Engineering				
2	Course Number & Code:	AP222				
3	Credit hours:	C.H				Total
		Theoretical	Practical	Training	Seminar	
		2	1	0	0	3
4	Study level/ semester at which this course is offered:	Second Year - Frist Semester				
5	Pre –requisite (if any):	FR112				
6	Co –requisite (if any):	None				
7	Program (s) in which the course is offered:	Bachelor of Veterinary Medicine				
8	Language of teaching the course:	English Language				
9	Location of teaching the course:	Faculty of Veterinary Medicine Building				
10	Prepared by:	Dr. Abdu-Alraoof Al-Shawkany				
11	Date of approval:					

II. Course description:

This course provides a basic knowledge of Genetic material functions, Central Dogma of Molecular Biology, Transformation Experiment, Chemical and Physical Structure of DNA and RNA, Transcription in eukaryote and Splicing mRNA , Eukaryotic gene organization, gene organization and Transcription in prokaryote, DNA Analysis and Quantitation, Recombinant DNA technology (rDNA), Real time PCR, DNA Sequencing and Molecular Markers.

Practical experiences in different extraction DNA and RNA methods, PCR Reaction components, steps technique and primer design used in diagnosis of disease will also be obtained.

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III. Intended learning outcomes (ILOs) of the course:

(A) Knowledge and Understanding:

Alignment of Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: **Knowledge and Understanding.**

Program Intended Learning Outcomes (Sub-PILOs) in: Knowledge and Understanding		Course Intended Learning Outcomes (CILOs) in: Knowledge and Understanding	
After completing this program, students will be able to:		After completing this course, students will be able to:	
A1-	Demonstrate a sound knowledge and understanding of concepts and principles of general culture, basic science, and that support veterinary medicine.	a1-	Determines the Genetic material functions, Central Dogma of Molecular Biology, Splicing mRNA, Eukaryotic and prokaryote gene organization Construct differences between DNA and RNA Structure.
A4-	Describes the foundations and procedural steps for treating all diseases that affect different animals, highlighting the medical conditions that need surgical interventions.	a2-	Give an account of DNA Sequencing methods and Molecular diagnostics.

Teaching And Assessment Methods For Achieving Learning Outcomes:

Alignment of Learning Outcomes of Knowledge and Understanding to Teaching and Assessment Methods:

Course Intended Learning Outcomes (CILOs) in Knowledge and Understanding		Teaching strategies/methods to be used	Methods of assessment
completing this course, students will be able to:			
a1-	Determines the Genetic material functions, Central Dogma of Molecular Biology, Splicing mRNA, Eukaryotic and prokaryote gene organization Construct differences between DNA and RNA Structure.	-Lectures using board, data shows and multimedia aids. - brainstorm. - Video film and discussion. -Self-learning by preparing essay and presentations (computer and faculty library) -Practical training	-Written exam -Practical exam -Oral exam - Quizzes - Report assignments - Discussion
a2-	Give an account of DNA Sequencing methods and Molecular diagnostics.		

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(B) Intellectual Skills:

Alignment of Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: **Intellectual skills**

Program Intended Learning Outcomes (Sub-PILOs) in Intellectual skills		Course Intended Learning Outcomes (CILOs) of Intellectual Skills	
After completing this program, students will be able to:		After completing this course, students will be able to:	
B1-	Competently practices analytical and critical thinking skills in studying and assessing health problems and reading the results of animal medical examinations that is related to sciences.	b1-	Explains column method to extract DNA from blood
B2-	Predicts an appropriate medical diagnosis for the most common disease states through analysis of clinical story data and the results of medical examinations of a sick animal.	b2-	Recognize between PCR and Real Time PCR

Teaching And Assessment Methods For Achieving Learning Outcomes:

Alignment of Learning Outcomes of Intellectual Skills to Teaching Methods and Assessment Methods:

Course Intended Learning Outcomes (CILOs) in Intellectual Skills.		Teaching strategies/methods to be used	Methods of assessment
After completing this course, students will be able to:		-Lectures using board, data shows and multimedia aids. - brainstorm. - Video film and Discussion - Use extraction kit - Use PCR kit - Visit governorate LAB	-Written exam -Practical exam -Oral exam - Quizzes - Report assignments - Discussion
b1-	Explains column method to extract DNA from blood		
b2-	Recognize between PCR and Real Time PCR		

(C) Professional and Practical Skills:

Alignment of Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: **Professional and Practical Skills**

Program Intended Learning Outcomes (Sub-PILOs) in Professional and Practical Skills	Course Intended Learning Outcomes (CILOs) in Professional and Practical Skills
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After completing this program, students will be able to:		After completing this course, students will be able to:	
C2-	Practices practical, diagnostic, clinical and research skills, including the collection of samples in various fields of veterinary medicine and related sciences, in a safe and effective manner, considering the ethics of the profession.	c1-	Use electrophoresis system to run DNA and PCR in agrose gal
C3-	Reads the results of laboratory investigations and diagnostic scans and writes reports and prescriptions for all common cases in a proper way.	c2-	Compute Tm in the Lab and use in PCR program

Teaching And Assessment Methods For Achieving Learning Outcomes:

Alignment of Learning Outcomes of Professional and Practical Skills to Teaching and Assessment Methods:

Course Intended Learning Outcomes (CILOs) in Professional and Practical Skills		Teaching strategies/methods to be used	Methods of assessment
After completing this course, students will be able to:		- Lecture Discussion - Practical training - Video film and Discussion - Use extraction kit - Use PCR kit - Visit governorate LAB - Examples and Some Exercise	-Written exam -Practical exam -Oral exam - Quizzes - Report assignments - Discussion
c1-	Use electrophoresis system to run DNA and PCR in agrose gal		
c2-	Compute Tm in the Lab and use in PCR program		

(D) General / Transferable Skills:

Alignment of Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: General and Transferable skills

Program Intended Learning Outcomes (PILOs) in General / Transferable skills	Course Intended Learning Outcomes (CILOs) in General / Transferable skills
After completing this program, students will be able to:	After completing this course, students will be able to:

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D1-	Communicates effectively with other fellow professions and animal owners and expresses his ideas clearly and objectively.	d1-	Work in a team group and work under pressure and / or contradictory conditions.
D3-	Practicing problem-solving, negotiation, supervision and veterinary medical management skills as well as writing research reports efficiently and professionally.	d2-	Share PCR and electrophoresis methods to colleagues

Teaching And Assessment Methods For Achieving Learning Outcomes:

Alignment of Learning Outcomes of General and Transferable skills to Teaching and Assessment Methods:

Course Intended Learning Outcomes (CILOs) in General and Transferable Skills		Teaching strategies/methods to be used	Methods of assessment
After completing this course, students will be able to:		- Lecture Discussion - Video film and Discussion - Examples and Some Exercise - Scientific visits - Assignments	- Achievement file - Evaluating student presentations. - Practical exam - Report assignments - Discussion - Note performance
d1-	Work in a team group and work under pressure and / or contradictory conditions.		
d2-	Share PCR and electrophoresis methods to colleagues		

IV. Course Content:

1 – Course Topics/Items:

a – Theoretical Aspect

Order	Topic List / Units	CILOs (symbols)	Sub-topic List	Number of weeks	Contact hours
1	Introduction and some concepts in Genetic Engineering	a1, a2, b1,	Gene and Genetic Engineering, Genetic material has two major functions, Central Dogma of Molecular Biology, Transformation Experiment, Hershey-Chase	1	2

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			Bacteriophage Experiment,		
2	Central Dogma of Molecular Biology, Transformation Experiment and Nucleic Acids structure	a1, a2, b1, b2, c1, c2	double helix model of DNA structure in 1953, nucleotides, Nitrogenous bases, Purines, Pyrimidines, Sugar Ribose Deoxyribose, Phosphates, Chemical Structure of DNA and RNA, Physical Structure, DNA Replication in live cells, Transcription in eukaryote and Splicing mRNA , Eukaryotic gene organization, Transcription in prokaryote	2	4
3	DNA Isolation	a1, a2, b1, b2, c1, c2	Definition, Major Steps in DNA isolation, extraction DNA Methods, Salting-out method, Organic extraction method, Cesium chloride density gradients, Anion-exchange method, Silica-based method	1	2
4	chine polymerase reaction	a1, a2, b1, b2, c1, c2	Polymerase Chain Reaction, Reaction requirements, The Basics of PCR Cycling, PCR Applications, type of PCR	1	2
5	DNA Analysis & Quantitation	a1, a2, b1, b2, c1, c2	Spectrophotometry, New technology NanoDrop, Gel electrophoresis, Purity of Nucleic acids, Power supply & Buffers, Real-time PCR.	1	2
6	Recombinant DNA technology (rDNA) steps, hosts and vectors	a1, a2, b1, b2, c1, c2	Steps Recombinant DNA technology (rDNA), Tools for (rDNA) or Genetic engineering, Restriction	1	2

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			Enzymes, DNA Ligase, Vectors, Cloning Vectors, Expression vectors		
7	Recombinant DNA technology (rDNA) Transformation methods	a1, a2, b1, b2, c1, c2	Types of vector, Hosts, Transformation methods, Chemical method, Electroporation, Protoplast fusion, Microinjection, Gene gun.	1	2
8	Recombinant DNA technology (rDNA) Screening (Strategies)	a1, a2, b1, b2, c1, c2	Screening (Strategies), Selective marker, Blue/white screening, Polymerase Chain Reaction, Gel Electrophoresis, DNA sequencing, Explain all Recombinant DNA technology (rDNA) by video	1	2
9	Real time PCR	a1, a2, b1, b2, c1, c2	What do mRNA levels tell us, quantitative mRNA/DNA analysis, Real-time Principles, Baseline, Threshold, CT, Method of fluorescence detection, DNA-binding agents: (SYBR Green). Hydrolysis probes :(TaqMan, Beacon, Hybridization probes: (Light Cycler), Real-time PCR advantages, Housekeeping gene, Data analysis, Real-Time PCR Applications.	2	4
10	Reverse transcriptase	a1, a2, b1, b2, c1, c2	RNA extraction methods and kits, Reverse transcriptase	1	2

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			enzyme, one and two step RT- PCR,		
11	DNA sequencing	a1, a2, b1, b2, c1, c2	Sanger Sequencing, Sequencing Reaction, Electrophoresis, Shotgun Sequencing, Pyrosequencing , Sequence Assembly, Assembly Problems, Phred Quality Scores.	1	2
12	Molecular diagnostics	a1, a2, b1, b2, c1, c2	Cancer is Caused by Nonlethal Genetic Mutations, Molecular Detection of Disease, Molecular Abnormalities in Solid Tumors, HER2/neu, Molecular Abnormalities in Solid Tumors, EGFR, Molecular Abnormalities in Solid Tumors, K-ras, Molecular Abnormalities in Solid Tumors, TP53, Other Genes Associated with Solid Tumors. Quantification by qPCR (TaqMan®)	1	2
Number of Weeks /and Units Per Semester				14	28

b- Training Aspect:

Order	Training Tasks	CILOs (symbols)	Number of weeks	Contact hours
1	Extracted DNA using Silica-based methods (bioneer company kit) 1 reactions / groups/	c1,c2	2	4

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	4 students			
2	Extracted DNA using Salting-out methods (preparing chemical in the lab) 1 reactions / groups/ 4 students	c1,c2	1	2
3	Preparing TBE buffer 50ml / groups/ 4 students	c1,c2	1	2
4	Run of DNA isolated by agrose gel Electrophoresis and take photo of its. (visit Vet and Human central lab)	c1,c2	2	4
5	Analysis and discussion gel photo and it`s problems	c1,c2	1	2
6	Determine annealing temperature by used the Tm.	c1,c2	1	2
7	Preparing Polymerase chain reaction (PCR) 1 reactions / groups/ 4 students (bioneer kit) (visit Vet and Human central lab)	c1,c2	2	4
8	Run of DNA PCR product by agrose gel Electrophoresis (visit Vet and Human central lab)	c1,c2	2	4
9	Compute Tm in the Lab and use in PCR program	c1,c2	1	2
10	Real time PCR tools (visit Vet and Human central lab) and Video film and Discussion	c1,c2	1	2
Number of Weeks /and Units Per Semester			14	28

V. Teaching strategies of the course:

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- Lectures using board, data shows and multimedia aids.
- Self-learning by preparing essay and presentations (computer and faculty library)
- Brainstorm
- Discussion
- Practical training
- video
- visit Vet and Human central lab

3-Assessment Methods:

- Written exam
- Practical exam
- Oral exam
- Quizzes
- Report assignments
- Discussion

Grading Scale:

Grades are awarded on a scale from A to F, where A is the best grade(90-100) and F is a fail (<50).

VI. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes (CILOs symbols)
1	Participation quizzes and assignments	2-14	10	10%	a1,a2
2	Mid-Term Exam	8	10	10%	a1,a2,b1,c1
3	Mid-Term Practical Exam	8	10	10%	a1,a2,c1,c2,

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5	Final Practical Exam	15	10	10%	a1,a2,c1,c2,
6	Oral exam	16	5	5%	a1,a2,b1
7	Final Exam	16	55	55%	a1,a2,b1,c1
Total		100	100%		

VII. Students' Support:	
Office Hours/week	Other Procedures (if any)
Saturday-Wednesday from 8:00 a.m.-2 p.m.	Student can contact me via email

VIII. Learning Resource (MLA style or APA style)S:	
1- Required Textbook(s) (maximum two)	
	Nicholl, D. S. 2008. An Introduction to Genetic Engineering, 3 nd edition. Cambridge University Press
2- Recommended Readings and Reference Materials	
	Brown, T.A. 2010. Cloning and DNA analysis An introduction, 6 nd edition. Faculty of Life Sciences University of Manchester, Manchester.
3- Essential References	
4- Electronic Materials and Web Sites etc.	
	<ul style="list-style-type: none"> • http://www.web-books.com/MoBio/ • http://en.wikipedia.org/wiki/Website • www.science-direct.com • www.springerlink.com
5- Other Learning Material:	

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X. Course Policies:	
1	Class Attendance: MANDATORY TO ATTEND ALL COURSE LECTURES
2	Tardiness: Not allowed at all. Students must be in class or in the practical session 10 minutes prior to the beginning of lectures or practical session
3	Exam Attendance/Punctuality: Attendance is mandatory; absence is accepted with valid excuse
4	Assignments & Projects: All assignments and projects are to be submitted on their due date. Any assignment turned in after the due date will not be accepted without valid and reasonable excuse
5	Cheating: Not tolerated and may lead to EXPELLING the student from the program
6	Plagiarism: Not tolerated AT ALL and may lead to EXPELLING the student from the program
7	Other policies: <ol style="list-style-type: none"> 1. All devices must be on silent or at least on vibration during lectures/labs 2. Before any exam (written, oral) we must check student's identity (student's card, ID, passport). Without any of these documents, the student will not be allowed in the exam room. 3. Any of type/ form of cheating is not allowed no matter what. 4. Maintain silence during lectures/exam and disturbance is not allowed. For any questions students should raise their hand and wait for permission to talk.

[Course Plan of Genetic and Genetic Engineering](#)

X. - Information about Faculty Member Responsible for the Course:							
Name of Faculty Member	Dr. Abdu-Alraoof Al-Shawkany	Office Hours					
Location & Telephone No.	Yemen-Sana`a, Thamr university, 771135616	SAT	SUN	MON	TUE	WED	THU

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E-mail	abdualraufe@yahoo.com abdualraufe@gmail.com	8am 2pm	8am 2pm	8am 2pm	8am 2pm	8am 2pm	
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XI. Course Identification and General Information:

1-	Course Title:	Genetic and Genetic Engineering				
2-	Course Number & Code:	AP222				
3-	Credit hours:	C.H				Total
		Th.	Seminar	Pr.	F. Tr.	
		2	-	1	-	3
4-	Study level/year at which this course is offered:	Second Year - Frist Semester				
5-	Pre –requisite (if any):	FR112				
6-	Co –requisite (if any):	None				
7-	Program (s) in which the course is offered	Bachelor of Veterinary Medicine				
8-	Language of teaching the course:	English language				
9-	System of Study:	Regular / Semesters				
10-	Mode of delivery:	Lectures and Practical				
11-	Location of teaching the course:	Faculty of Veterinary Medicine Building				

II. Course Description:

This course provides a basic knowledge of Genetic material functions, Central Dogma of Molecular Biology, Transformation Experiment, Chemical and Physical Structure of DNA and RNA, Transcription in eukaryote and Splicing mRNA , Eukaryotic gene organization, gene organization and Transcription in prokaryote, DNA Analysis and Quantitation, Recombinant DNA technology (rDNA), Real time PCR, DNA Sequencing and Molecular Markers.

Practical experiences in different extraction DNA and RNA methods, PCR Reaction components, steps technique and primer design used in diagnosis of disease will also be obtained. assigned exercises.

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II. Intended learning outcomes (ILOs) of the course:

After completing this course, students will be able to:

- a1- Determines the Genetic material functions, Central Dogma of Molecular Biology, Splicing mRNA, Eukaryotic and prokaryote gene organization
Construct differences between DNA and RNA Structure.
- a2- Give an account of DNA Sequencing methods and Molecular diagnostics.
- b1- Explains column method to extract DNA from blood
- b2- Recognize between PCR and Real Time PCR
- c1- Using PCR System
- c1- Use electrophoresis system to run DNA and PCR in agarose gel
- c2- Compute Tm in the Lab and use in PCR program
- d1- Apply the PCR and electrophoresis tools
- d1- Work in a team group and work under pressure and / or contradictory conditions.
- d2- Share PCR and electrophoresis methods to colleagues

V. Course Content:

A – Theoretical Aspect:

Order	Topics List	Week Due	Contact Hours
1	Introduction and some concepts in Genetic Engineering	1	2
2	Central Dogma of Molecular Biology, Transformation Experiment and Nucleic Acids structure	2,3	4
3	DNA Isolation	4	2
4	chime polymerase reaction	5	2
5	DNA Analysis & Quantitation	6	2
6	Recombinant DNA technology (rDNA) steps, hosts	7	2

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	and vectors		
	Mid-Term Exam	8	2
8	Recombinant DNA technology (rDNA) Transformation methods	9	2
9	Recombinant DNA technology (rDNA) Screening (Strategies)	10	2
10	Real time PCR	11,12	4
11	Reverse transcriptase	13	2
12	DNA sequencing	14	2
13	Molecular diagnostics	15	2
14	Final Exam	16	2
Number of Weeks /and Units Per Semester		16	32

b- Training Aspect:			
Order	Training Tasks	Week Due	Contact hours
1	Extracted DNA using Silica-based methods (bioneer company kit) 1 reactions / groups/ 4 students	1,2	4
2	Extracted DNA using Salting-out methods (preparing chemical in the lab) 1 reactions / groups/ 4 students	3	2
3	Preparing TBE buffer 50ml / groups/ 4 students	4	2
4	Run of DNA isolated by agrose gel Electrophoresis and take photo of its. (visit Vet and Human central lab)	5,6	4
5	Analysis and discussion gel photo and it`s problems	7	2

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	Mid-Term Exam	8	2
6	Determine annealing temperature by used the Tm.	9	2
7	Preparing Polymerase chain reaction (PCR) 1 reactions / groups/ 4 students (bioneer kit) (visit Vet and Human central lab)	10,11	4
8	Run of DNA PCR product by agrose gel Electrophoresis (visit Vet and Human central lab)	12,13	4
9	Compute Tm in the Lab and use in PCR program	14	2
10	Real time PCR tools (visit Vet and Human central lab) and Video film and Discussion	15	2
11	Final Exam	16	2
Number of Weeks /and Units Per Semester		16	32

V. Teaching strategies of the course:

- Lectures using board, data shows and multimedia aids.
- Self-learning by preparing essay and presentations (computer and faculty library)
- Brainstorm
- Discussion
- Practical training
- video
- visit Vet and Human central lab

VI. Assessment Methods:

- Written exam
- Practical exam

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- Oral exam
- Quizzes
- Report assignments
- Discussion

Grading Scale:

Grades are awarded on a scale from A to F, where A is the best grade (90-100) and F is a fail (<50)

No.	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Participation quizzes and assignments	2-14	10	10%
2	Mid-Term Exam	8	10	10%
3	Mid-Term Practical Exam	8	10	10%
4	Final Practical Exam	15	10	10%
5	Oral exam	16	5	5%
6	Final Exam	16	55	55%
Total			100	100%

II. Learning Resources:

1- Required Textbook(s) (maximum two).

1. Nicholl, D. S. 2008. An Introduction to Genetic Engineering, 3rd edition. Cambridge University Press
2. Brown, T.A. 2010. Cloning and DNA analysis An introduction, 6nd edition. Faculty of Life Sciences University of Manchester, Manchester

2- Essential References.

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3- Electronic Materials and Web Sites etc.	
	<ul style="list-style-type: none"> • http://www.web-books.com/MoBio/ • http://en.wikipedia.org/wiki/Website • www.science-direct.com • www.springerlink.com

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