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 Langauge				
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.

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

(A) Knowledge and Understanding:

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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:		-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
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.		

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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		

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(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	
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:

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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:**	
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

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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 Bacteriophage Experiment,	1	2
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

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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 Enzymes, DNA Ligase, Vectors, Cloning Vectors, Expression vectors	1	2
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,	2	4

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			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.		
10	**Reverse transcriptase**	**a1, a2, b1, b2, c1, c2**	RNA exraction methods and kits, Reverse transcriptase enzyme, one and two step RT- PCR,	1	2
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	1	2

			Genes Associated with Solid Tumors. Quantification by qPCR (TaqMan®)		
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/ 4 students	c1,c2	2	4
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

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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:

- 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).

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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,
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, 3nd 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.

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3- Essential References	
4- Electronic Materials and Web Sites *etc*.	
	• http://www.web-books.com/MoBio/ • http://en.wikipedia.org/wiki/Website • www.science direct.com • www.springerlink.com
5- Other Learning Material:	

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:** 1. All devices must be on silent or at least on vibration during lectures/labs

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	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:

		Office Hours					
Name of Faculty Member	**Dr. Abdu-Alraoof Al-Shawkany**						
Location & Telephone No.	**Yemen-Sana`a, Thamr university, 771135616**	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	**abdualraufe@yahoo.com** **abdualraufe@gmail.com**	8am 2pm	8am 2pm	8am 2pm	8am 2pm	8am 2pm	

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				

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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.

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 PCRc1- Using PCR System
c1- Use electrophoresis system to run DNA and PCR in agrose gal
c2- Compute Tm in the Lab and use in PCR programd1- 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	**chine polymerase reaction**	5	2
5	**DNA Analysis & Quantitation**	6	2

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6	**Recombinant DNA technology (rDNA) steps, hosts and vectors**	7	2
	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

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5	Analysis and discussion gel photo and it`s problems	7	2
	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

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VI. 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**)**

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, 3nd edition. Cambridge University Press 2. Brown, T.A. 2010. Cloning and DNA analysis An introduction, 6 nd edition. Faculty of Life Sciences University of Manchester, Manchester
2- Essential References.	
3- Electronic Materials and Web Sites *etc*.	
	• http://www.web-books.com/MoBio/ • http://en.wikipedia.org/wiki/Website • www.science direct.com • www.springerlink.com

3. Course Policies:	
1	**Class Attendance:** **MANDATORY TO ATTEND ALL COURSE LECTURES**
2	**Tardy:** Not allowed at all. Students must be in class 10 minutes prior to the beginning of lectures
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:**

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	Not tolerated **AT ALL** and may lead to **EXPELLING** the student from the program
7	**Other policies:** 1. All devices must be on silent or at least on vibration during lectures/labs. 2. Before any exam (written, practical, oral) student's identity will be checked (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 and disturbance is not allowed.

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