Course Specification

(Postgraduate Programs)

Course Title:	**Bioactive Natural Compounds**
Course Code:	**BIO-6000**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيلي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2 + Lab 0)				
2. Course type				
A.	☐University	☐College	☐ Department	☒ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: (undetermined level)				
4. Course General Description:				

This course describes the use of biologically active natural substances or molecules, including its relevance to bioscience and biotechnology. Classification of bioactive molecules, their necessity and purpose, and interpretation of their pharmacological activity are included. The course encompasses topics such as the origin of naturally occurring products, and the expression of activity of natural pharmaceutical drugs, basic chemical biology, and basic medicinal chemistry. The course topics include general applications of bioactive natural products and phytochemicals used in pharmaceuticals to treat numerous disease conditions. These natural chemicals protect against cancer through antioxidant and pro-oxidant actions and combat cancer via apoptosis and necrosis as well as modulation of the immune system. In addition, the course content describes trending topics including the antibacterial and antifungal effects of plant metabolites from tropical medicinal plants, molecular mechanistic actions, and the role of natural bioactive compounds as anti-diabetic agents, marine sources of pharmacological effects such as anti-cardiovascular, anti-coagulant, anti-obesity, bone growth, and healing. The course topics also provide basic knowledge regarding the natural biomaterials employed in genetic engineering.

5. Pre-requirements for this course (if any)**:**

None

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

This course aims to offer students a thorough comprehension of various classifications of secondary metabolites, commonly known as natural compounds, produced by diverse plants, marine macro-organisms, and microbes. Additionally, the course explores the potential pharmaceutical applications of these natural compounds. Moreover, this

educational module offers students the opportunity to gain expertise in the methods of extraction, purification, and determination of structure, as well as performing bioassays to evaluate the biological characteristics of marine natural substances. The course objectives encompass the role of natural bioactive compounds in treating diabetes, cancer, cardiovascular diseases, and their activity as anticoagulants.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	• Traditional classroom	√	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify) ……**	-
	Total	**30**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Outline the common bioactive natural compounds	K1	-Lectures -Tutorials	-Assignments -Class participation -Data search -Written exams

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.2	Describe the general applications of bioactive natural compounds	K2	-Lectures -Tutorials	Assignments -Class participation -Data search -Written exams
1.3	Explain the major molecular mechanistic pathways of natural compounds	K3	-Lectures -Tutorials	Assignments -Class participation -Data search -Written exams
2.0	Skills			
2.1	Relate the chemistry of bioactive natural products to their applications	S1	-Lectures -Class discussions	-Class participation -Presentations -Data search -Written exams
2.2	Design and conduct research work on a bioactive natural compound in the area of cell and molecular biology by employing lab skills and convenient methods	S2	-Guided lab work	Presentations -Reports
2.3	Interpret and analyze the research results using critical	S3	-Group discussions	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
	thinking and the appropriate analytical methods			
3.0	Values, autonomy, and responsibility			
3.1	Share in the discussion of scientific issues and submit the research data professionally via oral presentations and written formats	V1	-Group discussion	- Presentations -Reports
3.2	Perform the assigned work independently and collaborate effectively in a teamwork	V2	-Demonstrations of teamwork	Presentations -Reports
3.3	Adhere to the ethical rules and research principles while conducting research work in molecular biology	V3	-Lectures -Tutorials	-Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**An Introduction to Bioactive Natural Products and General Applications:** -Bioactive Natural Compounds: Distribution and Geographical Sources -Phytochemistry of Bioactive Natural Compounds	4
2.	**Metabolites from Plant Sources:** Comparison of Secondary Metabolites with Primary Metabolites Alkaloids ; Saponins; Phenolic Compounds; Terpenes and Terpenoids; Carbohydrates;Lipids; Glycosides	4
3.	**General Applications of Bioactive Natural Products**: -Traditional Medicine -Plant Polysaccharides in Pharmaceutical Applications	4
4.	**The Role of Phytochemicals in Cancer Prevention and Cure:** -Role of Phytochemicals in Cancer Prevention via Antioxidant Activity -Role of Phytochemicals in Cancer Prevention Via Pro-Oxidant Activity -Role of Phytochemicals in Cancer Cure Via Apoptosis Induction -Role of Phytochemicals in Cancer Cure Via Necrosis Induction	4
5.	**Natural Compounds Extracted from Medicinal Plants and Their Immunomodulatory Activities:** Plant-Derived Bioactive Compounds as Immunomodulators: Curcumin and Colchicine	2
6.	**Antibacterial and Antifungal Plant Metabolites from Tropical Medicinal Plants:** Target for Antimicrobial Agents and Resistance Mechanisms Tropical Plants with Relevant Antibacterial Activities	2
7.	**Antimicrobial Application of Phytoconstituents from Turmeric and Garlic:** -Phytochemistry of Turmeric: Antimicrobial Applications of Phytoconstituents from Turmeric -Phytochemistry of Garlic: Antimicrobial Mechanism of Phytochemicals of Garlic	2
8.	**Therapeutic Properties and Molecular Mechanisms of Carvacrol (Origanum vulgare):** -Extraction and Isolation of Carvacrol: Biosynthesis of Carvacrol -Anticancer Effect of Carvacrol and the Related Mechanism of Actions -Role of Natural Bioactive Compounds as Antidiabetic Agents	2
9.	**Mechanisms of Action of Antidiabetic Bioactive Substances**	2

10.	**Biological Activities of Marine Products and Nutritional Importance:** Marine Sources for Pharmacological Effect Anti-cancer.; Anti-Cardiovascular Effect ;Anti-coagulant Activity ; Anti-obesity ;Bone Growth and Healing	2
12.	**Cardiac Tissue Engineering:** A Role for Natural Biomaterials	
13.	**Extraction of Bioactive Natural Compounds**	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20 %
2.	**Midterm exam-2**	10th week	20%
3.	**Assignments, Participation, Reports, data search, Attendance, presentations**	Throughout the course duration	20 %
4.	**Final Exam**	16th week	40 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Dilipkumar P, Nayak A K. (2021). Bioactive Natural Products for Pharmaceutical Applications. Advanced Structured Materials, Vol. 140. ISBN: 978-3-030-54027-2 (eBook) https://doi.org/10.1007/978-3-030-54027-2 -Sinha RP, Hader DP.(2020) Natural Bioactive Compounds, Technological Advancements. ISBN: 978-0-12-820655-3 https://www.sciencedirect.com/book/9780128206553/natural-bioactive-compounds
Supportive References	https://2u.pw/mqlCs8f
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector and Smartboard
Other equipment (Depending on the nature of the speciality)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Indirect
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Developmental Genetics**
Course Code:	**BIO-6010**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2+ Lab 0)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☐Required		☒ Elective	
3. Level/year at which this course is offered: (undetermined level)				

4. Course General Description:

This graduate course introduces the students to the basic concepts and general principles of developmental biology. The main features of the embryonic development of important animal models such as mice, frogs, and fruit flies are described to provide a basis for understanding the underlying control mechanisms. The course contents also illustrate genetic and experimental methods that are in use to investigate these mechanisms. Special attention is paid to explaining the regulation of the early steps of embryonic development. The course contents develop the student's critical thinking to be able to explain how mutations of developmental genes can result in malformations.

5. Pre-requirements for this course (if any)**:**

None

6. Co-requirements for this course (if any)**:**

None

7. Course Main Objective(s):

The main objective of this graduate course is to develop a fundamental theoretical understanding of the complex "Epigenetic Phenomena". The course also aims to introduce the state-of-the-art modern approaches in epigenetics and chromatin research.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		-
3	Hybrid • Traditional classroom • E-learning		-
4	Distance learning		-

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify) .....**	
	Total	30

B.Course Learning Outcomes, Teaching Strategies, Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Outline basic concepts, principles and methods in developmental biology**	K1	Two credits weekly lectures	-Quizzes -Written exams -Presentations -Assignments
1.2	**Describe the main features of embryonic development of the frequently used animal models**	K2	Two credits weekly lectures	-Quizzes -Written exams -Presentations -Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.3	**Explain genetic control of the skeletal pattern and the main causes of malformations**	K3	Two credits weekly lectures	-Quizzes -Written exams -Presentations -Assignments
2.0	**Skills**			
2.1	**Apply basic concepts and principles in developmental biology**	S1	-Two credits weekly lectures -Group discussions	-Quizzes -Written exams -Presentations -Assignments
2.2	Analyze and interpret simple data from experimental embryology and developmental genetics.	S2	-Two credits weekly lectures -Group discussions	-Quizzes -Written exams -Presentations -Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	**Communicate the scientific issues in developmental biology and present the research results orally or in a written format**	V1	-Group discussions	-Presentations
3.2	**Demonstrate independence in performing the research work and effective cooperation in teamwork**	V2	-Group discussions -Presentations	-Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Introduction to developmental genetics:** - A history of developmental biology and developmental genetics	3
2.	**Basics of Embryology and Cell Types and Polarity**	3
3.	**Cell specification and types of development:** - instructive development - determinative development	4
4.	**Forward and Reverse Genetics**: -Forward genetic approaches: Mutagens, Breeding Schemes, Modifier Screens, Phenotyping, Causative Mutations etc…	3

	-Reverse Genetics approaches: Morpholino-Mediated Gene Knockdown, Targeting Induced Local Lesions in Genomes, Targeted Gene Inactivation et c…	
5.	**Model Systems for the Genetic Control of Development:** -The Development of the Fruit Fly - Egg-Polarity Genes - Segmentation Genes - Homeotic Genes in Drosophila - Hohomeobox Genes in Other Organisms	3
6.	**Gene Regulation in Development:** - Wnt signalling - Notch signaling - Non-coding RNAs - Left-right asymmetry	4
7.	**Development Patterns and Processes of Evolution:** -Programmed Cell Death (PCD) and Development - Common genes in developmental pathways - Evolution through change in gene expression	4
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20%
2.	**Midterm exam-2**	10th week	20%
3.	**Assignments, presentations, Attendance, data search, participation**	Throughout the course duration	20%
4.	**Final exam**	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Benjamin A Pierce.(2020). Genetics: a conceptual approach. 7th edition W.H. Freeman. ISBN-13-978-1319216801.
Supportive References	https://www4.uib.no

Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector, smart board
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Indirect
Effectiveness of students assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Molecular Pathology**
Course Code:	**BIO-6012**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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A. General information about the course:

1. Course Identification

1. Credit hours: (Lecture 2 + Lab 0)					
2. Course type					
A.	☐University	☐College	☐ Department	☒ Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (undetermined level)					
4. Course General Description:					

Molecular pathology is a discipline of molecular biology that is concerned with the investigation of the molecular basis of disease. It represents a discipline involving molecular biology and pathology in a unique combination. The course encompasses the knowledge gained from studying biochemistry, physiology, genetics, and cell biology. Thus, this graduate course is intended to provide students with the knowledge and skills to understand the molecular alterations contributing to the development of disease. The molecular basis of inflammation, cytotoxicity, autoimmune diseases, and blood cell pathologies are emphasized in this graduate course. Among the course topics are the molecular basis of diabetes, muscle diseases, enzymatic defects, and neurologic diseases. This multidisciplinary approach of this course implies the application of molecular techniques contributing to the investigation of disease.

5. Pre-requirements for this course (if any)**:**

-Molecular biology course
-Molecular genetics course

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

This course aims to provide the students with a critical understanding and in-depth knowledge of the molecular mechanisms integrated into a range of disease conditions. This graduate course significantly develops the student's proficiency and skills in the detection of the molecular alterations that accompany and contribute to cancer and non-cancer disease conditions. Through the knowledge acquired by studying this course, the students can identify apoptosis and its molecular markers, and the molecular alterations associated with inflammation, diabetes, and muscle disease. The course's main objective is to allow the students to be acquainted with the multidisciplinary approach of the various molecular techniques.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		-
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	8
5.	**Others (specify)**	0
Total		30

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Describe the various molecular mechanisms of disease	**K1**	-Two-credit weekly lectures using the available projection tools and visual learning resources -Lecture discussions Student participation	-Quizzes -Written -exams -Assignments -Presentations -Data Search

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.2	Illustrate the importance of molecular markers and pathways in the investigation of cancer cells	**K2**	-Two-credit weekly lectures using the available projection tools and visual learning resources -Lecture discussions Student participation	-Quizzes -Written -exams -Assignments -Presentations -Data Search
1.3	Explain how specific molecular alterations contribute to the causation of cellular dysfunctions	**K3**	-Two-credit weekly lectures using the available projection tools and visual learning resources -Lecture discussions Student participation	-Quizzes -Written -exams -Assignments -Presentations -Data Search
1.4	List the appropriate molecular assays relevant to the investigation of specific disease conditions	**K4**	-Two-credit weekly lectures using the available projection tools and visual learning resources -Lecture discussions Student participation	-Quizzes -Written -exams -Assignments -Presentations -Data Search
2.0	Skills			
2.1	Relate between the pathological findings and the results of molecular testing	**S1**	-Two-credit weekly lectures using the available projection tools and visual learning resources -Lecture discussions	-Quizzes -Written -exams -Assignments -Presentations -Data Search

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
			Student participation	
2.2	Write a proposal and conduct a research work by employing critical thinking and the convenient lab methods	**S2**	-Lab demonstrations	-Lab report -Presentation
2.3	Interpret and analyze the results of molecular tests using the appropriate analytical methods	**S3**	-Two-credit weekly lectures using the available projection tools and visual learning resources -Lecture discussions Student participation	-Presentations
3.0	Values, autonomy, and responsibility			
3.1	Perform the assigned research work independently and cooperate effectively in a team	**V1**	-Two-credit weekly lectures using the available projection tools and visual learning resources -Lecture discussions Student participation	-Lab reports -Direct observation
3.2	Communicate the scientific issues and present the research results orally or via written formats.	**V2**	-Class discussions	-Presentations
3.3	Adhere to the relevant ethics while conducting a research work	**V3**	-Lecture discussions	-Lab report -Direct observation

C. Course Content

No	List of Topics	Contact Hours
1.	**Molecular Mechanisms of Cell Death:** -Modes of Cell Death -Structural Features of Necrosis and Apoptosis -Cellular and Molecular Mechanisms Underlying Necrotic Cell Death -Apoptosis and Apogenes: -Pathways to Apoptosis -Molecular mechanisms of apoptosis	2
2.	**Molecular toxicology:** Molecules involved in cytotoxicity	2
3.	**Molecular pathology of inflammation:** -Leukocyte Adhesion, Migration, and Activation -Acute Inflammation and Disease Pathogenesis -Inflammatory cytokines -Pattern Recognition Receptors and Inflammatory Responses -Chronic Inflammation and Acquired Immune Responses	2
4.	**Autoimmune diseases:** Molecular basis of autoimmune diseases	2
5.	**Immune cells:** Molecular defects of immune cells	2
6.	**Molecular pathology of blood cells:** -Myeloid Disorders -Lymphocyte Disorders	2
7.	**Molecular basis of diabetes** Molecular pathology of endocrine pancreas	2
8.	**Molecular aspects of enzymatic defects** Molecular pathology of enzymatic disorders	2
9.	**Molecular mechanisms of carcinogenesis** Cancer Biomarkers	2
10.	**Molecular markers of solid tumours and cancer cells** Understanding cancer at the molecular level	2
11.	**Muscle diseases:** Molecular basis of muscle diseases	2
12.	**Neurologic disease:** Molecular alterations in Neurologic disease	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm-exam 1 (written exam)**	5th week	20%
2.	**Midterm-exam 2 (written exam)**	10th week	20%
3.	**Assignments, presentations, data search, participation, attendance**	Throughout the course duration	20%
4.	**Final exam (written exam)**	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Coleman WB, Tsongalis GJ. (2009). Molecular Pathology. The Molecular Basis of Human Diseases. Coleman WB and Tsongalis GJ (Eds). Academic Press. ISBN: 978-0-374419-7
Supportive References	https://www.prospects.ac.uk/universities/the-university-of-manchester-3888/school-of-medical-sciences-3893/courses/molecular-pathology-122416#section-course-content http://www.drps.ed.ac.uk/19-20/dpt/cxmclm11056.htm https://www.gla.ac.uk/coursecatalogue/course/?code=MED5459
Electronic Materials	
Other Learning Materials	Tutorial videos

2. Required Facilities and equipment

Items	Resources
facilities	Classroom

Items	Resources
(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	
Technology equipment (projector, smart board, software)	-Projector -Smartboard
Other equipment (depending on the nature of the speciality)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect (questionnaire)
Effectiveness of Students assessment	Faculty	Direct
Quality of learning resources	Peer Reviewer	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Human Genetic Diseases**
Course Code:	**BIO-6014**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2+ Lab 0)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☐Required		☒ Elective	
3. Level/year at which this course is offered: (undetermined level)				
4. Course general Description:				

This graduate course is an advanced course on the molecular genetics of human disease. It provides the students with an in-depth understanding of the major concepts in Human Genetics. The course focuses on the different types of genetic disorders along with illustrations of significant examples such as autosomal dominant, autosomal recessive, X-linked dominant, and X-linked recessive. The course emphasizes a contemporary overview of genetic variations within populations and the forces that shape them. This involves the changes in the frequencies of genetic variation in populations over space and time. The course also covers the identification and assessment of mutations that contribute to the development of abnormal phenotypes

5. Pre-requirements for this course (if any)**:**

None

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

The objective of this graduate course is to introduce the students to the modern approaches used to identify genetic factors in health and disease, and analyze variation within populations. The students through studying this course get familiar with concepts and methods such as complex traits, population studies, the molecular basis of genetic disease and Pedigree analysis.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)……**	
	Total	30

B. Course Learning Outcomes, Teaching Strategies, Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**List the different types of genetic disorders and Clarify the theoretical basis of population genetics**	**K1**	Two credits weekly lecture	-Quizzes -Assignments -Presentations -Written exams
1.2	**Explain how variations in the coding and non-coding components of the human genome can result in genetic diseases**	**K2**	Two credits weekly lecture	Quizzes -Assignments -Presentations -Written exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.3	**Recognize the significance of genetic testing in the diagnosis, prevention, and treatment of genetic diseases**	**K3**	Two credits weekly lecture	Quizzes -Assignments -Presentations -Written exams
2.0	Skills			
2.1	**Interpret and analyze the results of common genetic tests**	**S1**	-Two credits weekly lecture -Tutorials	-Assignments -Presentations -Written exams
2.2	**Investigate the frequency of genetic diseases by applying the Hardy-Weinberg equilibrium**	**S2**	-Two credits weekly lecture -Tutorials	-Assignments -Presentations -Written exams
2.3	**Relate between the encountered diseases and genetic factors**	**S3**	-Two credits weekly lecture -Tutorials	-Assignments -Presentations -Written exams
3.0	Values, autonomy, and responsibility			
3.1	**Discuss the latest advances in genomic technologies and their applications to the identification of genetic diseases**	**V1**	Group discussions	-Presentation -Reports
3.2	**Appraise the implications of genetic disorders on patients, families, tribes, and society**	**V2**	Group discussions	-Presentation -Reports
3.3	**Demonstrate the ability to evaluate and critically review literature describing the recent research into human genetic**	**V3**	Group discussions	-Presentation -Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Fundamental Concepts in Human Genetics:** Genetic Terminology, genetic information, sex chromosomes, autosomes, homologous chromosomes, replication, Human Genome, pedigree	2
2.	**Molecular Basis of Genetic Disease:** Genetic Diseases and Faulty DNA Repair Diseases caused by chromosomal aberrations Diseases associated with single-gene Mendelian inheritance Diseases associated with single-gene non-Mendelian inheritance Diseases caused by multifactorial inheritance	3
3.	**Inheritance of Traits in Humans and Pedigree Analysis:** The inheritance of chromosomes—Meiosis Symbols Used in Pedigrees Analysis of Pedigrees Autosomal Recessive Traits Autosomal Dominant Traits X-Linked Recessive Traits X-Linked Dominant Traits Y-Linked Traits	2
4.	**Studying Twins and Adoptions:** Concordance in Twins A Twin Study of Asthma Adoption Studies	2
5.	**Rare diseases and Common diseases:** AA amyloidosis, Adrenoleukodystrophy (ALD), Ehlers-Danlos syndrome, Mitochondrial diseases, Usher syndrome, Chromosomal disorders, Multifactorial disorders, Monogenic disorders **The Saudi Genome Project:** -Pathogenic Variants	3
6.	**Genetic Counseling and Genetic Testing:** Genetic Counseling Genetic Testing Interpreting Genetic Tests Direct-to-Consumer Genetic Testing	3

	Genetic Discrimination and Privacy Risk of Consanguinity on Genetic Diseases	
7.	**Gene Pool of a Population:** Allelic frequencies, phenotypic frequencies, genotypic frequencies	2
9.	**Hardy-Weinberg Law:** Genotypic Frequencies at Hardy–Weinberg Equilibrium Closer Examination of the Assumptions of the Hardy–Weinberg Law Implications of the Hardy–Weinberg Law Extensions of the Hardy–Weinberg Law Testing for Hardy–Weinberg Proportions Estimating Allelic Frequencies with the Hardy–Weinberg Law	3
10.	**Genetic Variation in Populations and their Analysis:** -Nonrandom Mating -Evolutionary Forces: mutations, genetic recombination, gene flow or gene migration, genetic drift, natural selection	2
11.	**Populations substructure**	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20%
2.	**Midterm exam-2**	10th week	20%
3.	**Assignments, presentations, data search, participation**	Throughout the course duration	20%
...	**Final exam**	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Benjamin A Pierce. (2020). Genetics: a conceptual approach. 7th edition W.H. Freeman. ISBN-13-978-1319216801.
Supportive References	https://www.ucl.ac.uk
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector, smart board
Other equipment (Depending on the nature of the speciality)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Molecular Immunology**
Course Code:	**BIO-6016**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Sciences**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2+ Lab 0)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: (undetermined)				
4. Course General Description:				
This course focuses on the molecular and cellular biology of the immune response, in particular the mechanisms through which the immune system identifies and combats various agents. Emphasis is placed on both the classical and the recent experimental findings that have shaped our present-day comprehension of immune recognition processes. The specific subtopics covered in this course include the diversifying nature of immunoglobulin receptors, the interactions between T cells and MHC molecules, the activation and signalling pathways of innate and adaptive immune responses, and the molecular mechanisms of hypersensitivities and autoimmune diseases.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requisites for this course (if any)**:**				
None				
7. Course Main Objective(s):				
This graduate course aims to introduce the students to an in-depth understanding of the concepts of immune recognition. The emphasized topics include molecules of the immune response, diversification mechanisms of immunoglobulins and immunoglobulin receptors. The course content acquaints the students with the molecular mechanisms of immunodeficiency diseases and those mechanisms clarify the interaction between the cancer cells and immune system. The molecular Among the main course objectives are T cell and Major Histocompatibility Complex (MHC) interactions, signalling mechanisms of innate and adaptive immune responses.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify) .....**	-
	Total	**30**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Outline the basic concepts of the innate and adaptive immune responses	K1	-Lectures -Tutorials (Informative videos and internet resources). -Class discussion	-Assignments -Participation -Presentation -Written exams
1.2	Identify the main chemical molecules mediating the immune responses	K2	-Lectures -Tutorials (Informative videos and internet resources). -Class discussion	-Assignments -Participation -Presentation -Written exams
1.3	Describe the signaling downstream of innate and adaptive immune responses	K3	-Lectures -Tutorials (Informative videos and internet resources). -Class discussion	-Assignments -Participation -Presentation -Written exams
1.4	Explain the main molecular mechanisms of hypersensitivity, autoimmune, and immunodeficiency diseases	K4	-Lectures -Tutorials (Informative videos and internet resources). -Class discussion	-Assignments -Participation -Presentation -Written exams

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.1	Relate the diversification of immunoglobulin receptors to the various immune reactions to a wide range of antigens	**S1**	-Demonstrations -Class discussions	-Presentation -Reports
2.2	Interpret and analyze the data of immune assays by employing critical thinking and the acquired knowledge in the area of molecular immunology	**S2**	-Demonstrations -Class discussions	-Presentation -Reports
2.3	Write a proposal and conduct experimental research work using the appropriate methods and techniques	**S3**	-Demonstrations -Class discussions	-Presentation -Reports
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate independence in performing lab work and show effective cooperation with a research team	**V1**	-Teamwork -Group Discussion	-Presentation -Group reports
3.2	Participate actively in discussions of immunology issues and communicate scientific data professionally via oral presentations and in writing format.	**V2**	-Group discussion -Seminars	-Presentation -Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**General Introduction:** Overview of the Immune System	2
2.	**The Major Histocompatibility Complex (MHC):** -General organization and inheritance, -MHC molecules and genes -Molecular mechanisms of antigen presentation on MHC class I and II molecules, -MHC and disease susceptibility	2
3.	**Cytokines:** -Properties of cytokines, -Cytokine receptors, cytokine secretion, -Cytokine antagonists -Cytokine-related diseases and therapeutic uses	2
4.	**Immunoglobulins:** -Structure and functions, -Expression of immunoglobulin genes, -Monoclonal and polyclonal antibodies -Antibody cloning and engineering antigens	4
5.	**Signalling Pathways**: -Downstream of receptors of the innate immune response: inflammasomes and autophagosomes	2
6.	**Signaling pathways:** -Downstream of the antigen receptors of T and B cells: T-cell Receptors (TCRs), structure and roles of TCRs, B-cell Receptors (BCRs), structure and roles of BCRs, immune checkpoints	4
7.	**Molecular mechanisms of hypersensitivity**	2
8.	**Molecular mechanisms of autoimmune diseases**	2

9.	**Immunodeficiency Diseases**	2
10.	**Cancer and the Immune System**	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20%
2.	**Midterm exam-2**	10th week	20%
3.	**Assignments, presentations, Reports, data search, attendance, participation**	Throughout the course duration	20%
4.	**Final exam**	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Abbas A, Andrew Lichtman, Shiv Pillai. Cellular and molecular immunology. W.B. Saunders, (ed), 9th International Edition.
Supportive References	
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector, smart board
Other equipment (Depending on the nature of the speciality)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title: Molecular Oncology
Course Code: BIO-6018
Program: Master of Science in Molecular Biology **(Cell and Molecular Biology)**
Department: Biology
College: Science
Institution: Imam Mohammad Ibn Saud Islamic University (IMSIU)
Version: 1
Last Revision Date: *Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2+ Lab 0)					
2. Course type					
A.	☐University	☐College	☐Department	☒ Track	
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (undetermined level)					
4. Course General Description:					
This graduate course provides the students with knowledge of cancer aetiology, growth and invasion. The course emphasizes the main intervening factors and molecular mechanisms that affect the progression of cancer along with the contemporary and emerging treatment modalities. Particular attention is paid to the mechanisms of alterations affecting cytoplasmic signalling pathways, gene expression, DNA damage/ repair and epigenetics. The course content extends to cover the issues of regulated cell death and cancer, molecular aspects of cancer cell metabolism, and tumour virology.					
5. Pre-requirements for this course (if any)**:**					
None					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
This graduate course aims to provide a fundamental understanding of molecular oncology, as well as the approaches used in cancer research. The acquired knowledge enables the students to describe the different types of tumours and the steps of tumorigenesis and understand the molecular mechanisms involved in the conversion of a normal cell into a malignant cell. Among the course objectives is the acquaintance of the students with the factors that affect the initiation and progression or inhibition of cancer development, and cancer diagnostics and treatment**.**					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify) .....**	
	Total	30

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Describe the relevant processes contributing to cancer development (tumorigenesis)	**K1**	-PowerPoint presentations -Informative videos and	-Quizzes -Assignments Presentations -Data search

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			internet resources. -Class discussions	-Written exams
1.2	List the various factors responsible for the initiation of carcinogenesis and oncogenes	**K2**	-PowerPoint presentations -Informative videos and internet resources -Class discussions	-Quizzes -Assignments Presentations -Data search -Written exams
1.3	Explain the mechanisms of mutagenesis and the role of growth factors and signalling pathways in progression of cancer	**K3**	-PowerPoint presentations -Informative videos and internet resources -Class discussions	-Quizzes -Assignments Presentations -Data search -Written exams
2.0	**Skills**			
2.1	Relate between the relevant molecular mechanisms and the development of various types of	**S1**	-Demonstrations -Lecture discussions	-Presentations
2.2	Write a proposal to conduct experimental work in the area of molecular oncology using critical thinking and related techniques.	**S2**	-Demonstrations -Lecture discussions	-Presentations -Reports
2.3	Analyze and interpret the data relevant to the molecular development of cancer	**S3**	-Demonstrations -Lecture discussions	-Presentation -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.1	Show independence and ability to cooperate in a teamwork	**V1**	-Demonstrations -Group discussions	- Reports
3.2	Communicate and discuss issues of molecular oncology and present research data professionally in a verbal manner or writing.	**V2**	-Group discussions	- Presentations -Reports
3.3	Adhere to ethical principles related to cancer research	**V3**	-Demonstrations	-Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**General introduction to oncology and tumor biology**	**2**
2.	**Tumorigenesis and different types of tumours:** -Tumor growth and angiogenesis, -Invasion and metastasis	**4**
3	**Genetics of normal and malignant cells:** -DNA repair mechanisms -Mechanisms of mutagenesis -Oncogenes -Tumor suppressor genes	**2**
4	**Epigenetics in malignancy:** -DNA methylation -Histone modifications -miRNAs	**2**
5	**Growth factors and related signalling pathways:** Role of growth factors and related signalling pathways in cancer progression	**2**
6	**Regulated cell death and cancer**	**2**

7	**Cancer cell metabolism and interaction with normal cells**	**2**
8	**Tumor virology**	**2**
9	**Major principles of cancer treatment:** -Radiotherapy -Hormonal treatment -Immunotherapy -Pharmacology -Antitumor agents.	**4**
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Mid-term exam 1**	5th week	20%
2.	**Mid-term exam 2**	10th week	20%
3.	**Presentations, reports, attendance, data search, participation**	Throughout the course duration	20%
...	**Final exam**	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Henke Yarbro, C, Wujcik, B M & Holmes Gobel, B (2010). Cancer Nursing, Principles and Practice, 7th ed, Jones and Bartlett Sudbury, Massachusetts. -Abeoff, MD, Armitage, JO, Niederhuber, JE, Kastan, MB & Gillies Mckenna, W (2008). Abeloffs' Clinical Oncology, 4th ed, Churchill Livingstone
Supportive References	
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector, smartboard
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Advanced Biochemistry**
Course Code:	**BIO-6110**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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A. General information about the course:

1. Course Identification:

1. Credit hours: 3(Lecture 2+ Lab 2)				
2. Course type				
A.	☐University	☐College	☐ Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 1 / first year)				
4. Course General Description:				

This postgraduate course provides the students with advanced biochemistry topics including regulation of protein functions, protein folding, enzyme functions, and proteomics. The course also focuses on the various advanced metabolic pathways including the biosynthesis of amino acids, and nucleotides synthesis and degradation. In addition, the integration of mammalian metabolism via hormonal regulation is also emphasized to enable the students to be acquainted with a comprehensive view of metabolic interactions.

5. Pre-requirements for this course (if any)**:**

None

6. Co-requisites for this course: (if any)**:**

None

7. Course Main Objective(s):

This course aims to develop a comprehensive understanding of significant issues in biochemistry that cover the integrated regulation of the various biochemical pathways. This is best exemplified by the pathways involved in amino acids, and nucleotides biosynthesis and degradation. The course aims to encompass the metabolic implications of some outstanding topics such as obesity and diabetes mellitus. Among the major course objectives is the development of professional lab skills to apply modern biochemical techniques.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	30
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify).....**	
	Total	60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Outline the process by which a protein structure acquires its functional three-dimensional shape.	K1	Three credits weekly involving lectures and tutorials	-Quizzes -Written exams -Assignments -Lecture discussions

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.2	Describe the various biosynthesis and degradation pathways such as that of nucleotides	**K2**	Three credits weekly involving lectures and tutorials	-Quizzes -Written exams -Assignments -Lecture discussions
1.3	Illustrate the biochemical basis of obesity and diabetes mellitus and their impact on glucose metabolism and homeostasis	**K3**	Three credits weekly involving lectures and tutorials	-Quizzes -Written exams -Assignments -Classroom participation
1.4	Explain how different organs contribute to the overall metabolic homeostasis.	**K4**	Three credits weekly involving lectures and tutorials	-Quizzes -Written exams -Assignments -Classroom participation
2.0	**Skills**			
2.1	Apply the proteomic techniques to study the expression, structure, and function of proteins by employing the acquired practical skills	**S1**	Independent lab work.	-Direct observation -Lab Reports
2.2	Interpret and analyze the cell- and tissue-specific biochemical data using the appropriate analytical methods.	**S2**	Independent lab work.	-Lab Reports

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
3.3	Design and conduct biochemical research work by applying critical thinking and the appropriate lab methods.	**S3**	Independent lab work.	-Lab reports - Presentations
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate autonomy in critically evaluating the scientific literature related to biochemistry topics.	**V1**	Independent assigned data search	-Classroom discussions - Presentations
3.2	Sow responsibility in making informed decisions regarding the biochemistry issues.	**V2**	Independent assigned data search	-Classroom discussions - Presentations
3.3	Share the scientific issues professionally and present the research results via oral presentations and written formats	**V3**	Participation in teamwork	-Group discussions - Presentations

C. Course Content:

No	List of Topics	Contact Hours
1.	**Course Introduction:** General introduction on protein structure and function, and the major metabolic pathways.	4
2.	**Protein folding**: Stepwise process of protein folding, Chaperones and their role in protein folding, and diseases associated with abnormalities of protein folding.	4
3.	**Regulation of protein function:**	4

	Synthesis and degradation of proteins, Phosphorylation and dephosphorylation in regulation of protein activity.	
4.	**Proteomics:** Introduction to proteomics, and mass spectrometry in proteomics.	4
5	**Overview of Nitrogen Metabolism:** Nitrogen cycling network, nitrogen fixation, and role of glutamine synthetase in nitrogen metabolism.	3
6.	**Amino acids metabolism:** Synthesis of amino acids, amino acids catabolism; deamination and transamination reactions, and urea cycle	2
7.	**Molecules Derived from Amino Acids:** Physiologically active amines: Epinephrine, norepinephrine, and dopamine, Arginine derivatives: Nitric Oxide and glutathione.	2
8.	**Biosynthesis and Degradation of Nucleotides:** De Novo and Salvage Pathways, ribonucleotides as a precursor of Deoxyribonucleotides, and degradation of Purines and Pyrimidines.	2
9.	**Integration of Metabolism:** **Integration of Metabolism-I:** Tissue-specific metabolism; role of the liver in processing and distributing nutrients. Adipose tissues and their role in Storing and Supplying Fatty Acids. **Integration of Metabolism-II:** Hormonal regulation of fuel metabolism; Metabolic effects of insulin and glucagon **Integration of Metabolism-III:** Obesity and regulation of the body mass, and diabetes mellitus	6
10.	**Selected Topics for Discussion**	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exam-1	5th week	20 %
2.	Midterm exam -2	10th week	20 %
3.	Presentations, data survey, discussion of published articles, Assignments	Throughout the semester duration	20%
4	Final exam	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Nelson D L., Cox MM, Hoskin AA. (2021). Lehninger Principles of Biochemistry. 8th Ed. Macmillan Learning. ISBN-13: 978-1-319-32234-2 -Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Scott, M. P., Bretscher, A. Matsudaira, P. 2021. Molecular Cell Biology (9th ed.). W. H. Freeman. -Berg, J.M., Tymoczko, J.L. and Stryer, L. 2019. Biochemistry. 9th Edition. W. H. Freeman Publishing, New York.
Supportive References	https://www.farmingdale.edu/courses/outlines/chm381.shtml
Electronic Materials	
Other Learning Materials	Tutorial videos

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector and smart board
Other equipment (Depending on the nature of the speciality)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Methods in Biochemistry**
Course Code:	**BIO-6112 (Lab Course)**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك عبد العزيز عبد الله رحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: 2(Lecture 1+ Lab 2)				
2. Course type				
A.	☐University	☐College	☐ Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 1 / first year)				
4. Course General Description:				
This graduate course provides the students with an in-depth exploration of biochemical methods. The students are equipped with the knowledge and practical skills essential for modern biochemical research. The covered topics include spectroscopy, centrifugation, electrophoresis, chromatography, and immunological methods. The course focuses on mastering key methods employed in the analysis, separation, and identification of biomolecules. Principles and theory of biochemical techniques are taught in a corresponding lecture course, and this is followed by the application of the techniques in the lab sessions.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requisites for this course: (if any)**:**				
None.				
7. Course Main Objective(s):				
This course aims to develop the laboratory skills of the students regarding the principles and applications of classical and modern biochemical methods. Major objectives include applying and mastering spectroscopic biochemical analysis, separating cellular components, gel electrophoresis, chromatographic technique, and immunological methods including ELISA and Western blotting. Among the objectives is the development of practical skills in handling instruments, preparing samples, conducting experiments, and troubleshooting.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	15
2.	**Laboratory/Studio**	30
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify) ……**	-
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.1	Outline the principles of UV-Visible, spectroscopy, and applications of fluorescence spectroscopy.	K1	-Lab Presentations and group discussions to introduce the biochemical analytical techniques	-Active participation in lab discussions. -Lab reports -lab exam
1.2	List the separation techniques including centrifugation, electrophoresis and chromatography.	**K2**	-Lab Presentations and group discussions to introduce the biochemical analytical techniques	-Active participation in lab discussions. -Lab reports -Lab exam
1.3	Explain the significance of various types of immunological methods and their applications.	**K3**	-Lab Presentations and group discussions to introduce the biochemical analytical techniques	-Active participation in lab discussions. -Lab reports -Lab exam
2.0	**Skills**			
2.1	Apply the biochemical methods and techniques professionally to support the various research purposes	**S1**	-Guided Lab work -Lab tutorials	-Active participation in lab discussions. -Lab reports -Lab exam
2.2	Design and conduct experimental research work by employing critical practical skills to address specific biochemical issues**.**	**S2**	-Guided lab experiments -Group discussions	-Lab reports -Presentations
2.3	Interpret, evaluate and analyze the experimental	**S3**	-Guided analysis of research data	-Lab reports -Presentations

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	data using the appropriate statistical methods, and draw meaningful conclusions.		-Group discussions	
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate independence in performing the research work, and cooperate effectively in a team.	**V1**	-Guided lab research work – Group discussions	-Lab reports -Presentations by research groups
3.2	Participate in discussion of scientific issues and present the research results professionally either orally or in a written format.	**V2**	-Tutorials on presenting research data -Seminars -Group discussions	-Presentations -Lab reports
3.3	Adhere to the relevant ethical rules while performing research work in biochemistry	**V3**	-Tutorials on research ethics	-Lab reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Introduction to Biochemical Methods:** Overview of the course objectives, structure, and importance of analytical techniques in biology.	2
2.	**Spectroscopy-I:** Principles of molecular absorption, optical density, and applications of visible and UV absorption in protein quantification.	4
3.	**Spectroscopy-II:** Principles of fluorescence, fluorescence spectroscopy, and types of fluorophores.	4
4.	**Centrifugation:**	2

	Theory and principles of Centrifugation, types of centrifugation techniques, and applications of centrifugation techniques in cellular fractionation and biomolecule separation.	
5.	**Electrophoresis Techniques-I:** Tools of electrophoresis, types of electrophoresis, and visualization of gel.	2
6	**Electrophoresis Techniques-II:** Polyacrylamide Gel Electrophoresis (PAGE), PAGE Tools, and SDS-PAGE.	2
7.	**Chromatography:** General principles of chromatography, different types of chromatography, and applications in biomolecule separation.	2
8.	**Immunological Methods-I:** Introduction to immunological methods, overview of antigen-antibody interactions, and ELISA techniques.	4
9.	**Immunological Methods-II:** Western blotting: Principles and application of Western blotting.	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exams**	5th and 10th weeks	30 %
2.	**Quizzes, presentations, lab reports, participation, attendance, data search, assignments**	Throughout the semester duration	30 %
4	**Final lab exam**	15th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Wilson, K., & Walker, J. (2018). Principles and Techniques of Biochemistry and Molecular Biology (8th ed.). Cambridge University Press.
Supportive References	https://www.su.se/polopoly_fs/1.622041.1660576721!/columnholder/column2/linklayout/file/KB7014%20HT22.pdf
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Well-equipped lab
Technology equipment (Projector, smart board, software)	Projector and smart board
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Advanced Cell and Molecular Biology**
Course Code:	**Bio-6114**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: 4 (Lecture 3+ Lab 2)				
2. Course type				
A.	☐University	☐College	☐ Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 1 / first year)				
4. Course General Description:				
This graduate course focuses on the study of nucleic acids and proteins and their interactions within cells, which play a crucial role in facilitating appropriate growth, division, and development. This course provides an in-depth examination of the biological systems at the molecular level in both prokaryotic and eukaryotic organisms. This course is centered on the organization, operation, and chemical processes involved in nucleic acids. The topics covered in this course include the structure and function of nucleic acids, the structure and replication of DNA, the transcription and processing of RNA, and the process of translation. The course emphasizes regulation and control of gene expression. The course offers students an understanding and recognition of the experimental methods employed in the field of molecular biology.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requirements for this course (if any)**:**				
None				
7. Course Main Objective(s):				
The course intends to provide students with essential knowledge about the composition and operation of nucleic acids. Furthermore, it aims to provide students with a thorough comprehension of DNA replication, repair, transcription, RNA processing, and translation of RNA transcripts into proteins in both prokaryotes and eukaryotes. Moreover, the course objectives include providing students with a thorough understanding of the fundamental principles that regulate the control of gene expression in both prokaryotes and eukaryotes.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	• **Traditional classroom**	√	100%
2	E-learning		-
3	Hybrid • **Traditional classroom** • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	30
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)……**	-
	Total	75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Describe DNA replication processes**	K1	-Lectures -Class participation	-Written exams -Class participation -Assessment of assigned work
1.2	**Outline forms of DNA damage and the mechanisms to repair**	K2	-Lectures -Class participation	-Written exams -Class participation -Assessment of assigned work
1.3	**Explain the intracellular mechanisms of transcription and**	K3	-Lectures -Class participation	-Written exams -Class participation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	discuss the regulation and control of gene expression			-Assessment of assigned work
2.0	**Skills**			
2.1	**Summarize critically the fundamentals of nucleic acids translation processes and analyze this information until the synthesis of proteins**	S1	-Lectures -Classroom discussions -Cooperative education	-Classroom participation -Presentations
2.2	**Relate the participation of the major organelles in eukaryotic cells to protein synthesis**	S2	-Lectures -Classroom discussions -Cooperative education	-Classroom participation -Presentations
3.0	**Values, autonomy, and responsibility**			
3.1	**Organize and summarize information from a variety of sources (textbooks, research papers and review articles), and use information technology to present scientific data to a varied audience**	V1	--Lectures -Classroom discussions	-Classroom participation -Presentations
3.2	**Demonstrate the ability to communicate scientific issues effectively both**	V2	-Lectures -Classroom discussions	-Classroom participation -Presentations

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	orally and in writing format			
3.3	**Show independence in performing assigned work and cooperate as a member of a team**	V3	Group discussions	-Assessment of assigned work -Presentations

C. Course Content:

No	List of Topics	Contact Hours
1.	**DNA Replication:** -DNA Replication Is Semiconservative -DNA Replication Is Usually Bidirectional -Telomeres Solve the DNA End-Replication Problem	2
2.	**DNA Damage and Repair:** -Mutations Can Occur Spontaneously During Replication Homologous Recombination and Mobile Genetic Elements -Bacterial DNA-Only Transposons Can Be Composite or Non-composite -Eukaryotes Also Have DNA-Only Transposons - Retrotransposons	2
3.	**Gene Expression:** **I. Transcription** -Mechanisms of Transcription -Transcription Involves Four Stages: RNA Polymerase Binding, Initiation, Elongation, and Termination -Transcription in Eukaryotic Cells Has Additional Complexity Compared with Prokaryotes -The Directional Flow of Genetic Information -Transcription and Translation Involve Many of the Same Components in Prokaryotes and Eukaryotes -Where Transcription and Translation Occur Differs in Prokaryotes and Eukaryotes -In Some Cases, RNA Is Reverse-Transcribed into DNA	8
4.	**RNA Processing and Turnover:** -The Nucleolus Is Involved in Ribosome Formation -Transfer RNA Processing Involves Removal, Addition, and Chemical Modification of Nucleotides -The Abundance of mRNA Allows Amplification of Genetic Information	8
5.	**Gene Expression:** II. The Genetic Code and Protein Synthesis	3

	-The Genetic Code -The Mechanism of Translation -Posttranslational Processing	
6.	**Bacterial Gene Regulation:** -The Genes Involved in Lactose Catabolism Are Organized into an Inducible Operon -The *lac* Operon The Genes Involved in Tryptophan Synthesis (a Repressible Operon)	2
7.	**Eukaryotic Gene Regulation:** **Genomic Control** -Eukaryotic Gene Expression Is Regulated at Five Main Levels -Gene Amplification and Deletion Can Alter the Genome -DNA Rearrangements Can Alter the Genome	4
8.	**Eukaryotic Gene Regulation:** **Transcriptional Control** -Different Sets of Genes Are Transcribed in Different Cell Types -Enhancers and Silencers Are DNA Elements Located at Variable Distances from the Promoter -Several Common Types of Transcription Factors Bind to DNA and Activate Transcription	8
9.	**Eukaryotic Gene Regulation:** **Post-transcriptional Control** -Control of RNA Processing and Nuclear Export Follows Transcription -Translation Rates Can Be Controlled by -Initiation Factors and Translational Repressors	4
10.	**-Posttranslational Control:** -MicroRNAs Produced by Normal Cellular Genes Silence the Translation of mRNAs -Modifications of Protein Structure, Function, and Degradation -Ubiquitin Targets Proteins for Degradation by Proteasomes	4
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20 %
2.	**Midterm exam-2**	10th week	20%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
3.	**Quizzes, Participation, presentations, reports, attendance**	Throughout the course duration	20%
4.	**Final exam**	16th week	40 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Bruce Alberts et al., Essential Cell Biology, Third edition, London, UK. (2009). ISBN-13: 978-0815341291. -Lodish, et al. Molecular Cell Biology. 5th ed. New York, NY: W.H. Freeman and Company, (2003). ISBN: 9780716743668. -Becker's WORLD OF THE CELL TENTH EDITION Jeff Hardin and James P. Lodolce(2022) -Robert F. Weaver. (2011) Molecular Biology, 5th Edition, McGraw-Hill Education. -Michael M. Cox, Jennifer Doudna, Michael O'Donnell. (2015) Molecular Biology: Principles and Practice, 2nd Edition, W. H. Freeman
Supportive References	
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector and Smartboard
Other equipment (Depending on the nature of the speciality)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of students' assessment	Program Leaders	Direct
Quality of learning resources	Peer Reviewer	Direct
The extent to which CLOs have been achieved	Program Leaders	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	BIOLOGY DEPARTMENT COUNCIL
REFERENCE NO.	23
DATE	23/8/1445

Course Specification

(Postgraduate Programs)

Course Title:	**Research Principles and Ethics**
Course Code:	**BIO-6200**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2+Lab 0)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 2 / first year)				
4. Course General Description:				
This course introduces the research principles and ethics to the graduate students. Research principles are those that should be considered when conducting research work. The fundamental research ethics are those rules to which the researchers should adhere to ensure the ethical conduct of the research. The course emphasizes topics such as confidentiality and protection of data, conflict of interest, avoiding deceptive practices, and minimization of risks. The significance of obtaining official approval before carrying out the research work is also emphasized.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Pre-requirements for this course (if any)**:**				
None				
7. Course Main Objective(s):				
This graduate course aims to provide the students with the basic knowledge of research principles and ethical rules related to research activities. The course objectives are mainly centred on adherence to the relevant ethical rules and research principles while performing research work. The identification of topics such as beneficence and non-maleficence, merit and integrity of research, justice, and the right to withdraw are among the objectives of this graduate course. The various types of conflict of interest and the differences between deceptive and non-deceptive practices in the research activities are also targeted.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning	-	-
3	Hybrid √ • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify) ……**	
	Total	30

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	List the steps essential to recruit research participants to share in a particular research work, and measures taken to maintain the research confidentiality	K1	Two credits weekly involving lectures and tutorials	-Quizzes -Written exams -Assignments -Lecture discussions

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.2	Describe the forms of conflict of interest that may compromise the flow of the research work	K2	Two credits weekly involving lectures and tutorials	-Quizzes -Written exams -Assignments -Lecture discussions
1.3	Explain the significance of obtaining the approval of an "Institutional Review Board"(IBR) to conduct a research work	K3	Two credits weekly involving lectures and tutorials	-Quizzes -Written exams -Assignments -Lecture discussions
1.4	Outline the measures taken to care for and use of experimental	K4	Two credits weekly involving lectures and tutorials	-Quizzes -Written exams -Assignments -Lecture discussions
2.0	Skills			
2.1	Relate a certain research principle and an ethical rule to a particular research study	S1	-Presentations -Group discussions	-Direct observation -Lab Reports
2.2	Design and conduct experimental research work in a way that maximizes benefits and minimizes the potential risks of the research study	S2	--Presentations -Group discussions	-Direct observation -Lab Reports
3.0	Values, autonomy, and responsibility			
3.1	Perform research work independently and effectively cooperate in a team with the	V1	--Presentations -Group discussions	-Direct observation -Lab Reports

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
	consideration of confidentiality and data protection			
3.2	Adhere to the relevant ethics while performing research work in the various disciplines of biology	V2	-Presentations -Group discussions	-Direct observation -Lab Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Approval of Ethics Board:** Approval of the "Institutional Review Board" (IBR) to conduct the research in compliance with national and international rules and regulations.	2
2.	**Research Participants:** **Recruit participants:** Ethical rules should be followed to recruit participants in a research study **Respect to persons:** Autonomy and protection of those with diminished autonomy **Justice:** Equal treatment is the core principle of justice concerning research **Avoiding deceptive practices:** Everyone in a particular research setting knows the design and objectives of the research **Providing the right to withdraw:** Research participants should always have the right to withdraw from the research process **Confidentiality and data protection:** Respect the confidentiality nature of information and protect anonym **Conflict of interest:** Independence of research and declaration of any conflict of interest	4
3.	**Animal Research (Use and Care of Lab Animals):** Humanity in the housing of experimental animals, and their anaesthesia and euthanasia.	2
4.	**Publishing Ethics (Author duties and rights):** **Duties:** Originality, concurrent publication, confidentiality, authorship, declarations, and image integrity **Rights:** using data freely, receiving attribution and credit, and sharing published work	2
5.	**Research Theory and Basics:**	4

	Research theory: Assumptions of researchers about findings in reality, how to detect changes, and how to extract conclusions **Research basics:** Research design(descriptive, correlation, comparative, experimental, simulation, evaluation); Research methods (conduction of research, collecting data, organizing data, analyzing data) **The integrity of research:** Proper design and reviewing of the research work to ensure the standards of integrity, quality, and transparency **Beneficence and non-maleficence:** maximizing the benefits of research and minimizing the potential risks to researchers	
6.	**Structuring the Research Project:** **Proposal and research plan:** Testing a particular hypothesis, Preparation and approving a proposal, and planning of research work **Searching and reviewing the literature:** Finding information and extended literature review **Collecting and analyzing data:** Quantitative and qualitative data analysis, reasoning, and conclusions	6
7.	**Writing up the Research:** Organizing notes on the literature, showing results, and discussing findings	2
8.	**Researchers' Rights**: Intellectual Property Intellectual Property Rights Types of Intellectual Property Rights (IPR)	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20%
2.	**Midterm exam-2**	10th week	20%
3.	**Assignments, presentations, attendance, data search, participation**	Throughout the course duration	20%
4.	**Final exam**	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Congiunti L, Francesco FL, Russo A, Serio M. Ethics in Research. Principles and Practical Considerations. Springer Cham. ISBN: 978-3-031-24059-1 ISSN: 2366-7516
Supportive References	https://www.city.ac.uk/research/support/integrity-and-ethics/ethics/principles https://uraf.harvard.edu/researchers-principles-policies https://research.virginia.edu/compliance/research-regulations https://research.illinoisstate.edu/ethics/human-subjects/policy/ https://www.nih.gov/health-information/nih-clinical-research-trials-you/guiding-principles-ethical-research https://www.apa.org/monitor/jan03/principles https://www.mcgill.ca/research/about/ran/research-policies-and-regulations https://www.dpi.nsw.gov.au/dpi/animals/animal-ethics-infolink/legislation-and-the-australian-code/animal-research-regulation
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom, laboratories
Technology equipment (Projector, smart board, software)	Projector, smart board
Other equipment (Depending on the nature of the speciality)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Cell Culturing Technology**
Course Code:	**BIO-6201 (Lab Course)**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2 + Lab 2)				
2. Course type				
A.	☐University	☐College	☐ Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 2 / First year)				
4. Course General Description:				
This graduate course serves as an introductory guide, providing insights into the enhancement of biological research, specifically in the transition from basic research to modern approaches in cell biology, through the application of cell culture technologies. This course covers foundational aspects such as biosafety levels, laboratory equipment, subculture various methods and a short introduction to the three-dimensional cell culture technique. In addition, cell counting methods and viability assessment are among the topics that the course will cover. The course offers an accessible opportunity to unravel the intricate pathways of biomedical research, where cell culture stands out as a powerful tool.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requisites for this course: (if any)**:**				
None.				
7. Course Main Objective(s):				
The primary objective of this graduate course is to provide the students with both theoretical and practical experience necessary to carry out experimental work using cell and tissue cultures as inevitable *in vitro* tools of research. The course content aims to foster an understanding of the noteworthy progress made in the techniques of cell culturing. The knowledge acquired from this course empowers the students to perform their research work independently in cell culture laboratories. By the end of the course, students will be equipped with the professional skills to maintain animal cells and tissues under *in vitro* conditions.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		-
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	30
3.	**Field**	
4.	**Tutorial**	-
5.	**Others (specify) ……**	
	Total	60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Outline the principles of cell culture techniques, encompassing biosafety levels, culture conditions, and key characteristics of cell lines.	K1	-Lab Presentations and group discussions to introduce the cell culture techniques	-Active participation -Lab reports -Lab exam

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.2	List the differences between finite and continuous cell lines, and the distinctions between adherent and suspension cell cultures.	**K2**	-Lab Presentations and group discussions to introduce the various types of cell lines.	-Active participation -Lab reports -Lab exam
1.3	Describe cryopreservation including freezing mediums, and the protocols for both preserving and thawing cultured cells.	**K3**	-Lab Presentations and group discussions to introduce cryopreservation	-Active participation -Lab reports -Lab exam
2.0	**Skills**			
2.1	Apply the cell culture techniques in a professional manner to support the various research purposes.	**S1**	-Guided Lab work -Lab tutorials	-Active participation -Lab reports -Lab exam
2.2	Design and conduct experimental assay by employing critical practical skills and the proper cell culturing methods	**S2**	-Guided lab experiments -Group discussions	-Lab reports -Presentations
2.3	Interpret and analyze the experimental data by applying the appropriate statistical methods, and derive meaningful conclusions through evaluation.	**S3**	-Guided analysis of research data -Group discussions	-Lab reports -Presentations
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate responsibility for research reliability by upholding the highest standards of accuracy in all cell culture-related experiments and data reporting.	**V1**	-Guided lab research work –Group discussions	-Lab reports -Presentations by research groups
3.2	Participate in discussion of scientific issues and recognize the importance of effective	**V2**	-Tutorials on presenting research data	-Presentations -Lab reports

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
	communication orally or in a written format to achieve successful outcomes in cell culture experiments.		-Seminars -Group discussions	
3.3	Follow the principles of ethical conduct of research in handling cell cultures.	V3	-Tutorials on research ethics	-Lab reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Cell culture laboratory:** Biosafety levels, Basic equipment, and laboratory safety practices.	3
2.	**Introduction to cell culture:** Cell culture, Finite vs. continuous cell line, and culture conditions.	2
3.	**Cell culture basics:** Acquiring cell lines, Adherent vs. suspension culture, media and Cell culture plastics.	3
4.	**Subculturing of Adherent Cells:** Media recommendations and Protocol for passaging adherent cells.	3
5.	**Subculturing Suspension Cells:** Passaging suspension cultures, suspension culture vessels, and Protocol for passaging suspension cells.	3
6	**Freezing Cells:** Guidelines for cryopreservation, freezing medium, and Protocol for cryopreserving cultured cells.	2
7.	**Thawing Frozen Cells:** Guidelines for thawing, materials needed, and Protocol for thawing frozen cells.	2
8.	**Cell Counting Methods:** Hemocytometer, automated cell counters.	2
9.	**Cytotoxic studies:** MTT Assay, LDH assay	2
10.	**The Third Dimension in Cell Culture** Fundamentals, types and applications of 3D-Cell Cultures.	2
Total		**60**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exam	5th & 10th weeks	30 %
2.	Quizzes, presentations, lab reports, participation, attendance, data search, assignments	Throughout the semester duration	30 %
4	Final lab exam	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Kasper, C.; Charwat, V.; Lavrentieva, A.(2018). Cell Culture Technology, 1st ed.; Springer International Publishing: Berlin/Heidelberg, Germany, 2018; ISBN 978-3-319-74854-2. -Davis JM. (2011). Animal Cell Culture: Essential Methods. Wiley-Blackwell, John Wiley & Sons: Chichester, UK. Doi:10.1002/9780470669815.
Supportive References	https://www.kbcc.cuny.edu/academicdepartments/bio/documents/Bio_57_syllabus.pdf https://education.ki.se/course-syllabus/1BA017/6305 https://www.btec.ncsu.edu/academic/courses/bit466-566.php
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Well-equipped lab
Technology equipment (Projector, smart board, software)	Projector and smart board
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Techniques in Cell and Molecular Biology**
Course Code:	**BIO-6202**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2+ Lab 2)				
2. Course type				
A.	☐University	☐College	☐ Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 2 / first year)				

4. Course general Description:

This graduate course provides the students with the principal and practical applications of both conventional and modern techniques in cell and molecular biology. The course covers a variety of topics of interest to students who study and do research work in the area of molecular biology as well as cell-related issues. Practical skills in fundamental techniques such as DNA and RNA extraction, quantification and electrophoresis are focused in this course. Through the course study, the student's lab skills are upgraded to encompass the advanced relevant techniques including standard Polymerase chain reaction (PCR), primer design and real-time PCR. The course emphasizes experimental design, execution, and data analysis. The acquired knowledge and skills enable the students to perform research work independently and share in collaborative projects culminating in a comprehensive understanding of fundamental methodologies in molecular biology. Upon successful completion of the course, the students become competent to contribute professionally in the disciplines of molecular biology.

5. Pre-requirements for this course (if any)**:**

None

6. Co-requisites for this course: (if any)**:**

None

7. Course Main Objective(s):

This course is designed to equip students with a set of recognizable skills and knowledge to conduct impactful molecular biology research. Starting with an acquaintance of introductory techniques such as DNA and RNA extraction and quantification, students progressively manage to master complex methodologies such as polymerase chain reaction (PCR) and real-time PCR. The course aims to build up student ability in experimental design, execution, and data analysis; and simultaneously strengthens students' capability to independently or collaboratively undertake projects within a research context. Through hands-on experience with modern laboratory equipment, students will develop a robust understanding of the practical applications and significance of molecular biology in scientific exploration.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	30
3.	**Field**	
4.	**Tutorial**	0
5.	**Others (specify)……**	
	Total	60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Outline the principles of nucleic acids extraction and quantification methods.	K1	-Lab demonstrations -Tutorials -Guided hands-on practice	-Active participation in lab discussions. -Lab reports -lab exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	Describe the advanced molecular biology techniques, such as PCR and real-time PCR, and identify the necessary lab equipment.	**K2**	-Lab demonstrations -Tutorials -Guided hands-on practice	-Active participation in lab discussions. -Lab reports -Lab exam
1.3	Explain the considerations and list the essential tools related to primer design.	**K3**	-Lab demonstrations -Tutorials	-Active participation in lab discussions. -Lab reports -Lab exam
2.0	**Skills**			
2.1	Employ hands-on skills to conduct experimental work in molecular biology using the proper methods and techniques.	**S1**	-Guided Lab work -Lab tutorials	-Direct observations -Lab reports -Lab exam
2.2	Design experimental work and relate the theoretical knowledge to the applicable methodology as a mode of carrying out professional research work.	**S2**	-Guided lab experiments -Group discussions	-Lab reports -Presentations
2.3	Evaluate, interpret, and analyze the results of molecular research using the appropriate analytical methods.	**S3**	-Guided analysis of research data -Group discussions	-Lab reports -Presentations
3.0	**Values, autonomy, and responsibility**			
3.1	Show independence in performing lab work and collaborating effectively in teamwork.	**V1**	-Monitored lab research work –Group discussions	-Lab reports -Presentations by research groups
3.2	Participate in the discussions of specialized molecular issues, and present scientific data professionally as oral	**V2**	-Tutorials on presenting research data -Seminars -Group discussions	-Active participation -Presentations

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	presentations as well as in written format			
3.3	Practice the ethical conduct of research and follow the approved research principles.	**V3**	-Tutorials on research ethics and principles	-Lab reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Introduction to Molecular Biology Laboratory:** -Solution preparation and dilution -Pipetting	2
2.	**Genomic DNA Extraction:** -Phenol Chloroform Extraction -DNA Extraction Kits	2
3.	**RNA Extraction:** -RNA Isolation with Extraction Kits.	2
4.	**DNA and RNA quantification by Spectrophotometric Assay:** -Determination of DNA Purity and Concentration by Spectrophotometric Assay.	2
5.	**Electrophoresis:** -Separation of DNA Fragments in Agarose Gel	2
6.	**Primer Design:** -General Considerations in Primer Design. -Web-Based Tools for Primer Design.	2
7.	**Polymerase Chain Reaction (PCR) Optimization:** -Principles of PCR -Amplification of a target gene. -Gel electrophoresis to analyze PCR products	4
8.	**RNA Extraction and Reverse Transcription:** -RNA extraction from cells with Trizol Reagent -Reverse transcription of RNA to cDNA.	2
9.	**Real-time PCR (qPCR):** -Principles of real-time PCR -Designing qPCR primers and probes	4

	-Setting up a qPCR reaction.	
10.	**Analysis of qPCR data and quantification of target gene expression**: -Absolute and relative quantification -2^(–delta delta CT).	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exams	5th and 10th weeks	30 %
2.	Quizzes, presentations, lab reports, participation, attendance, data search, assignments	Throughout the semester duration	10 %
	Final lab exam	15th week	20%
4	Final exam	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Wilson K., Walker J. (2018). Principles and Techniques of Biochemistry and Molecular Biology. 8th Edn. Cambridge University Press.
Supportive References	
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Well-equipped lab
Technology equipment (Projector, smart board, software)	Projector and smart board

Items	Resources
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Molecular Genetics**
Course Code:	**Bio-6210**
Program:	**Master of Science in Applied Biology (Molecular Genetics)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2 + Lab 0)				
2. Course type				
A.	☐University	☐College	☐ Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 2 / first year)				
4. Course General Description:				
This graduate course focuses on the study of different types of inheritances. It exhibits the role of genes then chromosome formation within the nucleus of cells, which play a crucial role in facilitating appropriate cellular divisions and development to all living organisms, especially human beings. This knowledge flow provides an in-depth examination of the biological systems at the molecular level in both prokaryotic and eukaryotic organisms. This course is centered on Mendelian laws and extends after Mendelian theories. The topics covered in this course include monohybrid and dihybrid crosses (Mendelian Genetics); genetics for a single gene (with two alleles or more); quantitative genetics (polygenic inheritance); lethal alleles and related human diseases like fauvism and Huntington's disease; types of mutations; gene mapping; and population genetics principles. Types of mutations and related genetic diseases are also addressed.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requisites for this course (if any)**:**				
None				
7. Course Main Objective(s):				
The course intends to provide students with essential knowledge about genetic composition starting from the role of nucleic acids. Furthermore, it aims to provide students with a thorough comprehension of DNA packaging, chromatin formation, remolding chromatin, euchromatin and heterochromatin, and finally chromosome karyotyping. Moreover, it provides students with a thorough understanding of the fundamental principles of different types of inheritances in both prokaryotes and eukaryotes.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	• Traditional classroom	√	100%
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	16
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	8
5.	**Others (specify) ……**	-
	Total	**30**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**List genetic vocabularies and the general concepts around it.**	K1	-Lectures -Class participation	-Written examination -Class participation, -Assessment of assigned work
1.2	**Outline Mendelian and non-Mendelian inheritance, and clarify Mendelian laws**	K2	-Lectures -Class participation	-Written examination -Class participation,

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
	when inheritance is related to more than two pairs of genes.			-Assessment of assigned work
1.3	**Explain the genes conversions into chromatin fibers then finally into chromosomes.**	K3	-Lectures -Class participation	-Written examination -Class participation, -Assessment of assigned work
2.0	**Skills**			
2.1	**Summarize the fundamentals of population genetics, analyze mutations into gene and chromosomal mutations, and illustrate gene mapping.**	S1	-Lectures -Class participation -Group discussions	-Presentations -Reports
2.3	**Interpret how sexual reproduction produces genetic varieties and the differences between Sex chromosomes-linked traits and Sex-influenced traits**	S2	-Lectures -Class participation -Group discussions	-Presentations -Reports
3.0	**Values, autonomy, and responsibility**			
3.1	**Organize information from a variety of sources (textbooks, research papers and review articles), and use technology to prepare and process information**	V1	-Class participation -Group discussions	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
3.2	**Demonstrate the ability to communicate scientific issues effectively both orally and in writing**	V2	-Class participation -Group discussions	-Presentations -Reports
3.3	**Show independence in performing assigned tasks and cooperate as an active member of a team**	V3	-Class participation -Group discussions	-Presentations -Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Introduction Molecular Genetics and definitions of Genetic concepts**	**2**
2.	**Monohybrid and Dihybrid Crosses (Mendelian Genetics):** -Alleles of Each Gene Segregate from Each Other During Gamete Formation -Alleles of Each Gene Segregate Independently of the Alleles of Other Genes	**2**
3.	**Genetics for a Single Gene (with two alleles):** **Degrees of Dominance:** Genetics for a Single Gene (more than two alleles (Multiple Alleles) Examples: human blood types(ABO grouping), coat color in rabbits	**2**
4.	**Genetics for two or more genes :** Types of Gene Interactions -Allelic/non-epistatic gene interaction -Non- Allelic/epistatic gene interaction -Complementary gene interaction	**2**
5.	**Quantitative Genetics :** **Polygenic Inheritance:** -In humans, height, weight, and skin color are examples of quantitative traits **Lethal genes and their types:** -Dominant lethal allele: ex. Huntington's-disease -Recessive lethal allele -Conditional lethal alleles: e.g. Fauvism	**4**
6.	**DNA Packaging:** -Bacteria Package DNA in Bacterial Chromosomes and Plasmids	**4**

	-Eukaryotes Package DNA in Chromatin and Chromosomes -Nucleosomes Are the Basic Unit of Chromatin Structure -Changes in Histones and Chromatin Remodeling Proteins Can Alter Chromatin Packing -Chromosomal DNA Contains Euchromatin and Heterochromatin -Chromosomes Can Be Identified by Unique Banding Patterns -Eukaryotic Chromosomes Contain Large Amounts of Repeated DNA Sequences	
7.	**Chromosome theory of inheritance and Karyotyping:** -Sexual Reproduction Produces Genetic Variety -Meiosis Generates Genetic Diversity **Complete linkage – incomplete linkage – crossing over**	**2**
8.	**Sex inheritance and genetic diseases:** **Sex-linked characteristics in humans:** -Colorblindness -Hemophilia -Short-sightedness -Muscle atrophy -Sex chromosomes-Linked traits and Sex-influenced traits	**2**
9.	**Mutations:** Gene mutations Chromosome mutations	**2**
10.	**Population genetics and Gene Mapping**	**2**
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20 %
2.	**Midterm exam-2**	10th week	20%
3.	**Quizzes, participation, reports, presentations, attendance**	Throughout the course duration	20 %
4.	**Final Exam**	16th week	40 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Bruce Alberts et al., Essential Cell Biology, Third edition, London, UK. (2009). ISBN-13: 978-0815341291. -Lodish, et al. Molecular Cell Biology. 5th ed. New York, NY: W.H. Freeman and Company, (2003). ISBN: 9780716743668. -Becker's WORLD OF THE CELL TENTH EDITION Jeff Hardin and James P. Lodolce(2022) -Robert F. Weaver. (2011) Molecular Biology, 5th Edition, McGraw-Hill Education. -Michael M. Cox, Jennifer Doudna, Michael O'Donnell. (2015) Molecular Biology: Principles and Practice, 2nd Edition, W. H. Freeman.
Supportive References	
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector, Smartboard
Other equipment (Depending on the nature of the speciality)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Epigenetics**
Course Code:	**BIO-6216**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2 +Lab 0)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☒ Required		☐ Elective	
3. Level/year at which this course is offered: (Level 2/ first year)				

4. Course General Description:

This graduate course provides the students with the rigorous foundations in epigenetics. Epigenetics by definition is the study of how cells modulate gene activity without altering the DNA sequence, i.e. the factors beyond the genetic code. Epigenetic changes modify DNA in a way that regulates gene expression without changing the sequence of DNA building blocks. Epigenome implies all the modifications that regulate the activity (expression) of the genes. This course emphasizes diverse topics such as the various epigenetic mechanisms, how the epigenetic status of the genome is formed and maintained, and the role of epigenetic factors in gene regulation. The involvement of epigenetics in disease development and the modern approaches to assessing epigenetic changes of the genome are also focused.

5. Pre-requirements for this course (if any)**:**

None

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

The objective of this course is to provide the students with a fundamental theoretical understanding of complex Epigenetic Phenomena. The course familiarizes the student with the current technology and drives principles of epigenetics. Among the course aims is to allow the students to identify the state-of-the-art experimental approaches in "Epigenetics and Chromatin Research".

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify) ……**	
	Total	30

B. Course Learning Outcomes, Teaching Strategies, Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Distinguish epigenetic inheritance from genetic**	**K1**	Two credits weekly lectures	-Quizzes -Presentations -Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	inheritance and the mechanisms of both.			-written exams
	List the various methods used to assess gene-specific and genome-wide epigenetic changes	**K2**	Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
1.2	**Outline the structure and organization of chromatin and how it plays a role in epigenetic regulation**	**K3**	Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
2.0	Skills			
2.1	**Interpret and analyze the role of DNA methylation in epigenetic gene regulation**	**S1**	-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.2	**Relate between the epigenetic changes and various disorders that can result from these changes**	**S2**	-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.3	**Design a research study in epigenetics using critical thinking and the acquired skills**	**S3**	-Two credits weekly lectures -Tutorials	-Presentations -Reports
3.0	Values, autonomy, and responsibility			
3.1	**Show independence and responsibility and cooperate effectively in a team to carry out research work**	**V1**	Group discussions	-Presentations -Reports
3.2	**Discuss the scientific issues and present research results via oral presentations and in written format.**	**V2**	Group discussions	-Presentations -Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Fundamental principles about epigenetics:** - Epigenetics as a new frontier in biology - Genetics to epigenetics - The Epigenome	4
2.	**The mechanisms and molecules that regulate epigenetic processes:** - Chromatin modifications - DNA methylation and non-coding RNAs - Dynamic organization of the genome and epigenetic processes	4
3.	**Epigenetic phenomena in different animal model organisms:** - X chromosome inactivation in Mammals - Transgenerational epigenetic inheritance in animals	3
4.	**How can epigenetics influence the life of an organism?** - Inheritance of chromatin modifications - Epigenetic reprogramming and genomic imprinting - Epigenetic and cell differentiation - Epigenetic variations in human populations	4
5.	**Environmental epigenetics:** - Nutrition drives heritable epigenetic changes - Epigenetic inheritance of environmental stresses - Epigenetic control of selfish elements during environmental changes	3
6.	**Epigenetic mechanisms in diseases:** - Epigenetics and aging - Epigenetic mechanisms in metabolic diseases - Epigenetic in cancer - Therapeutic epigenetic approaches to cancer	4
7.	**Future perspective:** - New frontiers of epigenetic research -Epigenetic discoveries for human society	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20%
2.	**Midterm exam-2**	10th week	20%
3.	**Assignments, presentations, attendance, data search, participation**	Throughout the course duration	20%
4.	**Final exam**	16h week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Benjamin A Pierce. (2020). Genetics: a conceptual approach. 7th edition W.H. Freeman. ISBN-13-978-1319216801.
Supportive References	https://www.kaust.edu.sa
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector, smart board
Other equipment (Depending on the nature of the speciality)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students' assessment	Faculty	Direct

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title: Cell Imaging
Course Code: BIO-6310 (Lab Course)
Program: Master of Science in Applied Biology
Department: Biology
College: Science
Institution: Imam Mohammad Ibn Saud Islamic University
Version: 1
Last Revision Date: *Pick Revision Date.*

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عبد الملك عبد العزيز عبد الله رحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: 2(Lecture 1+ Lab 2)				
2. Course type				
A.	☐University	☐College	☐ Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 3 / second year)				
4. Course general Description:				
This graduate course offers a comprehensive exploration of cell imaging techniques, encompassing fundamental principles and practical applications. It equips biology students with the necessary knowledge to employ imaging techniques and processing of images for the benefit of their research. The course content covers specialized topics related to light microscopy as well as fluorescence microscopy. Additionally, the students through studying this course become familiar with some imaging techniques such as flow cytometry, cell migration, and electron microscopy. The course allows the students to gain hands-on experience in using Image software for image processing. The course further covers the imaging techniques of cell migration and software employed for image analysis.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requisites for this course: (if any)**:**				
None.				
7. Course Main Objective(s):				
The course aims to provide students with a comprehensive understanding of cell imaging techniques. Acquaintance of light microscopy and fluorescence microscopy, and mastering staining techniques such as DAPI for nuclear visualization are among the course objectives. Through research projects, students will apply the appropriate imaging techniques as research tools to elucidate and confirm research results. The application of multiple imaging techniques with the other techniques in cell and molecular biology enhances the research quality and integrity.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		-
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	15
2.	**Laboratory/Studio**	30
3.	**Field**	-
4.	**Tutorial**	
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Outline the principles of cell culture imagining and its application.	K1	-Lab Presentations and group discussions to introduce the cell imaging techniques	-Active participation in lab discussions. -Lab reports -lab exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	Demonstrate acquaintance with diverse imaging modalities such as light microscopy, fluorescence microscopy, electron microscopy, and flow cytometry.	**K2**	-Practical sessions to demonstrate types of microscopy and flow Cytometry technique -Lab discussions	-Active participation in lab discussions. -Lab reports -Lab exam
1.3	Identify a range of software used to process and analyze cell images.	**K3**	Laboratory sessions to demonstrate software applications	-Active participation in lab discussions. -Lab reports -Lab exam
2.0	**Skills**			
2.1	Apply practical skills to operate and optimize the various imaging instruments including light and electron microscopes, and flow cytometers.	**S1**	-Guided Lab work -Lab tutorials	-Active participation in lab sessions. -Lab reports -Lab exam
2.2	Design and conduct research work that is based on imaging and microscopy analysis of living cells**.**	**S2**	-Guided lab experiments -Group discussions	-Lab reports -Presentations
2.3	Use the Image software, and employ professional skills to apply digital image processing and analysis.	**S3**	-Guided hands-on lab work to apply digital imaging and analysis using proper software -Group discussions	-Active participation in lab applications -Presentations
3.0	**Values, autonomy, and responsibility**			
3.1	Show independence in carrying out research projects and cooperate effectively with a research team.	**V1**	-Guided lab research work -Group discussions	-Lab reports -Presentations by research groups
3.2	Share in discussions of scientific issues and demonstrate proficiency in presenting	**V2**	-Tutorials on presenting research data -Seminars	-Presentations -Lab reports

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	research results to varied audiences.		-Group discussions	
3.3	Adhere to values of responsibility in handling cell imaging techniques.	**V3**	-Tutorials on research ethics	-Lab reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Introduction to Cell Imaging:** -Overview of Cell Biology. -Historical Perspectives of cell imaging techniques. -Importance of cell imaging in research	2
2.	**Light Microscopy Basics:** -Principles of Light Microscopy. -Bright field and phase-contrast microscopy. -Microscope components and operation.	2
3.	**Fluorescence Microscopy:** -Introduction to fluorescence microscopy -Principles of fluorescence and fluorophores. -Fluorescent dyes used in cell Imaging.	2
4.	**Applications of Fluorescence Microscopy (Dye Staining):** -Nuclear staining techniques. -Applications in chromatin and DNA Studies -DAPI staining and Hoechst.	3
5.	**Flow Cytometry Basics:** -Introduction to flow cytometry. -Principles of flow cytometry: Light scattering and fluorescence	2
6.	**Applications of Flow Cytometry:** -Cell cycle analysis. -Detection of apoptotic cells by flow cytometry. -Imaging of flow cytometry analysis	3

7.	**Cell Imaging of Cell Migration:** -Overview of cell migration and its applications in molecular research. -Scratch assay (wound healing assay) -Imaging of migrating cells	2
8.	**Electron Microscopy:** -Principles of transmission electron microscopy (TEM). -Structure of TEM -Stains used to contrast cells in TEM -Imaging of cellular ultrastructural details	2
9.	**Electron Microscopy:** -Principles of scanning electron microscopy (SEM). -Structure of SEM -Coating of specimen surface -Imaging of surface details	2
10.	**Imaging of DNA**	2
11.	**Introduction to Imaging Software:** -Overview of digital imaging and its capabilities. - Importance of Image analysis in the procedures of cell imaging.	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exams	5th & 10th weeks	30 %
2.	Quizzes, presentations, lab reports, participation, attendance, data search, assignments	Throughout the semester duration	30 %
4	Final lab exam	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Scott, M. P., Bretscher, A. Matsudaira, P. (2021). Molecular Cell Biology (9th ed.). W. H. Freeman D.J. Taatjes, J. Roth.(2013). Cell imaging Techniques: Methods and Protocols (2nd ed.), Humana Press, New York. Kubitscheck, U. (2019). Fluorescence Microscopy: From Principles to Biological Applications. Wiley. Ormerod, M. G. (2006). Flow Cytometry: A Practical Approach (3rd ed.), Wiley.
Supportive References	https://www.gu.se/sites/default/files/202008/SC00004_Course_syllabus.pdf
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Well-equipped lab
Technology equipment (Projector, smart board, software)	Projector and smart board
Other equipment (Depending on the nature of the specialty)	Light and fluorescent microscopes

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of students assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title: Genetic Engineering and Genomics
Course Code: BIO-6312
Program: Master of Science in Applied Biology (Cell and Molecular Biology)
Department: Biology
College: Science
Institution: Imam Mohammad Ibn Saud Islamic University
Version: 1
Last Revision Date:

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2+ Lab 2)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 3 / second year)				

4. Course general Description:

This course introduces the students to the molecular methods and applications of recombinant DNA technology as well as the structural and functional genomics. This graduate course focuses on tools of genetic engineering (vectors and enzymes), genetic engineering blotting techniques, application of recombinant technology to diagnostics and therapeutics. Genome definition and function, genome variations and diversifications, and structural organization of eukaryotic genomes, organelle genomes, sequencing and mapping, and comparative genomics are among the topics covered in this course. The course also places an emphasis on transcriptomes, population genetics and genomics, basic bioinformatics, population-level variation (SNPs, MNPs, and indels), evolutionary genomics, and functional genomics.

5. Pre-requirements for this course (if any)**:**

None

6. Co-requirements for this course (if any)**:**

None

7. Course Main Objective(s):

The major aim of this graduate course is to provide a comprehensive knowledge, via lectures, tutorials, and lab activities, to the students regarding the modern concepts of genetic engineering and genomics. The course also aims to develop professional laboratory skills and practices that enable the students to perform research activities in the multidisciplinary fields of genetic engineering. The students, by the aid of the acquired knowledge, become competent to recognize and explain databases about genes and genomes.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		-
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	30
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify) .....**	
	Total	60

C. Course Learning Outcomes, Teaching Strategies, and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Explain the concepts of genetic engineering including those related to techniques, applications and limitations**	K1	Three credits weekly lectures	-Quizzes -Presentations -Assignments -Classroom discussions -Written exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	**Outline the structural organization of eukaryotic nuclear and organelle genomes**	K2	Three credits weekly lectures	-Quizzes -Presentations -Assignments -Classroom discussions -Written exams
1.3	**Describe the modern sequencing techniques and the whole genome sequencing strategies**	K3	Three credits weekly lectures	-Quizzes -Presentations -Assignments -Classroom discussions -Written exams
1.4	**List the lab tools that are necessary to identify and analyze genes and genomes**	K4	Three credits weekly lectures	-Quizzes -Presentations -Assignments -Classroom discussions -Written exams
2.0	**Skills**			
2.1	**Practice the different techniques applied in the lab settings of genetic engineering**	S1	-Lab demonstration -Independent lab activities	-Lab reports -Lab exams
2.2	**Apply genome-wide and high-throughput DNA and RNA analyses in order to detect genomic variations and changes in gene expression**	S2	-Lab demonstration -Independent lab activities	-Lab reports -Lab exams
2.3	**Interpret and analyze the genomic data by employing the appropriate analytical methods**	S3	-Lab demonstration -Independent lab activities	-Lab reports -Lab exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.4	**Propose and conduct a research work using the different methods of genetic engineering, and genome sequencing and assembly.**	S4	-Lab demonstration -Independent lab activities	-Lab reports -Lab exams
3.0	**Values, autonomy, and responsibility**			
3.1	**Perform a research work independently, and cooperate effectively in team activities.**	V1	Group discussions	-Performance -Participation -Lab reports
3.2	**Participate in discussions of the scientific issues, and present scientific data to a varied audience**	V2	Group discussions	-Performance -Participation -Lab reports
3.3	**Adhere to the ethics related to the research activities in the field of genetic engineering and genomics**	V3	Group discussions	-Performance -Participation -Lab reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Tools and Techniques of Genetic Engineering:** -Tools: restrictions enzymes, vectors, CRISPR-Cas -Techniques: PCR, RAPD, RFLP, AFLP, Cloning, blotting, Isolation of Chromosomes, In Situ Hybridization, Next-Generation Sequencing Technologies, Sequencing an Entire Genome, Creating Random Mutations, Site-Directed Mutagenesis, Knockout, Silencing Genes with RNAi,	**4**
2.	**Introduction To Genomics:** What is a genome? How does my genome work?	**2**
3.	**Basic Aspects of Gene Expression & Regulation** Eukaryotic gene expression	**4**

4.	**Structural Genomics** Genetic Maps Physical Maps Sequence Variation: The Denaturation and Renaturation of DNA, copy-Number Variations Single-Nucleotide Polymorphisms Expressed-Sequence Tags Bioinformatics Metagenomics Synthetic Biology	**8**
	Functional Genomics Predicting Function from Sequence Gene Expression and Microarrays Gene Expression and Reporter Sequences Genome wide Mutagenesis	**4**
5.	**Genome Models** Saccharomyces cerevisiae, Drosophila melanogaster Caenorhabditis elegans Danio rerio Mus musculus Rattus norvegicus	**4**
6.	**Comparative Genomics** Syntheny, homologous and orthologous genes Eukaryotic Genomes Comparative Drosophila Genomics The Human Genome Comparison of Human and Chimpanzee Genomes Is Helping to Reveal Genes That Make Humans Unique?	**4**
7.	**Sequenced Genomes Databases** The Genome Sequence DataBase (GSDB), Database of Genomic Structural Variation (dbVar), Database of Genotypes and Phenotypes(dbGaP)	**8**
9.	**Proteomics Analyzes** Determination of Cellular Proteins Affinity Capture Protein Microarrays Structural Proteomics	**8**
	The Saudi Genome Project: -Database 0f Genetic Information	**2**
Total		**60**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	15%
2.	**Midterm exam-2**	10th week	15%
3.	**Assignments, presentations, attendance, participation**	Throughout the course duration	10%
4.	**Final lab exam**	15th week	20%
...	**Final exam**	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Desmond S. T. Nicholl (2023). An Introduction to Genetic Engineering, 4th edition, Cambridge University Press, ISBN-13-978-1009180597. -Arthur M. Lesk (2017). Introduction to Genomics, 3rd edition, Oxford University Press ISBN-13- 978-0198754831. -Benjamin A Pierce (2020) Genetics: a conceptual approach. 7th edition W.H. Freeman. ISBN-13-978-1319216801.
Supportive References	https://harvard.simplesyllabus.com https://m.mu.edu.sa
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom, laboratories
Technology equipment (Projector, smart board, software)	Projector, smart board
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Cell Signalling and Communication**
Course Code:	**BIO-6314**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (2Lecture 2+ Lab 2)					
2. Course type					
A.	☐University	☐College	☐Department	☒ Track	
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 3 / second year)					
4. Course general Description:					
This graduate course provides the students with concepts of the major cellular signalling events, starting at the cell surface and ending up in the nucleus. The course contents illustrate the mechanisms through which the cells communicate with each other and their microenvironment. The signalling events that result from these interactions and their translation into cellular responses are also emphasized.					
5. Pre-requirements for this course (if any)**:**					
None					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
The objective of this graduate course is to provide an in-depth understanding of specialized areas of cell biology relevant to cellular signalling pathways. The course also aims to clarify how cells interact/communicate specifically with their microenvironment. Developing an appreciation for the signalling pathways that mediate cellular responses and the related molecular mechanisms underlying these processes.					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	30
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify) ……**	-
	Total	60

B. Course Learning Outcomes, Teaching Strategies, Assessments Methods

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**List the different types of cellular receptors and their characteristics**	K1	Two credits weekly lectures	-Quizzes -Presentations -Assignments -Written exams
1.2	**Describe the major signaling pathways by which cells communicate with each other and with the extracellular matrix, and the molecular components of these communication pathways**	K2	Two credits weekly lectures	-Quizzes -Presentations -Assignments -Written exams

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.3	**Explain how the various signaling pathways lead to specific cellular responses**	K3	Two credits weekly lectures	-Quizzes -Presentations -Assignments -Written exams
2.0	**Skills**			
2.1	**Compare the various types of cell signalling encountered in multicellular organisms**	S1	-Two credits weekly lectures -Lecture discussions and tutorials	-Quizzes -Presentations -Assignments -Written exams
2.2	**Relate critically between the internal receptors and the cell-surface receptors**	S2	-Two credits weekly lectures -Lecture discussions and tutorials	-Quizzes -Presentations -Assignments -Written exams
2.3	**Demonstrate the connection between cellular signal pathways and medical phenomena**	S3	-Two credits weekly lectures -Lecture discussions and tutorials	-Quizzes -Presentations -Assignments -Written exams
3.0	**Values, autonomy, and responsibility**			
3.1	**Participate in discussions to show how mutations in signalling proteins lead to dysregulated biological outcomes**	V1	-Group discussions	-Participation -Presentations
3.2	**Demonstrate the ability to independently identify questionable research issues in the area of cell signalling and suggest possible approaches**	V2	Group discussions	Performance Evaluation-Participation -Presentations

C. Course Content:

No	List of Topics	Contact Hours
1.	**Introduction to cell signaling**: -Overview of cell signalling: Signaling, Signal transduction, ligand, receptors - Forms of signalling in general: Paracrine, Synaptic, Autocrine, Endocrine, cell-cell contact, Types of Receptors	4
2.	**Intercellular signalling pathways: Basics:** - Tools for Intercellular Signaling - Steps of Intercellular Signaling - Regulation of Intercellular Signaling - Hormones in Intercellular Signaling	4
3.	**Intracellular signalling: Basics:** - Reception of External Signals - Activation and Deactivation of Signaling Proteins - Processing of Multiple Signals	4
4.	**Intracellular Signaling and Molecular Tools:** - Variability of Signaling Proteins - Molecular Tools for Intracellular Signaling - Basic Mechanisms of Intracellular Signaling - Modular Structure of Signaling Proteins and Signaling Complexes	4
3.	**Organization of intracellular Signaling and Cell-type Specificity:** - Linear Signaling Pathways, Branching and Crosstalk - Signaling Networks - Redundancy and Specificity of Signaling Redundancy - Regulation of Signaling Pathways - Spatial Organization of Signaling Pathways - Compartmentalization and Transport - Evolution of Signaling Pathways - Cell-type Specificity: expression, splicing, stability, posttranslational modification, subcellular localization	4
4.	**Extracellular signalling:** -Types of signal molecules and specific receptors - Steps of extracellular signals -G-protein–coupled receptors - Gs cAMP Dependent Pathway - Gi cAMP Dependent Pathway	4
5.	**Extracellular matrix (ECM) signalling in morphogenesis and tissue repair:** - ECM signalling via cellular receptors	4

	- ECM signaling via proteolytic cleavage - ECM signalling via exposure of cryptic sites	
6.	**Extracellular Matrix and Cell Signaling Transduction:** - Integrin Cell Signaling Pathway Transduction - Growth Factor Signaling Transduction - Cell Signaling Transduction Related Cell Adhesion	4
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20%
2.	**Midterm exam-2**	10th week	20%
3.	**Assignments, presentations, attendance, data search, participation**	Throughout the course duration	20%
...	**Final exam**	16th exam	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Hancock, J. (2010). Cell Signaling. 3rd Edn. Oxford University Press, ISBN- 13:9780199232109.
Supportive References	
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector, smart board
Other equipment (Depending on the nature of the speciality)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Project Planning and Proposal Writing**
Course Code:	**BIO-6391**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (Lecture 2 + Lab 0)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 3/ second year)				
4. Course General Description:				
This graduate course is designed to provide the students with the basic guidelines for writing research proposals and planning research projects. The course focuses on the key points that render the proposal and project plan in an integrated form which undoubtedly reflect the outcomes of the intended research work. The course content emphasizes that proposal writing and project planning are an aforethought process that requires employing background knowledge and writing skills. It is explained that the proposal should reveal the biological problem in question and how this problem is addressed through performing the research work. It is stressed in the course content that the expected research outcomes should be clarified in the proposal objectives. It also emphasizes the additive impact of the anticipated research results on the current knowledge in the relevant biology disciplines. The course explains how project planning is strongly related to the quality of proposal writing.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requirements for this course (if any)**:**				
None				
7. Course Main Objective(s):				
The course's main objectives are centred on the process of proposal writing and project planning. The course aims to equip the students with the necessary knowledge and the required skills to reach a well-written research proposal and a well-planned research project. Elements of a high-quality proposal and fundamentals of an integrated project plan are key objectives of the course. The course aims also encompass paying the student attention to the importance of involving the biological problem that needs to be addressed in the proposal content. In addition, the course aims to provide the students with the skills necessary to plan a well-organized research project to address the problem in question using the most convenient research tools.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify) .....**	
	Total	30

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Describe the major considerations in writing an acceptable research proposal in compliance with the relevant biology speciality**	**K1**	-Two-hour credit lectures -Demonstrations -Tutorials	-Assignments -Reports -Data Search -Participations -Written exams
1.2	**Outline the proposal elements and the finalizing steps to**	**K2**	-Two-hour credit lectures -Demonstrations	-Assignments -Reports -Data Search

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
	submit a research proposal as a crucial step preceding conducting a research work		-Tutorials	-Participations -Written exams
1.3	**Explain the key points in planning a research project and how to maintain the research integrity**	**K3**	-Two-hour credit lectures -Demonstrations -Tutorials	-Assignments -Reports -Data Search -Participations -Written exams
2.0	Skills			
2.1	**Employ the acquired knowledge, critical thinking, and skills to reach a well-written research proposal**	**S1**	-Two-hour credit lectures -Demonstrations -Tutorials -Class discussions	-Assignments -Reports -Data Search -Participations -Presentations -Written exams
2.2	**Design a well-planned research project and select the most convenient research methods and techniques to solve a biological problem**	**S2**	-Two-hour credit lectures -Demonstrations -Tutorials -Class discussions	-Assignments -Reports -Data Search -Participations -Presentations -Written exams
2.3	**Relate between the plan of the project and the objectives of the approved research proposal**	**S3**	-Two-hour credit lectures -Demonstrations -Tutorials -Class discussions	-Assignments -Reports -Data Search -Participations -Presentations -Written exams
3.0	**Values, autonomy, and responsibility**			
3.1	**Perform research work independently and cooperate effectively with a teamwork**	**V1**	-Group discussions	-Reports -Presentations
3.2	**Communicate scientific issues**	**V2**	-Group discussions	-Reports -Presentations

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
	professionally with peers and present a research proposal clearly as an oral presentation or written format			
3.3	**Adhere to the relevant ethical rules while writing a proposal or planning a research project**	**V3**	-Group discussions	-Reports -Presentations

C. Course Content:

No	List of Topics	Contact Hours
1.	**Objectives of a Research Proposal Writing:** -Showing how the intended research work fits into the topic of research -Clarifying the biology question(s) that will be answered -Explain what findings will be added to the current knowledge	**4**
2.	**Proposal Narrative:** Generation of an outline, choosing a meaningful title, and resources	**4**
3.	**Essential Proposal Elements (Composing a research proposal):** -A discernible logic flow from the introduction to references -Title, introduction, background literature, objectives (goal statement), experiment or field study, materials, methods and techniques, analysis of results, expected outcomes, references, and appendices (documents supporting proposal)	**4**
4.	**Enhancing the Impact of a Research Proposal:** -Showing an in-depth understanding of the existing literature -Employing writing skills and using diagrammatic representations -Preparing research proposal to be persuasive and achievable	**4**
5.	**Utilizing the Relevant Resources:** Utilizing the resources to prepare a research proposal (internet resources, search engines, textbooks, etc.)	**4**
6.	**Finalizing the proposal format and proposal submission:** Proofreading and editing of the proposal draft	**2**
7.	**Proposal Evaluation and Approval:** -Convincing evaluators about the significance and outcomes of the intended research work	**4**

	- Obtaining approvals from various evaluation committees	
8.	**Planning Research Project:** Project objectives, background knowledge, design of experiment or field study, methods, analysis tools, showing results, and discussing findings	**4**
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20%
2.	**Midterm exam-2**	10th week	20%
3.	**Attendance, assignments, reports, presentations, participation**	Throughout the course duration	20%
...	**Final exam**	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	-Your Research Project Designing, Planning, and Getting Started. 2018. Nicholas Walliman. 4th Ed. Oxford Brookes University, UK. ISBN: 1526441209 -General Guide to Writing Research Proposal. 2019. Oso WY, -Onen D. The Jorno Kenyatta Foundation. ISBN: 9789966227164 -Research Projects and Research Proposals. 2009. A Guide for Scientists Seeking Funding. Paul G. Chapin. ISBN: 9780511500084
Supportive References	http://www.libguides.usc.edu/writingguide . https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5037942/
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (Projector, smart board, software)	Projector, smart board
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Indirect
Effectiveness of students' assessment	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Course Specification

(Postgraduate Programs)

Course Title:	**Research Project**
Course Code:	**BIO-6499**
Program:	**Master of Science in Applied Biology (Cell and Molecular Biology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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عبد الملك بن عبد العزيز بن عبد الله الرحيمي الناصر

A. General information about the course:

1. Course Identification:

1. Credit hours: (4)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 4 / second year)				
4. Course General Description:				

This graduate course provides students with the opportunity to conduct independent research projects with the guidance of academic supervisors. A research project for students is an extended essay that presents a research question for analysis and evaluation. Conduction of the research work is the subsequent step to project planning and submission of research proposals. Assigned research projects enable students to explore areas of interest across various biology disciplines, under the supervision of academic staff members. Through the independent conduction of planned projects, students are encouraged to develop and employ a range of research skills such as a collection of data from diverse sources and systematic reviewing of the relevant literature. Proper keeping of records, interpretation and analysis of research results, safe practices under laboratory and field conditions, and presentation of scientific issues are among the targeted skills. Given these skills, the students have the chance to develop a deeper understanding of research topics that are targeted in their projects. Through this course, the students are equipped with the experience of research and project management as well as the professional skills that are crucial to performing future research work. Successful completion of this course represents the cornerstone to qualify the enrolled students for graduation.

5. Pre-requirements for this course (if any)**:**

None

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

The major course objectives are centred on research planning, research conducting, and research reporting. According to course aims, the students are engaged in practical independent research focusing on their specializations to achieve the planned proposal objectives. The research project is planned and formulated in a proposal in terms of research purpose, background, methods, analysis of research results, and documentation. One of the major course objectives is to allow the students to independently manage research projects within a scheduled work-frame. The students should comply with the relevant ethical rules, and the safety measures appropriate to their research work. The course also aims to provide the students with practical skills concerning the selection and employment of the appropriate research methods.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	-	0
2	E-learning	-	0
3	Hybrid • Traditional classroom • E-learning	-	0
4	Distance learning	-	0

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	0
2.	**Laboratory/Studio**	30
3.	**Field**	30
4.	**Tutorial**	0
5.	**Others (specify)**	
	Total	60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Outline the sequence of preliminary steps, including topic approval, project planning and proposal submission, that precede the launch of a research project	K1	-	-Presentations -Reports
1.2	Explain how to balance the sections of description and analysis in scholarly writing and how to implement them in the final research report	K2	-	-Presentations -Reports
1.3	Describe how to prepare a checklist for the research project by listing the research resources and identifying the data sources, along with other requirements	K3	-	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.1	Relate the intended original research to the proposal objectives and current trends to execute experimental or field research work.	S1	-	-Presentations -Reports
2.2	Employ the theoretical knowledge and practical experience to apply the research methodologies for generating reliable data	S2	-	-Presentations -Reports
2.3	Apply critical thinking and professional skills to test research hypotheses and address the research questions	S3	-	-Presentations -Reports
2.4	Formulate the final research report, by including the applied methods, results, and analysis, in a way that reflects in-depth knowledge and practical skills.	S4	-	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate a strong sense of independence and, an attitude of accountability and responsibility while carrying out the research project.	V1	-	-Presentations -Reports
3.2	Participate in discussions relevant to the research project, communicate scientific issues, and present research results orally and in written formats to varied audiences	V2	-	-Presentations -Reports
3.3	Adhere to the relevant ethical rules and demonstrate the ability to comply with safety procedures appropriate to the research project	V3		-Presentations -Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Preliminary steps of the research project:** -The nature of the research area -Finding a research topic -Feasibility of research topic -Validity of research area -Formulating a research question, statement, or hypothesis	8
2.	**Planning and designing a research project:** -Methods for testing hypotheses -Experimental models and field studies -Experimental design -Research methods and techniques	8
4.	**Finding and evaluating sources:** -Locating, collecting and evaluating information for a specific research purpose - Acquisition of technical information - Methods of collecting information -Credible sources to make up a literature review -Up-to-date information -Relevance of sources -Validity of sources	8
5.	**Conducting research:** -Primary research (lab experiments and field studies) -Execution of research plan to achieve research goals	36
6.	**Formulating a research report:** **-Research report format** **-Components of a research report:** **Introduction:** Presenting the hypothesis and purpose of the project **Literature review:** Description of the publications, evaluating the existing research, and validating the research aims. **Methodology:**	8

	Application of Research methods to test hypothesis Quantitative (description and observation) Qualitative (Numerical) **Results and findings** **Analyzing and interpreting research data:** Statistical analysis of research data Interpretation of research results **Discussion:** Relating results to the research hypothesis, Explaining results Validating results by published data Significance of the research **Conclusion:** Summarizing the research report **References:** Listing of correctly cited references	
7.	**Presentation and evaluation of the research report:** -Presentation of research report (oral and written formats) -Evaluation of research report (supervisors and examiners)	4
Total		**120**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Oral presentation**	At the end of the project	25%
2.	**Reports**	Throughout the course duration	75%
3.	-	-	-
...	-	**Total**	**100%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Thomas G. (2022). How to Do Your Research Project: A Guide for Students. 3rd Ed. SAGE Publications Ltd. ISBN 10: 1529757711 Berry R. (2004). The Research Project. How to Write It, 5th Ed. ISBN 9780415334457 Ewart J, Ames K. (2020). Managing Your Academic Research Project. Springer Singapore. ISBN: 978-981-15-9194-5
Supportive References	https://www.gla.ac.uk/coursecatalogue/course/?code=BIOL513P https://ocasys.rug.nl/current/catalog/course/WBCH901-15
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Laboratories, equipment, instruments
Technology equipment (Projector, smart board, software)	Projector, smart board
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	-	-
Effectiveness of students' assessment	-	-
Quality of learning resources	Supervisor (s)	Direct
The extent to which CLOs have been achieved	Department and Faculty	Direct
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**

Elective. Track -I

عبد الملك عبد العزيز عبد الله رحيتي الناصر

عبد الملك عبد العزيز عبد الله رحيتي الناصر

Course Specification
(Bachelor)

Course Title:	**Statistical Analysis of Biological Data**
Course Code:	**STA 6118**
Program:	**Master of Science in Applied Biology**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2023 – V1**
Last Revision Date:	**None**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 2 Lab, 0 Tutorial)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered:					
Level 1 / Year 1					
4. Course general Description:					
This course comprehensively introduces statistical methods and their application in biological research (in Molecular Biology, Biodiversity, and Biotechnology). It is designed for graduate students in the Master of Science in Applied Biology program who seek to develop a solid foundation in statistical analysis relevant to biological data. The course offers the students the necessary skills to compute and analyze measurements of location and deviations, frequencies, and covariation. The course also emphasizes the utilization of sample data to estimate population parameters. The course focuses on applying univariate and multivariate statistical approaches and explaining statistical ideas without requiring intricate mathematical proofs.					
5. Pre-requirements for this course (if any):					
None					
6. Co-requisites for this course (if any):					
None					
7. Course Main Objective(s):					
This course comprehensively introduces statistical methods and their application in biological research (in Molecular Biology, Biodiversity, and Biotechnology). It is designed for graduate students in the Master of Science in Applied Biology program who seek to develop a solid foundation in statistical analysis relevant to biological data. The course offers the students the necessary skills to compute and analyze measurements of location and deviations, frequencies, and covariation. The course also emphasizes the utilization of sample data to estimate population parameters. The course focuses on applying univariate and multivariate statistical approaches and explaining statistical ideas without requiring intricate mathematical proofs..					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%

No	Mode of Instruction	Contact Hours	Percentage
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	**0**	**0%**
4	Distance learning	**0**	**0%**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**30**
2.	**Laboratory/Studio**	**30**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		**60**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	*Course Learning Outcomes*	*Code of CLOs aligned with program*	*Teaching Strategies*	*Assessment Methods*
1.0	**Knowledge and understanding**			
1.1	**Describe the basic statistical methods related to principal statistical inference, linear models, and probability-based methods.**	**K1**	**Lectures, problem-solving, Classroom discussions**	**Direct: Regular Exams, Lab Assignments, Practical exam**
1.2	**Identify the statistical analyses meeting the data analysis demands in biological research work.**	**K1, K2**	**Lectures, problem-solving, Classroom discussions**	**Direct: Regular Exams, Lab Assignments, Practical exam**
1.3	**Recognize the common biological types and the principles of data collection and generating descriptive statistics.**	**K1**	**Lectures, problem-solving, Classroom discussions**	**Direct: Regular Exams, Lab Assignments, Practical exam**
1.4	**Use computer programs to solve problems in Applied Biology.**	**K1, K2**	**Lectures, problem-solving, Classroom discussions**	**Direct: Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.1	**Design experiments in varied Applied Biology disciplines and test a generated hypothesis.**	**S1**	**Lectures, problem-solving, Classroom discussions**	**Direct: Regular Exams, Lab Assignment, Practical exam**
2.2	**Formulate the necessary approaches to problems relevant to biological data analysis.**	**S2, S3**	**Lecturing, Interactive learning.**	**Direct: Assignments, Practical exam**
2.3	**Evaluate the significance of critical analysis and interpretation and draw the appropriate conclusions.**	**S3, S4**	**Lecturing, Interactive learning.**	**Direct: Assignments, Practical exam**
2.4	**Utilize the appropriate statistical methods and computer analyzing packages.**	**S1**	**Lectures, problem-solving, Classroom discussions.**	**Direct: Regular Exams, Lab Assignment, Practical exam**
3.0	**Values, autonomy, and responsibility**			
3.1	**To show the ability to work independently and cooperate with a team to collect and analyze biological data.**	**V1**	**Lectures, problem-solving, Classroom discussions**	**Direct: Regular Exams, Lab Assignments, Practical exam**
3.2	**To share in specialized meetings and professionally present statistical analyses' outputs to varied audiences.**	**V2**	**Lectures, problem-solving, Classroom discussions**	**Direct: Regular Exams, Lab Assignments, Practical exam**
3.3	**To demonstrate the ability to communicate effectively varied statistical methods and their applications.**	**V4**	**Lectures, problem-solving, Classroom discussions**	**Direct: Regular Exams, Lab Assignments, Practical exam**

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction:** The Meaning of Statistics, The Uses of Statistics, Descriptive and Inferential Statistics, Sources of Data: Surveys and Experiments, Retrospective and Prospective Studies, Demographic Data, Population and Sample, Qualitative and Quantitative Data, Scales of Measurement.	**10**
2	**Exploring Data with Tables and Graphs:** Frequency Distributions for Organizing and Summarizing Data; Histograms; Graphs That Enlighten and Graphs That Deceive; Scatterplots, Correlation, and Regression. ***Applications using statistical software.***	**12**

No	List of Topics	Contact Hours
3	**Describing, Exploring, and Comparing Data:** Measures of Center; Measures of Variation; Measures of Relative Standing and Boxplots. ***Applications using statistical software.***	**12**
4	**Probability and Probability Distributions:** Basic Probability Concepts, Normal Probability Distribution, Discrete Probability Distributions: Binomial and Poisson. ***Applications using statistical software.***	**10**
5	**Estimating Parameters and Determining Sample Sizes:** Sampling and Sampling Distribution; Estimation of mean, variance and proportion for a single population; Error of estimation; Sample size determination; Estimation of the difference between 2 means, ratio of 2 variances and difference of 2 proportions for two populations. ***Applications using statistical software.***	**16**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Homeworks, Mini projects**	**During the semester**	**15%**
2.	**First Midterm**	**Week 6**	**25%**
3.	**Lab exam**	**Week 12**	**20%**
4.	**Final Exam**	**Week 15**	**40%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	1. ***Experimental Design and Data Analysis for Biologists,*** 2nd Editions; Gerry P. Quinn, Michael J. Keough, Cambridge University Press, 2023. **(Main Reference).** 2. ***The Analysis of Biological Data,*** 3rd Edition; Michael C. Whitlock; Dolph Schluter, W. E. Freeman, 2020.
Supportive References	***Analyzing Environmental Data,*** Walter W. Piegorsch, A. John Bailer, John Wiley & Sons, Ltd., 2005. ***Statistics for Environmental Science and Management,*** 2nd Edition, Bryan F. J. Manly, CRC Press, 2009.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ Each classroom should be equipped with a whiteboard and a projector. ▪ Laboratories should be equipped with computers and an internet connection.
Technology equipment (projector, smart board, software)	The rooms should be equipped with a data show and Smart Board. All computers should be equipped with the following software: • Microsoft Excel • IBM SPSS • R-Project
Other equipment (depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Each student will complete two evaluation forms during the semester and at the end of the course.
Effectiveness of Students' assessment	Instructor	At the end of each semester, the course instructor should complete the course report, which includes a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.
Quality of learning resources	Students	Each student will complete two evaluation forms during the semester and at the end of the course.
The extent to which CLOs have been achieved	Instructor	At the end of each semester, the course instructor should complete the course report, which includes a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.
Other	None	

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	4/1446
DATE	06/03/1446 (09/09/2024)