Course Specification

(Postgraduate Programs)

Course Title: Forensic Serology and DNA Fingerprinting
Course Code: BIO 6209
Program: Executive Master of Forensic Science
Department: Biology and Chemistry
College: Science
Institution: Imam Mohammad Ibn Saud Islamic University
Version: 1
Last Revision Date: 29 September 2024

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A. General information about the course:

1. Course Identification:

1. Credit hours: 3 (2 lectures, 2 laboratories, 0 tutorials)				
2. Course type				
A.	☐University	☐College	☒ Program	☐Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 3 l Year 2)				
4. Course General Description:				
This course focuses on forensic identification, analysis, and comparison of the biological evidentiary samples. Electrophoresis, DNA extraction and purification procedures. Polymerase chain reaction (PCR), and methods of genetics and DNA analysis and detection. Casework training and students will get hands-on experience.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requirements for this course (if any)**:**				
None				
7. Course Main Objective(s):				
At the end of the course, the students will be able to 1. Explain how the forensic serology discipline utilizes the genetic markers typing and DNA profiling, in criminal investigations, to associate a person, place, or item with a crime, and in civil applications, such as paternity testing, baby mix-up, and as an aid in identifying individuals. 2. Describe methods of red cell antigens, serum/plasma, red cell enzyme analysis and DNA profiling. 3. Recognize the significance of maintaining chain-of-custody of the samples and applying the laboratory safety measures. 4. Know the significance and value of quality assurance and quality control. 5. Explain fully the duties of the serologist/DNA analyst as expert witness.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	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 PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Outline the basic concepts of forensic serology as it applies to the collection, preservation and testing of biological evidence	K1	Interactive Lecture Discussion and Dialogue Mind Maps Concept Maps Standard Method Inductive Method Self-Learning Cooperative Learning Field Visits	Written tests Class discussion questions Class assignments Homework Short research/reports Summaries Presentations
1.2	State the biological evidence in criminal matters using DNA technologies,	K2, K3, K4	Interactive Lecture Discussion and Dialogue Mind Maps	Written tests Class discussion questions

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	including the methods routinely used for the isolation of DNA from cells and techniques applied to DNA quantitation, electrophoretic separation, as well as data analysis, interpretation and reporting		Concept Maps Standard Method Inductive Method Self-Learning Cooperative Learning Field Visits	Class assignments Homework Short research/reports Summaries Presentations
1.3	List the forensic serology discipline utilization the genetic markers typing and DNA profiling, in criminal investigations, to associate a person, place, or item with a crime, and in civil applications, such as paternity testing, baby mix-up, and as an aid in identifying individuals	K1, K4	Interactive Lecture Discussion and Dialogue Mind Maps Concept Maps Standard Method Inductive Method Self-Learning Cooperative Learning Field Visits	Written tests Class discussion questions Class assignments Homework Short research/reports Summaries Presentations
1.4	Recognize the significance of maintaining chain-of-custody of the samples and applying the laboratory safety measures	K2, K3	Interactive Lecture Discussion and Dialogue Mind Maps Concept Maps Standard Method Inductive Method Self-Learning Cooperative Learning Field Visits	Written tests Class discussion questions Class assignments Homework Short research/reports Summaries Presentations
1.5	Describe the significance and value of quality assurance and	K4	Interactive Lecture Discussion and Dialogue Mind Maps	Written tests Class discussion questions

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	quality control		Concept Maps Standard Method Inductive Method Self-Learning Cooperative Learning Field Visits	Class assignments Homework Short research/reports Summaries Presentations
2.0	**Skills**			
2.1	Explain the application of experimental techniques and procedures routinely used in this field	S1, S2	Practical Application Microteaching Modeling and Simulation Project-Based Learning Discovery Learning Collaborative Learning	Observation / Rating Scales Practical Tests Self-Assessment Peer Assessment
2.2	Interpret DNA data	S1, S3	Practical Application Microteaching Modeling and Simulation Project-Based Learning Discovery Learning Collaborative Learning	Observation / Rating Scales Practical Tests Self-Assessment Peer Assessment
2.3	Evaluate reports, review and testimony skills required of a DNA analyst	S2, S4	Practical Application Microteaching Modeling and Simulation Project-Based Learning Discovery Learning Collaborative Learning	Observation / Rating Scales Practical Tests Self-Assessment Peer Assessment
3.0	**Values, autonomy, and responsibility**			
3.1	Use laboratory instruments and	V1	Modeling Dialogue and	Observation Self-

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	computers		discussion Self-learning Collaborative learning	assessment Peer assessment Achievement file
3.2	Write reports and preparation of presentations and the preparation of graphics and models by using technology	V2	Modeling Dialogue and discussion Self-learning Collaborative learning	Observation Self-assessment Peer assessment Achievement file

C. Course Content:

No	List of Lecture Topics	Contact Hours
1.	Immune system, immune response, innate and acquired immunity, antigens, antibodies, haptens and adjuvants, immunoglobulin- types, physicochemical properties and function, rising of anti-sera, Lectins - their forensic significance. Buffers and serological reagents, methods of sterilization employed for serological work.	5
2.	Composition of blood, Formation of blood, Blood groups – history, biochemistry and genetics of ABO, Rh, Mn and other systems. Methods of ABO blood grouping (absorption-inhibition, mixed agglutination and absorption elution) from blood stains and other body fluids/stains viz. menstrual blood, semen, saliva, sweat, tear, pus, vomit, hair, bone, nail etc., blood group specific ABH substances. Secretors and non-secretors. Blood groups that make racial distinctions. Lewis antigen, Bombay Blood groups. HLA antigens and HLA typing. Role of sero-genetic markers in individualization and paternity disputes. Pitfalls in red cell typing.	5
3.	Determination of human and animal origin from bones, hair, flesh, nails, skin, teeth body tissue, fluids/ stains viz. blood, menstrual blood, semen, saliva, sweat, tear, pus, vomit, etc., through immunodiffusion and Immuno-electrophoresis, cross reactivity among closely related species. Individualization of blood stains: Determination of blood groups, sex age and racial origin from dried bloodstains.	6
4.	Red cell enzymes: Genetics, polymorphism and typing of PGM, GLO-I, ESD, EAP, AK, ADA etc. and their forensic significance. Serum proteins: Genetics, polymorphism and typing of - Hb, HP, Tf, Bf, C3 etc. and their	3

	forensic significance.	
5.	An overview of molecules involved in the flow of genetic information, double helical structure of DNA, alternate forms of DNA double helix, denaturation and renaturation of DNA, DNA binding proteins, factors affecting DNA stability, types and structure of RNA, RNA-DNA hybrid helices, DNA repair, direct and indirect evidence for DNA and RNA as the genetic material. Chemical nature of DNA and RNA. Replication of DNA in prokaryotes and eukaryotes, genetic code, degeneracy and universality of genetic code, transcription and translation machinery. Nature and structure of human genome and its diversity. mt-DNA, Y-Chromosomes and the peopling, migration, of modern humans. Concept of gene – Conventional and modern views. Fine structure of gene, split gene, pseudogene, non-coding gene, overlapping genes and multiple gene families.	3
6.	Concept of sequence variation - VNTRs, STRs, Mini STRs , SNPs. Detection techniques - RFLP, PCR amplifications, Amp-FLP, sequence polymorphism, Y-STR, Mitochondrial DNA. Evaluation of results, frequency estimate calculations and interpretation, Allele frequency determination, Match probability – Database, Quality control, Certification and Accreditation.	4
7.	History of DNA profiling applications in disputed paternity cases, child swapping, missing person's identity, civil immigration, veterinary, wildlife and agriculture cases. Legal perspectives – legal standards for admissibility of DNA profiling – procedural & ethical concerns, status of development of DNA profiling in India & abroad. Limitations of DNA profiling. Population databases of DNA markers –STRs, Mini STRs, SNPs. New & Future technologies: Analysis of SNP, DNA chip technology-Microarrays Cell free DNA, Synthetic DNA.	4
Total		**30**

No	List of Laboratory Topics	Contact Hours
1.	Serology instrumentation	3
2.	Blood identification	3
3.	Blood pattern identification	3
4.	Urine identification by analysis of blood group antigenic substances, polymorphic proteins, and DNA	4
5.	Immunoassay	3
6.	Sweat & Semen identification	3
7.	Forensic microscopy of hair and fibers	2
8.	DNA extraction and STR identification from Hair, nails, and bones	3

9.	STR Genotyping via Capillary Electrophoresis	2
10.	Allele frequency calculations & paternity test	2
11.	SNP analysis for mtDNA sequence	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes, oral test, oral presentation, group project, essay, and Attendance	During the semester	30%
2.	Midterm Exam	8th week	30%
3.	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	Forensic Serology, Shanan Tobe, 1st Edition, 2022, ISBN: 9780128129685 Forensic Serology and DNA Profiling , Na Vikraman , 9th June 2021, ISBN: 1230004838678
Supportive References	None
Electronic Materials	None
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms and Laboratories
Technology equipment (Projector, smart board, software)	Projector and Smart board
Other equipment (Depending on the nature of the specialty)	Forensic Science-related instruments, including safety cabinet, centrifuges, incubators, thermal cyclers, trans-illuminators, gel electrophoresis apparatus

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct
Effectiveness of students' assessment	Program Leaders	Direct
Quality of learning resources	Peer Reviewer	Indirect
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	**Department of Biology Council**
REFERENCE NO.	**Meeting No. 6**
DATE	**29/9/2024**