Course Specification

(Postgraduate Programs)

Course Title:	**Statistics for Forensic Scientists**
Course Code:	**STA 6117**
Program:	**Executive Master of Forensic Science**
Department:	**Biology and Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	**9 September 2024**

Table of Contents

A. General information about the course: 3

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods 4

C. Course Content 5

D. Students Assessment Activities 6

E. Learning Resources and Facilities 7

F. Assessment of Course Quality 7

G. Specification Approval 8

A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐ University	☐ College	☒ Program	☐ Track	☐ Others
B.	☒ Required		☐ Elective		
3. Level/Year at which this course is offered: Level 2 / Year 1					
4. Course general Description:					
This course aims to provide students with foundational knowledge in forensically relevant probability theory, statistical analysis, and modeling methods to prepare them to apply these tools to their specific areas of expertise. In addition, students will gain skills in using the logical approach to interpret observations and results in the context of practical forensic examples, case studies, and databases of forensic data.					
5. Pre-requirements for this course (if any)**:**					
None.					
6. Co-requisites for this course (if any)**:**					
None.					
7. Course Main Objective(s):					
Upon successful completion of the course, the students will be able to: **1.Outline the role of hypotheses and inference in forensic science;** **2.Apply probability theory to the interpretation of evidences and traces;** **3.Apparaise the value of traces in a wide range of scenarios encountered inforensic science (including source level and activity level questions,database hits, and multiple traces);** **4.Explain the value of the evidence in verbal and written forms;** **5.Analyze and visualize data using the appropriate statistical software.**					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**60**	**100%**
2	E-learning	**0**	**0%**
3	Hybrid • Traditional classroom • E-learning	**0**	**0%**

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning	0	0%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**30**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**30**
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	**Identify a relevant statistical analysis in problems of Kinship, relatedness in pedigrees, DVI, and Familial searching.**	**K2**	**2 lecture hours\week**	**Direct: Regular Exams**
1.2	**Describe forensic automatic likelihood ratio methods.**	**K3**	**2 tutorial hours\week**	**Direct: Short Quizzes**
1.3	**State the differences between populations and samples and methods to make inferences for well-designed experiments and surveys.**	**K2**	**Self-study**	**Direct: Regular Exams**
1.4	**Describe some relevant basic statistical**	**K4**	**Real-life problems**	**Direct: Short Quizzes**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	procedures to test the validity of DNA-matching procedures and models.			
2.0	Skills			
2.1	Evaluate the collection of traces and interpret the results of analyses through propositions, hypotheses, and statistical methods.	S1	Self-study	Direct: • Participations • Short Quizzes
2.2	Compose investigative and problem-solving skills to evaluate forensic science problems.	S3	Real-life problems	Direct: Homework and Mini projects
2.3	Compare various methods to record andcommunicate observations and evaluation of traces throughout all stages of an investigation.	S2, S4	Real-life problems	Direct: Short Quizzes
3.0	Values, autonomy, and responsibility			
3.1	Generate initiatives with independence and responsibility.	V2	Personal questions	Direct: Participation
3.2	Appraise team works.	V2	Teamwork and class discussions.	Direct: Homework and Mini projects

C. Course Content

No	List of Topics	Contact Hours
1.	Chapter 1-The history of forensic inference and statistics:	6

	Introduction. What is the scientific method? What is statistics? Statistics, forensic practice, and the criminal justice system. Populations and samples, deduction and induction, examples in practice.	
2.	**Chapter 2-Probability models and uncertainty:** Measurement, variability and uncertainty. Reliability, repeatability, and reproducibility, accuracy and precision. Probability distributions, parameters. Probability models for discrete and continuous variables. Expectation, variance, covariance and correlation of variables. Uncertainty on Sensitivity and Specificity.	**8**
3.	**Chapter 3-Statistical Inference:** Definitions. Goals of inference. Point estimation, properties of estimators, standard errors, sampling distributions. Interval estimation, Hypothesis testing, types of errors, *p*-values. Frequentist methods for statistical inference. Bayesian methods and forensic inference. Comparing philosophies of statistical inference. Validation of forensic automatic likelihood ratio methods. Bayesian networks in forensic science.	**8**
4.	**Chapter 4-Collecting data:** From probability to inference. Collecting data: observational studies, surveys, and experiments. Sampling methods: probability versus non-probability sampling. Precision, margin of error, and calculation of sample size. Experiments and experimental design.	**8**
5.	**Chapter 5-Diagnostic Tests:** Sensitivity and Specificity. Positive and Negative Predictive Values. Likelihood Ratio and Post-test Probability. Comparing Sensitivities and Specificities of Two Diagnostic Procedures.	**10**
6.	**Chapter 6-Odds Ratio:** Likelihood Function for the Odds Ratio. Likelihood Function for Relative Risk with Fixed Entries. Calculating the Odds Ratio Likelihood Function and Support. Validation of forensic automatic likelihood ratio methods.	**10**
7.	**Chapter 7-Applications of Statistics to Particular Fields in Forensic Science:** Evidence types (DNA, latent prints, firearms, ...). Kinship. Statistical support for conclusions in fingerprint examinations. Forensic glass evidence. Types of evidence and types of forensic questions. Statistical models in forensic voice comparison. Bringing new statistical approaches to eyewitness evidence	**10**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**HomeWorks, Quizzes, Mini projects**	**During the semester**	**30%**

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
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	• **W. Cook, W. Cunningham, W. Pulleyblank, and A. Schrijver,** Combinatorial Optimization; Wiley-Blackwell, 1997. • **B. Korte, and J. Vygen,** Combinatorial Optimization; Springer, 2012. • **C. Papadimitriou, K. Steiglitz**, Combinatorial Optimization: Algorithms and Complexity; Dover Publications Inc., 2000.
Supportive References	1. **D. Avis, A. Hertz, and O. Marcotte (editors),** Graph Theory and Combinatorial Optimization, Springer, 2005. 2. **D.-Z. Du, P.M. Pardalos (editors),** Handbook of Combinatorial Optimization, Kluwer Academic Publishers, 1999.
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.)	▪ **Each class room 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 data show and Smart Board.**
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	During the semester and at the end of the

Assessment Areas/Issues	Assessor	Assessment Methods
		course each student will complete two evaluation forms.
Effectiveness of Students assessment	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
The extent to which CLOs have been achieved	**Instructor**	**At the end of each semester the course instructor should complete the course report, including 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)**