Course Specification

— (Postgraduate)

Course Title:	**Advanced statistical algorithms**
Course Code:	**202596-3**
Program:	**M.Sc. in Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Taif University**
Version:	**2023**
Last Revision Date:	**7/4/1445**

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	
B.	☒ Required			☐ Elective	

3. Level/year at which this course is offered: SECOND LEVEL / FIRST YEAR

4. Course general Description: Expectation-Maximization (EM) algorithm - Various types of Markov chain Monte Carlo (MCMC) algorithms - Approximate Bayesian computation (ABC) algorithm – Applications of these algorithms under Bayesian framework.

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

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

7. Course Main Objective(s): After careful study of this course, student should be able to do the following:
1. Provide an introduction to EM algorithm.
2. Provide an introduction to MCMC algorithm.
3. Provide an introduction to ABC algorithm.
4. Use these algorithms under Bayesian framework.

2. Teaching Mode: (mark all that apply)

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

No	Mode of Instruction	Contact Hours	Percentage
	• 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**	15
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	<u>Recognize</u> EM algorithm	K1	• Lectures Group discussions	• Quizzes • Exams Assignments
1.2	<u>Outline</u> MCMC algorithm.	K2	• Lectures Group discussions	• Quizzes • Exams Assignments
1.3	<u>Outline</u> ABC algorithm.	K2	• Lectures Group discussions	• Quizzes • Exams Assignments
1.4				
2.0	**Skills**			
2.1	<u>Apply</u> EM and MCMC to estimate the parameters.	S2	• Lectures Group discussions	• Quizzes • Exams Assignments
2.2	<u>Evaluate</u>, and compare between estimators.	S4	• Lectures Group discussions	• Quizzes • Exams Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
...				
3.0	**Values, autonomy, and responsibility**			
3.1	<u>**Participate**</u> effectively within groups and independently.	**V1**	Projects	Through the oral presentation of the projects.
3.2	<u>**Express**</u> mathematical and statistical ideas orally and in writing	**V4**	Projects	Through the oral presentation of the projects.
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	**Expectation-Maximization (EM) algorithm, Continue Expectation-Maximization (EM) algorithm**	9
2.	**Various types of Markov chain Monte Carlo (MCMC) algorithms.**	9
3.	**Approximate Bayesian computation (ABC) algorithm.**	9
4.	**Applications of these algorithms under Bayesian framework.**	9
5	**Applications of these algorithms under Bayesian framework.**	9
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes + Homeworks+ oral presentation +written test+ group project	Continues	%30
2.	Final exam	16th	%70
3.			
...			

*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	<u>**Geoffrey J. McLachlan, Thriyambakam Krishnan**</u>**, The EM Algorithm and Extensions, 2008, 2d edition,Wiley.**
Supportive References	**S. JAMES PRESS , Subjective and Objective Bayesian**

	Statistics Principles, Models, and Applications, 2003, 2d edition, Wiley.
Electronic Materials	
Other Learning Materials	Blackboard system

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture halls, containing white boards, and electronic monitors - The seats fit the number of students - Laboratories equipped with suitable numbers of computers
Technology equipment (Projector, smart board, software)	Data Show
Other equipment (Depending on the nature of the specialty)	Wi-Fi internet connections

F. Assessment of Course Quality:

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

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

G. Specification Approval Data:

COUNCIL /COMMITTEE	Department of Mathematics and Statistics
REFERENCE NO.	
DATE	7/4/1445

قسم الرياضيات والإحصاء
Mathematics and Statistics
Department

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