Course Specification

(Bachelor)

Course Title:Data Modeling and Simulation
Course Code:COMP 451
Program:B.S in Computer Science
Department:Computer science
College:College of Computer Science and Information Technology
Institution:Jazan University
Version:V2
LastRevision Date:28-10-2023

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐ University	☐ College	☒ Department	☐ Track	☐ Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: (Level 12/Year 4)					
4. Course general Description:					

This course provides an overview of models and simulations and of modeling and simulation techniques. Techniques include time-driven, event-driven dynamic models/simulations and Monte Carlo Simulation. Classification of models: discrete or continuous, stochastic or deterministic, static or dynamic. The course also provide thorough understanding of random number generation, Queuing models, Simulation of queuing systems, inventory systems input modeling and verification & validation of simulation models.

5. Pre-requirements for this course (if any):
None

6. Pre-requirements for this course (if any)**:None**

7. Course Main Objective(s):

1. Discuss the fundamental concepts of modeling and simulation
2. Demonstrate the simulation model language.
3. Explain methods to build Simulation models.
4. Compare and contrast methods for random number generation.
5. Design, code, test, and debug simulation programs.
6. Simulate the systems based on the queueing theory.

2. Teaching mode(mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid ● Traditional classroom ● E-learning		
4	Distance learning		

3. Contact Hours(based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	28
2.	**Laboratory/Studio**	28
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	4
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	**Define** the basics of modeling and simulation.	K1	Lectures/ Presentations/ Media lectures	Assignment – 1 Midterm Final Exam
1.2	**Describe** inventory and queuing theory models related to simulation.	K1	Lectures /Presentations Media lectures	Assignment – 1 Midterm exam Final Exam
1.3	**Describe** concepts of discrete event simulation.	K1	Lectures /Presentations Media lectures	Assignment – 1 Midterm exam Final Exam
2.0	**Skills**			
2.1	**Apply** techniques of	S1	Lectures	Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	random number generation.		/Presentations Lab demonstration	Assignment-2 Lab Assignment Lab Exam
2.2	**Develop** a model for any kind of system and analyze the behavior of a system under different conditions.	S2	Lectures /Presentations Lab demonstration	Midterm Exam Lab Exam Final Exam Assignment-2
2.3	Develop a model for any kind of system and analyze the behavior of a system under different conditions.	S3	Lectures /Presentations Lab demonstration	Assignment -1/Assignment -2/Practical Assignment / Mid Term/Final Practical/Final Theory / Final Presentation
3.0	**Values, autonomy, and responsibility**			
3.1	**Demonstrate**collaborative work in an environment of collective action.	V2	Group Discussion	Assignment – 2 (Group discussion in the lab)

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to Simulation** a) Definition b) When simulation is appropriate tool c) When simulation is not appropriate tool d) Advantages and Disadvantages of Simulation e) Application area of simulation f) System and System Environment g) Components of system h) Model of a System i) Types of Models j) Discrete-Event System Simulation k) Steps in Simulation Study	4T+4P

2.	**Simulation examples** a) Simulation of queuing systems b) Simulation of Two Channel queueing System c) Simulation of inventory systems	4T+4P
3.	**General Principle** a) Concepts in Discrete-Event Simulation b) The Event-Scheduling / Time-Advance Algorithm c) World Views d) Manual simulation Using Event Scheduling **SimulationSoftware** a) Simulation Software b) Evolution of Simulation Software c) Simulation in High Level Language (C, C++, Pascal, Fortran) d) Simulation packages	4T+4P
4.	**Queueing Models** a. Characteristics of Queueing System b. Calling Population c. System Capacity d. Arrival Process e. Queue Behavior and Queue Discipline f. Service Time and Service Mechanism g. Queueing Notation – Kendall Notation	2T+2P
5.	**Random Number Generation** a) Properties of random numbers b) Generation of Pseudo-Random Numbers c) Techniques for Generating Random Numbers d) Test for Random numbers e) Frequency Tests f) Kolmogorov – Smirnov Test g) Chi-Square Test ❖	2T+2P
6.	**Input Modeling** a) Collecting Data b) Identifying Distribution c) Histograms	2T+2P

	d) Parameter Estimation e) Goodness-of-Fit	
7.	**Verification and Validations of Simulation Models** a) Verification of Simulation Models b) Validation of Simulation Models of Simulation Models Calibration and Validation of Models	2T+2P
8.	Lab Exam + Revision	2T + 2P
Total		**26T+26P**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam	6th-7th week	15%
2.	Assignment I	3rd week	10%
3.	Assignment II (Case Study/ Group assignment)	6th-7th week	15%
4.	Lab Exam + Lab Assignment	As per schedule	20%
5.	Final Theory Exam	As per schedule	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	• **Discrete-Event System Simulation**, Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, 5th Edition, Pearson Education, 2010, ISBN-13: 978-0136062127
Supportive References	**Chris chung, Christopher A. chung**, "Simulation modeling Handbook: A practical approach ", CRC Press 2003, ISBN-13: 978-0849312410
Electronic Materials	• https://serc.carleton.edu/NAGTWorkshops/data_models/index.html • https://www.cs.nmt.edu/~jholten/ModelingAndSimulation/lectures.html • http://www.cs.mcgill.ca/~hv/classes/MS/lectures.html • https://www.tutorialspoint.com/modelling_and_simulation/modelling_and_simulation_discrete_system_simulation.htm
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classroom equipped with projector, whiteboard, and sufficient seating arrangements. • Lab with software installed and individual computer terminal for each student.
Technology equipment (projector, smart board, software)	Whiteboards and projectors for classroom and lab Following software for lab work: • Matlab R2021b
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	Indirect (Course evaluation survey form)
Effectiveness of Students assessment	CRC / QAU / HoD	Direct (Course reports / result analysis)
Quality of learning resources	Track leaders / CRC	Indirect (Review, meetings and star rating with suggestions for further modification and improvements)
The extent to which CLOs have been achieved	CRC / QAU	Direct (CLO assessment template further verified at course coordinator, Track leader and QAU level)
Other	Students	Indirect (Course evaluation survey form)

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

Assessment Methods(Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**DEPARTMENT COUNCIL**
REFERENCE NO.	**ENGCSCS2406**
DATE	**19-09-2024**