Jordan University of Science and Technology

Faculty of Science & Arts

Mathematics Department

MATH470 Probabilistic Models In Operations Research - JNQF Level: 7

First Semester 2024-2025

Course Catalog
3 Credit Hours. This course is the second part of a series of operations research courses. The first part was about deterministic models in operations research. Topics of this course include Markov Chains, Queuing models including exponential models, Simulating real life problems that involve stochastic behavior.
Teaching Method: On Campus

Text Book	
Title	Operations Research Applications and Algorithms
Author(s)	Winston W. L.
Edition	4th Edition
Short Name	TextBook
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref 1	Operations Research an Introduction	Taha H. A.	8th Edition	
Ref 2	Introduction to Stochastic Processes	Hoel P. G., S. C. Port, and C. J. Stone	1st Edition	
Ref 3	Introduction to Stochastic Models in Operations Research	3. Hillier F. S. and G. J. Lieberman	1st Edition	

Instructor	
Name	**Prof. Mahmoud Alrefaei**
Office Location	D1 Level 0

Office Hours	
Email	alrefaei@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Mon, Wed : 10:00 - 11:30 Room: NF45

Prerequisites		
Line Number	**Course Name**	**Prerequisite Type**
902301	MATH230 Probability Theory	Prerequisite / Pass

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Week 1	Introduction, Stochastic Processes, Markov Chains, examples	From **TextBook**
Week 2	n-step transition probabilities, classification of states in a Markov chain	From **TextBook**
Week 3	Steady-state probability and mean first passage times	From **TextBook**
Week 4	Absorbing chains	From **TextBook**
Week 5	Queuing Theory: Some queuing terminology, Modeling arrival and service processes	From **TextBook**
Week 6	Poisson Processes Birth-Death processes The M/M/1 queuing systems	From **TextBook**
Week 7	The M/M/1/c queuing systems	From **TextBook**
Week 8	The M/M/s queuing systems	From **TextBook**
Week 9	Finite source models: The machine repair model	From **TextBook**
Weeks 9, 10	Exponential queues in series and open queuing network	From **TextBook**
Week 11	Discrete event simulation, Random numbers generations	From **TextBook**
Week 12	Random numbers generations	From **TextBook**
Week 13	Monte Carlo simulation, Simulation with continuous random variables	From **TextBook**
Week 14	Simulating a single server queuing system	From **TextBook**
Week 15	Review	From **TextBook**

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
Be able to formulate Markov chain problems, analyze their properties and find and interpret their steady-state behavior. [1SLO1(K1S1)] [1L7K1]	25%	

Be able to formulate exponential queuing models and analyze their asymptotic behavior. [1SLO2(S23C1)] [1L7S3]	40%	
Be able to simulate systems that behave stochastically and conduct some applications of simulation. [1SLO3(C24)] [1L7C2]	15%	
An ability to work on teams to study real-life problems involving uncertainty and model them as Markov chains or queuing models, establish goals, collect data and interpret them. [1SLO6(S2C3)] [1L7S2]	10%	
Build Markov chain and the Queuing models, analyze them, draw conclusions and present them in front of range of audience. [1SLO4(C3)] [1L7C3]	10%	

Relationship to Program Student Outcomes (Out of 100%)					
SLO1(K1S1)	SLO2(S23C1)	SLO3(C24)	SLO4(C3)	SLO5(C4)	SLO6(S2C3)
25	40	15	10		10

Relationship to NQF Outcomes (Out of 100%)				
L7K1	L7S2	L7S3	L7C2	L7C3
25	10	40	15	10

Evaluation	
Assessment Tool	**Weight**
First Exam	20%
Second Exam	25%
Final Exam	40%
course work and Project	15%

Policy	
Attendance	Course attendance is a most, students who absent more than 20% of the classes equivalent to 7 classes (with or without excuse) will not be allowed to continue the course.
Cheating	Cheating is prohibited; and in case of cheating, the student will be subject to punishment according to the Standard JUST policy.
Exams	All exams are closed book and notes. The final exam is comprehensive (covers all the material). Incomplete exams need approval from the department head or the dean of the faculty.
Withdraw	The deadline for theoretical courses withdrawal (without reimbursement of tuition fees) is 10/1/2025. Students who are prohibited because they exceed the absentee limit can withdraw before this time also.
Communications	Student can communicate through JUST email or e-learning system, any other personal emails or social media communication are not allowed.