Course Specification
(Bachelor)

Course Title: Queuing Systems
Course Code: INE 5321
Program: Bachelor of Science in Industrial Engineering
Department: Industrial Engineering Department
College Faculty of Engineering
Institution: King Khaled University.
Version: *2*
Last Revision Date: *8/12/2025*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐ University	☐ College	x Department	☐ Track	☐ Others
B.	x Required		☐ Elective		
3. Level/year at which this course is offered: (10/5)					
4. Course general Description:					
The subject of the course is the introduction to Classical Queueing Theory. In Queuing Theory, the basic concepts are presented, with emphasis on the structural characteristics of the systems, the evaluation of their effectiveness and their practical applications. The course presents Poisson processes and systems with one or more service stations, infinite or finite population and infinite or finite waiting positions. For presenting the analytical relationships, emphasis is given on the way these arise from Markov's general equilibrium relations and Little's Law					
5. Pre-requirements for this course (if any):					
INE4371					
6. Co-requisites for this course (if any):					
NIL					

7. Course Main Objective(s):
I. Introduction to Classical Queueing Theory. II. Mastering the basic concepts of the queuing theory with emphasis on the structural characteristics of the systems. III. Evaluation of the effectiveness of the system.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100
2	E-learning		
3	Hybrid		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	30
5.	**Others (specify)**	
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	Understand strengths and weaknesses of Queueing Models	K1	Lectures and tutorials	Assignments Midterm Exam Final Exam
1.2	able to read and understand the current performance analysis and	K1, K2		

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	queueing theory literature upon completion of the course.			
1.3	Easily learn any Queueing software, having understood the theoretical and conceptual framework.	K2, K3		
2.0	Skills			
2.1	Identify in practice the problems that can be addressed by Queueing Theory.	S3, S5	Lectures and tutorials	Assignments Midterm Exam Final Exam
2.2	analyze their structure and characteristics			
2.3	identify the requirements in data and parameters			
2.4	Proceed to deepening stochastic processes in industrial processes			
3.0	Values, autonomy, and responsibility			
3.1	Work individually or within a team and communicate effectively to perform the assigned tasks (Homework/Group Project)	V3, V4	Lectures and tutorials	Assignments Project

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction**	10
	1.1 Measures of System Performance 1.2 Characteristics of Queueing Systems	
	1.3 The Experience of Waiting 1.4 Little's Law	
	1.5 General Results 1.6 Simple Bookkeeping for Queues	
2	**Review of Stochastic Processes**	20
	2.1 The Exponential Distribution 35 2.2 The Poisson Process	
	2.3 Discrete Time Markov Chains	
	2.4 Continuous Time Markov Chains	
3	**Simple Markovian Queueing Models**	30
	3.1 Birth Death Processes 3.2 Single Server Queues (M=M=1)	
	3.3 Multi-server Queues (M=M=c)	

	3.4 Choosing the Number of Servers	
	3.5 Queues with Truncation (M=M=c=K) 3.6 Erlang's Loss Formula (M=M=c=c) 3.7 Queues with Unlimited Service (M=M=1)	
	3.8 Finite Source Queues 3.9 State Dependent Service 3.10 Queues with Impatience 3.11 Transient Behavior 121 3.12 Busy Period Analysis	

Total		60

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	6 to 8 Assignments	2, 3, 4, 5, 6, 7, 8, 9	25
2.	Quiz 1	3	
3.	Quiz 2	7	
4.	Project	6	5
5.	Mid Term Exam 1	5	15
6.	Mid Term Exam 2	10	15
7.	Final Exam	13	40
...			100

*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	Applied Probability and Queueing Models" Authors: S. Chakravarthy and A. Krishnamoorthy Publication Year: 2022 Publisher: Springer ISBN: 9783030920423
Supportive References	Fundamentals of Queueing Theory, Shortle, J. F., Thompson, J.M., Gross, D. and Harris, C. M., Wiley, 5th ed., 2018, 5th Edition, **ISBN-13:** 978-1118943526, **ISBN-10:** 111894352X Introduction to Management Science, Global Edition 13th Edition, 2019. Bernard W. Taylor III, Pearson, **ISBN-13: 978-1292263045**
Electronic Materials	1- http://web2.uwindsor.ca/math/hlynka/qsoft.html 2- https://queueing-systems.ens-lyon.fr/
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classroom**
Technology equipment (projector, smart board, software)	**Projector or Smart board**
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students/ Faculty /Head of department	Indirect assessment based on survey (Course evaluation survey/Student's surveys, Faculty surveys etc…) Faculty Performance Profile
Effectiveness of Students assessment	Students/ Independent faculty	Indirect assessment based on survey (Course evaluation survey/ Student's surveys), Assessment is checked by an independent faculty.
Quality of learning resources	Student and faculty	Indirect assessment based on survey (Evaluation of IT and Websites, learning resources surveys)
The extent to which CLOs have been achieved	Quality Committee	Direct through Rubrics analysis
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**REVIEWED BY CURRICULUM COMMITTEE** **APPROVED BY QUALITY COMMITTEE**
REFERENCE NO.	**9-6-47**
DATE	**25/06/1447**