Course Description Form for the Academic Year 2024-2025

Department of Operations Research and Intelligence Technologies/College of Computer Science and Mathematics

For the Remaining Two Years of the Course System

Note: The course system will be discontinued after two years and replaced by the Bologna System.

Stage 3 Course 1

Course Description Form

1. Course Name: unconstrained optimization (1)
2. Course Code: CMOR23-F3111
3. Semester / Year:
4. Description Preparation Date:27/1/2025
5. Available Attendance Forms: In presence
6. Number of Credit Hours (Total) / Number of Units (Total) 4 Hours / 3 Units
7. Course administrator's name (mention all, if more than one name)
Name: Dr.Huda esam ahmed Email: **dr.hudaea@uomosul.edu.iq** Name: Ghalya tawfeeq Basheer Email: ghalia.tawfeek@uomosl.edu
8. Course Objectives

Providing the student with skills in solving unconstrai optimization problems with one variable using different methods	**• Finding optimal strategies** **• How to build a competitive mo** **• Market competition rules**

9. Teaching and Learning Strategies
A- Knowledge and understanding A1- The student should mention the basic definitions A2-The student should write some optimization formulas A3- The student should describe the method A4- The student should distinguish between optimization methods A5- The student explains the mathematical formula of the method A6- The student should summarize the steps to solve the meth

B - Subject-specific skills

B1 - The student applies the method to a numerical problem
B2 - The student should reveal the error in the method.
B3 - The student tabulates the results

C- Thinking skills

C1- That the student chooses the best method.
C2-The student should compare the solution methods.
C3- That the student converts the method and steps for solving the problem from one form to another.
C4- To plan how to use the appropriate method in the solution

D - General and transferable skills (other skills related to employability and personal development).

D1- That the student can discover errors himself and solve the
D2- That the student improves the method used in the solution
D3- Enabling the student to analyze the results

10. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	Basic concepts	Lecture and discussion	Observation
2	4	A	Taylor' s series expansions necessary and sufficiency conditions	Lecture and discussion	Observation
3	4	A&B	Statement of an optimization problem	Lecture and interrogation	(H.W)
4	4	A&B	one variable unconstrained optimization problems	Lecture problem solving	Written tests
5	4	B&C	Concave and convex functions of one variable	Lecture and discussion	Written tests
6	4	B&C	Necessary and sufficient condition of one variable	Lecture and discussion	Observation

	7	**4**	B&C	**Dichotomous search method**	Lecture and discussion	Observation
	8	**4**	B&C	**Interval halving method**	Lecture and discussion	Observation
	9	**4**	A&B	**Fibonacci method**	Lecture and problem solving	Observation
	10	**4**	B&C	**Golden section method**	Lecture and discussion	(H.W)
	11	**4**	B	**Quadratic interpolation method**	Lecture and project	Observation
	12	**4**	D	**Cubic interpolation method**	Lecture and discussion	(H.W)
	13	**4**	A&B	**Newton's method**	Lecture and problem solving	Observation
	14	**4**	A&C	**Quasi newton method**	Lecture and discussion	Observation
	15	**4**	A&C	**Secant method**	Lecture and interrogation	TEST

11. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any) Operati Research (2011) gupta	
Main references (sources) Engineering optimizati theory and practice (2009) Rao	Operation Resea (2011) gupta
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	www.gametheory.n

Course Description Form

1. Course Name: Stochastic process(1)
2. Course Code: CMOR23-F3121
3. Semester / Year
4. Description Preparation Date:2024/2025
5. Available Attendance Forms: In presence
6. Number of Credit Hours (Total) 4 / Number of Units 3
7. Course administrator's name (mention all, if more than one name)
Name: Hind talaat Email: hindtalaat48@uomosul.edu.iq hind talaat48@uomosul.edu.iq
8. Course Objectives

Course Objectives Introducing the student to the stochastic process a its characteristics • Enable the student to solve Markov chain models • Introducing the student to the simple and high transition probability matrix • Introducing the student to the concept of prima distribution and solving illustrative examples of it • Introducing the student to the properties of Mark chains • Enable the student to classify Markov chains a their states. • Introducing the student to the stationa distribution of Markov chains and solving examp of it	**• Finding optimal strategies** **• How to build a competi model** **• Market competition rules**

9. Teaching and Learning Strategies
A- Knowledge and understanding

A1- The student should know the stochastic process and menti its most prominent characteristics
A2- The student knows the Markov chain and cites an example th explains it
A3- The student solves a Markov chain model
A4- The student should distinguish between the matrix of simp and higher transitional probabilities
A5- The student should solve examples of the transitio probability matrix
A6- State the characteristics of the Markov chain
A7- Find the stability distribution of the Markov chain
B - **Subject-specific skills**
B1 - To classify the given Markov chain
B2 - To classify the states of the Markov chain for the giv transition matrix
B3 - The student should test whether the given Markov chain ha stable distribution

C- Thinking skills

C1- The student solves a real-life problem using a Markov chain
C2- The student should compare the solution methods
C3- To rearrange the solution method
C4- To plan how to use the appropriate method in the solution
D - General and transferable skills (other skills related employability and personal development).
D1- That the student implements the method used in the proof
D2- That the student improves the method used in the solution
D3- To verify the method
D4- Enabling the student to solve the results

10. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	Review of probability theory	Lecture and discussion	Assignments and Observation (H.W)
2	4	A	Definitions of stochastic processes .	Lecture and discussion	Assignments and Observation (H.W)

				Specification of Stochastic processes .		
	3	**4**	A&B	Examples of stochastic processes Properties of stochastic process	Lecture and discussion	Assignments and Observation (H.W)
	4	**4**	A&B	Markov Chain . Definition and examples of Markov Chain .	Lecture and problem solving	Written tests
	5	**4**	**B&A**	The one and m-steps transition probabilities . Transition probability matrix with examples . Complete proof for the theorem about specification of homogenous Markov chain by its transition probability and the initial distribution	Lecture and problem solving	Written tests
	6	**4**	**A & C**	Introduction of Random walk Definition and examples of Random walk	Lecture and discussion	Assignments and Observation (H.W)
	7	**4**	**B & C**	**Mid-term Exam.** Higher transition probability .	Lecture and discussion	Assignments and Observation (H.W)
	8	**4**	**A& C**	Theorems for the n-th step transition matrix with two states (complete proof)	Lecture and discussion	Assignments and Observation (H.W)

			Derivation of chapman - kolmogrov equation .		
9	**4**	**B & C**	Initial distribution Theorem about Prob. distribution of the system or process after n-step later. Examples of initial distribution	Lecture and problem solving	Presentation (power point)
10	**4**	B	Transition Diagram & Transition Tree Classification of Chains accessible and communicate states with examples .	Lecture and discussion	Assignments and Observation (H.W)
11	**4**	D	Properties of communicate states . Irreducible chain , closed set of states , absorbing state, irreducible and reducible chain Remarks	Lecture and Project	Project(Report)
12	**4**	**A&B**	Examples of how to classify a Markov chain		
13	**4**	A &C	Classification of States Definitions of First Passage and mean	**Lecture and problem solving**	Assignments and Observation (H.W)

				recurrence time Recurrent and Transient states ,Positive and null recurrent periodic and aperiodic states , Ergodic with examples . Remarks		
	14	**4**	**A& C**	Examples of how to classify states of a Markov chain	Lecture and discussion	Assignments and Observation (H.W)
	15	**4**	C&D	Stationary distribution of a Markov chain . Definition of stationary distribution and theorem and examples	**Lecture and interrogation**	TEST

11. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	Operation Resea (2011) gupta
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	www.gametheor net

Course Description Form

1− Course Name: fazzy logic (1)
2− Course Code: CMOR24−F3131
3− Semester / Year: 3nd
4− Description Preparation Date:1/9/2024
5- Available Attendance Forms: In presence
6- Number of Credit Hours (Total) / Number of Units (Total) 4/3
7- Course administrator's name (mention all, if more than one name)
Name: Neaam Hazim Ahmed Email: neam.alfahady@uomosul.edu.iq

8− Course Objectives	
Course Objectives	1-This course deals with the basic concept of fuzzy logic and classical logic. 2-Enabling the student to identify fuzzy logic. 3-To have a basic idea of the use of fuzzy logic and why 4-Recognize the types of fuzzy functions and their modeling with life problems and ways to use them.

9− Teaching and Learning Strategies	
Strategy	A: Knowledge and understanding 1A- The student learns how to use fuzzy logic to find the expected value 2A- The student learns to find the fuzzy matrix of variables and the relationship between them 3A- The student learns how to use fuzzy matrices in daily life 4A- The student learns about the concept of the fuzzy system and its types. B- Subject-specific skills

1b- The student learns the concept of fuzzy sets and the relationship between them and classical sets.

2b- The student learns the relationship between fuzzy sets and how to deal with them. And how to benefit from them in reality.

3b- The student learns the fuzzy theory in making the best decision and using it in solving fuzzy equations.

4b- The student learns the fuzzy system, its types and its uses in the neighborhood of fuzzy equations.

C- Thinking skills

1c- The student learns how to determine the best metho in fuzzy decision.

2c- The student applies fuzzy methods to real problems.

3c- The student learns fuzzy equations and how to find and use them.

4c- The student learns the fuzzy system and its parts an finding the best decision.

D - General and transferable skills (other skills related to employability and perso development).

D1-The student implements different fuzzy methods.
D2- The student knows how to model the fuzzy equation.
D3- Write a computer program to find the fuzzy membership functio
D4- Know the difference between the fuzzy membership functions and their uses.

10− Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	A	Examples of classic se	Lecture discussio	Lecture a discussi
2	3	A	Examples of discrimi function properties	Lecture discussio	Lecture a discussi
3	3	A&	Application of fuzzy s	Lecture discussio	Lecture a discussi

4	3	A&	Organic function exercises for the trapez	Lecture problem solving	Lecture a proble solving
5	3	**B&A**	Practical examples of various fo of organic functions	Lecture problem solving	Lecture a proble solving
6	3	**A &**	Programming organic functions in MATLAB	Lecture discussio	Lecture a discussi
7	3	**B &**	exam	Lecture discussio	Lecture a discussi
8	3	**A&**	Examples of membership functions and group power	Lecture discussio	Lecture a discussi
9	3	**B &**	Example of operations on fuzzy sets	Lecture a problem solving	Presentation (power point)
1(	3	B	Practical examples of fuzzy organic function	Lecture discussio	Assignme and Observat (H.W)
1	3	D	Programs f fuzzy examp		
1	3	**A&**	Application of class and fuzzy relations	Lecture a Project	Project(Report)
1	3	A ,C&D	Example interrelationsl and fu matrices	**Lecture problem solving**	Assignme and Observat (H.W)
1	3	**A&**	Example of fu mixing relationships	Lecture discussio	Assignme and Observat (H.W)
1	3	C&	exam	**Lecture interrogat**	TEST

11- Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

12- Learning and Teaching Resources

Required textbooks (curricular books, if any	
Main references (sources)	1 Kwang H. Lee, "First Course on Fuzzy Theory and Applications" S. N. Sivanandam, S. Sumathi and N. Deepa "Introduction to Fu Logic using MATLAB"

Recommended books and references (scientific journals, reports…)	Sources from the Internet		
Electronic References, Websites	http://www.pattern recobnition . Pdf.		

Course Description Form

1. Course Name: Intelligent Techniques (1)

2. Course Code: CMOR24-F3141

3. Semester / Year:First / 2025

4. Description Preparation Date: 23-1-2025

5. Available Attendance Forms: In presence

6. Number of Credit Hours (Total) / Number of Units (Total) 4/3

7. Course administrator's name (mention all, if more than one name)

Name: Assist. Prof. Dr. Niam Abdulmunim Abdulmajeed
Email: niam.munim@uomosul.edu.iq

8. Course Objectives

Course Objectives	Learn about the term artificial intelligence, its b concepts, its components, and the various applicatior includes to solve many problems. This course deals with research methods and search algorithms (or computer programs) that simulate human mental abilities or other behavioral patterns to give the computer the ability to learn and deduce situations that the machine has not learned. Learn about artificial intelligence algorithms (metaheuristics algorithms) and their applications to find the optimal solution in scientific and optimization research.

9. Teaching and Learning Strategies

Strategy	1. Knowledge in the field of artificial intelligence and intelligent technologies and their importance. 2. Employing intelligent technologies and artificial intelligence to serve society. 3. Introducing the applications of intelligent technologies.

	4. Use search algorithms and intuitive and supra-intuitive algorithms. 5. The student graduates as Agent. Marathi output 6. Knowledge skills. 7. Memorization and analysis skills. 8. Skills for use and development. 9. Publishing research and participating in local and international conferences. 10. Participation in seminars and workshops. 11. Keeping pace with developments in the field of specialization. 12. Analysis of artificial intelligence technologies, benefits and challenges. 13. Enabling the student to write programs in artificial intelligence and its algorithms, s problems, interpret results, and be able to make the optimal decision in using algorithm operations research and optimization.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4		Artificial Intelligence, basic definitions and concepts Simon-Noel model, data, information and knowledge	Lecture, discussion and interrogation	written tests
2	4		representing knowledge by logic Logical deduction, semantic networks	Lecture, discussion and interrogation	written tests
3	4		Search Methods Basic concepts with examples	Lecture, discussion and interrogation	written tests
4	4		Water Jug Problem 8-Puzzle Problem	Lecture, discussion and interrogation	written tests
5	4		Search Strategies Basic concepts	Lecture, discussion and interrogation	written tests
6	4		Blind Search Algorithms – basic concepts Depth-First Search Algorithm – Basic concepts with examples Apply Depth-First search algorithm to 8-puzzle problem	Lecture, discussion and interrogation	written tests
7	4		Breadth-First Search Algorithm – Basic concepts with examples	Lecture, discussion and interrogation	written tests
8	4		Apply Breath-First search algorithm to 8-puzzle problem	Lecture, discussion and interrogation	written tests

9	4		Heuristic Search Algorithms Hill Climbing Algorithm	Lecture, discussion and interrogation	written tests
10	4		Apply Hill Climbing algorithm to 8-puzzle problem	Lecture, discussion and interrogation	written tests
11	4		Best-First Search Algorithm Apply Best-First Search algorithm to 8-puzzle problem	Lecture, discussion and interrogation	written tests
12	4		A^* Algorithm Game Playing algorithms MINIMAX Algorithm Alpha-Beta Pruning Algorithm	Lecture, discussion and interrogation	written tests
13	4		Machine learning Machine learning models	Lecture, discussion and interrogation	written tests
14	4		Machine learning classifications Machine learning algorithms	Lecture, discussion and interrogation	written tests
15	4		A week of preparation before the final exam		

11. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W.)

12. Learning and Teaching Resources

Required textbooks (curricular books any)	Artificial Intelligence: A Modern Approach ,2021(Pearson Se in Artifical Intelligence) 4th Edition, Kindle Edition
Main references (sources)	S.sumathi&Surekha P.,2010,Computational Intellige Paradigms Theory and Applications Using MATLAB,CRC Pre
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	https://www.youtube.com/watch?v=qv0iE8nmxRU

Course Description Form

1. Course Name: Inventory Model (2)

2. Course Code: **CMOR23-F4121**

3. Semester 1 / 2025

4. Description Preparation Date:1/2/2025

5. Available Attendance Forms: In presence

6. Number of Credit Hours (4) / Number of Units (2)

7. Course administrator's name (mention all, if more than one name)

Name: Dr. Mohammed Ahmed Al-Kailany **Email**: alkailanym@uomosul.edu.iq	**Name**: A.P. Othman Attya Wardy Email: othman.attya@uomosul.edu.iq

8. Course Objectives

1. Introduction to Inventory Models
2. Characteristics of Inventory Models
3. Efficiency Metrics of Inventory Models
4. Types and Classifications of Inventory Models
5. Supply and Consumption Processes in Inventory
6. Two Different Inventory Management Models: Economic Order Quantity (EOQ) Model and Reorder Point (ROP) Model
7. The Core Concept of Inventory Models That Integrates Different Types of Inventory Models
8. Developing Problem-Solving Skills in Inventory Management Through Applying Equations to Solve Practical Examples, Such as Calculating the Optimal Order Quantity or Determining the Reorder Point.

9. Teaching and Learning Strategies

A- Knowledge and Understanding

- A1: The student should recall previous formulas.
- A2: The student should write some key terms.
- A3: The student should clearly describe the model.
- A4: The student should distinguish between different models.
- A5: The student should explain the mathematical formula used.
- A6: The student should summarize the steps for solving the mathematical formula.

B- Subject-Specific Skills

- B1: The student should apply the model to a real-world case.
- B2: The student should identify errors in the model.
- B3: The student should organize the results in a structured table.

C- Thinking Skills

- C1: The student should present a real-world problem.
- C2: The student should compare different solution methods.
- C3: The student should rearrange the solution approach to improve results.
- C4: The student should plan the use of an appropriate solution method

D- General and Transferable Skills (Other Skills Related to Employabilit and Personal Development)

- D1: The student should implement the adopted method with proof.
- D2: The student should enhance the chosen solution method.
- D3: The student should verify the correctness of the applied method.
- D4: The student should be able to accurately solve and interpret the results.

10. Course Structure

Week	Hours	Learning Outcomes	Unit/Topic Name	Teaching Method	Assessment Method
1	4	A	Inventory Definition and General Overview	Lecture & Discussion	Observation
2	4	A	Inventory Objectives, Concepts, and Inventory Control Assumptions	Lecture & Discussion	Observation
3	4	A, B	Inventory System Concepts and Characteristics, Storage Types	Lecture & Questioning	Oral Exams
4	4	A, B	Cost Definitions: Unit Cost, Setup Cost, Shortage Cost	Lecture & Problem Solving	Written Exams
5	4	B, C	Safety Stock, Lead Time, Holding Cost	Lecture & Discussion	Observation
6	4	B, C	Order Quantity and Reorder Point	Lecture & Discussion	Observation
7	4	B, C	Demand in Inventory Models and Inventory Model Classification	Lecture & Discussion	Observation
8	4	D	Deterministic Inventory Models	Lecture & Discussion	Observation
9	4	A, B	Purchase Model Without Shortages	Lecture & Problem Solving	Presentation
10	4	B, C	Purchase Model With Shortages	Lecture & Discussion	Observation

11	4	B	Purchase Model Without Shortages (Exercises & Solutions)	Lecture & Project	Project
12	4	A, B	Purchase Model With Shortages (Exercises & Solutions)	Lecture & Problem Solving	Observation
13	4	A, C	Fixed and Determined Demand for a Single Item	Lecture & Discussion	Observation
14	4	A, C	Reorder Point	Lecture & Questioning	Exams
15	4	C, D	Reorder Point During Lead Times	Discussion	Homework
16	-	-	Preparation Week Before the Final Exam	General Review	-

11. Course Evaluation

- Written tests
- Project(Report)
- Presentation (power point)
- Assignments and Observation (H.W)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	[1] "Operations and Production Management" – A book to support theoretical concepts. [2] "Operation Research" by Prem Kumar Gupta and D.S. Hira. Al-Shamrati, Hamed Saad Noor, & Al-Zubaidi, Ali Khalil (2007). Introduction to Operations Research. Hashemite Kingdom of Jordan: Majd Alawi Publishing & Distribution.
Recommended books and references (scientific journals, reports...)	1- Samanta, G. P. (2016). "A production inventory model with deteriorating items & shortages". Yugoslav Journal of Operations Research, 14(2). 2- Alfares, H. K. (2014)." Production-inventory system with finite production rate, stock-dependent demand, & variable holding cost". RAIRO – Operations Research, 48(1), 135-150. https://doi.org/10.1051/ro/2013058
Electronic References, Websites	1. **APICS (Association for Supply Chain Management)** o Website: https://www.apics.org o Description: APICS offers certifications, training, and resources on inventory management and supply chain practices. 2. **MIT OpenCourseWare - Supply Chain Management** o Website: https://ocw.mit.edu o Description: Free online courses from MIT that cover inventory management as part of supply chain topics. 3. **Investopedia - Inventory Management** o Website: https://www.investopedia.com o Description: Provides definitions and explanations of key inventory management concepts like EOQ, JIT, and ABC analysis. 4. **Harvard Business Review (HBR) Articles** o Website: https://hbr.org

- Search for articles on inventory management, supply chain optimization, and related topics.

5. **Coursera and Udemy Courses**
   - Platforms: https://www.coursera.org | https://www.udemy.com
   - Description: Online courses on inventory management, supply chain, and logistics offered by universities and industry experts.

Software Tools for Inventory Management

1. **SAP ERP**
   - Website: https://www.sap.com
   - Description: Enterprise resource planning software with robust inventory management features.
2. **Oracle NetSuite**
   - Website: https://www.netsuite.com
   - Description: Cloud-based inventory and supply chain management software.
3. **Fishbowl Inventory**
   - Website: https://www.fishbowl.com
   - Description: A popular inventory management solution for small and medium-sized businesses.
4. **TradeGecko (now QuickBooks Commerce)**
   - Website: https://www.tradegecko.com
   - Description: Inventory and order management software for e-commerce businesses.
5. **Zoho Inventory**
   - Website: https://www.zoho.com/inventory

Course Description Form

13. Course Name: Regression Analysis (1)
14. Course Code: **CMOR23-F3161**
15. Semester / Year: first course
16. Description Preparation Date: 1/2/2025
17.Available Attendance Forms: In presence
18.Number of Credit Hours (Total) 3 / Number of Units (Total): 2

19. Course administrator's name (mention all, if more than one name)

Name: Salih Mooaed Shaker
Email: salih.mooaed@uomosul.edu.iq

20. Course Objectives

Course Objectives	• **Determine relationships betw variables** • **Estimate regression parameter** • **Prediction of the estimated mo** • **Controlling dependent variable**

21. Teaching and Learning Strategies

Strategy	1- Identify the concepts of regression analysis 2- Determine the analysis hypotheses 3- Data modeling and analysis using estimation methods 4- Characteristics of capabilities 5- Create a variance analysis table 6- Identify the formation of confidence limits and the path the regression line 7- Identify the correlation coefficient and the coefficient determination 8- Testing hypotheses and identifying deviations in analy assumptions 9- Testing the extent to which the model matches the data 10- Testing homogeneity and independence of errors

22. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	1	Definition of regression analysis, uses and causal relationships	Lecture and discussion	watching

2	3	2	Analysis assumptions th must be met In the linea model	Lecture and discussion	watching
3	3	4 و 3	Estimating regression parameters and the characteristics of capabilities	Lecture and exercises	watching
4	3	5	Hypothesis testing and t Analysis of variance	Lecture and exercises	watching
5	3	6	Estimate confidence intervals.	Lecture and exercises	Oral exams
6	3	6	Regression through the origin	Lecture and exercises	watching
7	3	7	Coefficient of determination and correlation coefficient Simple and its characteristics	Lecture and exercises	watching
8	3	7	Correlation coefficient: relationship to the regression coefficient	Lecture and exercises	watching
9	3	8	Violations and defects in the analysis assumptions	Lecture and exercises	watching
10	3	8	Test whether the analysi hypotheses Generally available	Lecture and exercises	Written tests
11	3	9	Test whether the relationship between... Variables X and y linea	Lecture and exercises	watching
12	3		Mid-course exam		
13	3	9	Lack of fit test	Lecture and exercises	watching
14	3	10	Test whether the error variance Stable and homogeneous	Lecture and exercises	watching
15	3	10	Test whether the errors a independent	Lecture and exercises	watching

23. Course Evaluation

Written tests
the report
Assignments and Observation (H.W)

24. Learning and Teaching Resources

Required textbooks (curricular books, if any	Al-Rawi, Khashi Mahmoud, 1987, Introductio Regression Analysis, University of Mosul, Iraq
Main references (sources)	1-Draper, N. R. and Smith H. 1981. Appl Regression Analysis, 2nd.ED.
Recommended books and references (scientific journals, reports...)	Richard B. Darlington & Andrew F. Hayes. (2017). "Regression Analysis and Lin Models", The GUILFORD PRESS, New York London.
Electronic References, Websites	https://www.coursera.org/learn/predictive-modeling-model-fitting-regression-analysis

Course Description Form

25. Course Name: English Language
26. Course Code: CMOR23-F3171
27. Semester / Year:3 rd
28. Description Preparation Date:2024/2025
29.Available Attendance Forms: In presence
30.Number of Credit Hours (Total) / Number of Units (Total)
31. Course administrator's name (mention all, if more than one name)
Name: Zainab Qusay Ahmed Taqy ALOraibi Email: Zainab.q@uomosul.edu.iq
32. Course Objectives

Course Objectives • To be able to speak English. • To be able to compose freely and independen in speech and writing. • To be able to read books with understanding	• **Finding optimal strategies** • **How to build a competitive mo** • **Market competition rules**

33. Teaching and Learning Strategies
A- Speaking skill A1- He must have the ability to think and speak in English A2- The ability to speak English fluently A3- The ability to formulate sentences correctly **B - Reading skill** B1 - The ability to read sentences correctly B2 - Correct pronunciation of words. **C- Writing skill** C1- The ability to write sentences in English correctly The ability to express ideas through writing **D - Listening skills.** D1- Developing the student's listening skill D2-The ability to distinguish words while listening
34. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	2	A	Introduction: about study materials of Headway Pre-intermediate Plus.	Lecture and discussion	Assignments and Observation
2	2	A, B, D	Grammar: Have (got) to, practices.	Lecture and discussion	Assignments and Observation
3	2	A, B, D	Should/must, questions and answers. Reading.	Lecture and discussion	Assignments and Observation
4	2	A, B	Vocabulary: words that go together, everyday English at the doctor.	Lecture	Written tests
5	2	**A, D**	Grammar: verb patterns and infinitives, practices.	Lecture and problem-solving	Assignments and Observation
6	2	**A, D**	Time and conditional clauses, practices (when, as soon as). listening and speaking/ life in 2050.	Lecture and discussion	Assignments and Observation
7	2		Mid-term Exam		
8	2	**B, D**	Reading and speaking/ the world's first megalopolis.	Lecture and discussion	Assignments and Observation
9	2	**B, C**	Vocabulary: Hot verbs/ take- get- do and make.	Lecture and problem-solving	Assignments and Observation
10	2	B	Vocabulary: -ed/ -ing adjective,	Lecture and discussion	Assignments and Observation

				reading about (Into the wild).		
	11	**2**	**A, D**	Expressions about exclamations with so and such.	Lecture and discussion	Assignments and Observation
	12	**2**	**A, B**	Grammar: actives and passives voice, practices.		
	13	**2**	**A, C**	Verbs and nouns that go together, practices.	**Lecture and problem–solving**	Assignments and Observation
	14	**2**	**A, B**	Reading: about the discovery of DNA., expressions about(notices).	Lecture and discussion	Assignments and Observation
	15	**2**	**D, C**	Study material review	**Lecture**	Observation

35. Course Evaluation

Written tests
Assignments and Observation (H.W)

36. Learning and Teaching Resources

Required textbooks (Headway pre-intermediate plus student's b (john and Lize Soars))	
Main references (Headway pre-intermediate plus work's book)	Operation Resea (2011) gupta
references (scientific journals, reports…)	
Websites https://7esl.com/ , https://worldenglishblog.com/hasnt doesnt-have-pdf/	www.gametheory.n

Stage 3 Course 2

Course Description Form

1. Course Name: unconstrained optimization (2)

2. Course Code: CMOR23-F3211

3. Semester / Year:2nd

4. Description Preparation Date:27/1/2025

5. Available Attendance Forms: In presence

6. Number of Credit Hours (Total) / Number of Units (Total) 4 Hours / 3 Units

7. Course administrator's name (mention all, if more than one name)

Name: Dr.Huda esam ahmed Email: **dr.hudaea@uomosul.edu.iq**
Name: Ghalya tawfeeq Basheer Email: ghalia.tawfeek@uomosl.edu.iq

8. Course Objectives

Providing the student with skills in solv unconstrained multivariate optimization proble using different methods	**• Finding optimal strategies** **• How to build a competitive model** **• Market competition rules**

9. Teaching and Learning Strategies

A- Knowledge and understanding

A1- The student should mention the basic definitions
A2-The student should write some optimization formulas
A3- The student should describe the method
A4- The student should distinguish between optimization methods
A5- The student explains the mathematical formula of the method

A6- The student should summarize the steps to solve the method

B - Subject-specific skills

B1 - The student applies the method to a numerical problem

B2 - The student should reveal the error in the method.

B3 - The student tabulates the results

C- Thinking skills

C1- That the student chooses the best method.

C2-The student should compare the solution methods.

C3- That the student converts the method and steps for solving the problem from or form to another.

C4- To plan how to use the appropriate method in the solution

D - General and transferable skills (other skills related to employability and personal development).

D1- That the student can discover errors himself and solve them.

D2- That the student improves the method used in the solution

D3- Enabling the student to analyze the results

10. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	Multivariable unconstrained optimization	Lecture and discussion	Observation
2	4	A	Basic concepts	Lecture and discussion	Observation
3	4	A&B	Necessary and sufficient condition of Multivariable unconstrained optimization	Lecture and interrogation	(H.W)
4	4	A&B	Concave and convex of Multivariable unconstrained optimization	Lecture problem solving	Written tests
5	4	B&C	rth differential of function	Lecture and discussion	Written tests
6	4	B&C	Taylor's method	Lecture and discussion	Observation

	7	**4**	B&C	**Steepest descent method**	Lecture and discussion	Observation
	8	**4**	B&C	**Conjugate gradient method (FR)**	Lecture and discussion	Observation
	9	**4**	A&B	**Conjugate gradient method (HS)**	Lecture and problem solving	Observation
	10	**4**	B&C	**Conjugate gradient method (PR)**	Lecture and discussion	(H.W)
	11	**4**	B	**Newton's method**	Lecture and project	Observation
	12	**4**	D	**Marquardt method**	Lecture and discussion	(H.W)
	13	**4**	A&B	**Quasi newton method**	Lecture and problem solving	Observation
	14	**4**	A&C	**Davidon-Fletcher-Powell method**	Lecture and discussion	Observation
	15	**4**	A&C	**Broyden-Fletcher-Goldfarb-shanno method**	Lecture and interrogation	TEST

11. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

12. Learning and Teaching Resources

Required textbooks (curricular books, if a	Operation Research (2011) gupta
Main references (sources) Engineeri	optimization theory and practice (200 Rao
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	www.gametheory.net

Course Description Form

37. Course Name: Stochastic process(2)	
38. Course Code: CMOR23-F3221	
39. Semester / Year	
40. Description Preparation Date:2024/2025	
41.Available Attendance Forms: In presence	
42.Number of Credit Hours (Total) 4 / Number of Units (Total) 3	
43. Course administrator's name (mention all, if more than one name)	
Name: Hind talaat Email: hindtalaat48@uomosul.edu.iq hind talaat48@uomosul.edu.iq	
44. Course Objectives	
Course Objectives Enable the student to solve Markov chains usi MATLAB • Enable the student to solve the profit analy problem and the traveling salesman problem usi the MATLAB program • Introducing the student to the counting process, t Poisson process, and its hypotheses • Enable the student to solve problems related to t Poisson process • Introducing the student to the distributio associated with the Poisson process with proof • Introducing the student to the characteristics of t Poisson process with proofs	**• Finding optimal strategies** **• How to build a competi model** **• Market competition rules**

• Enable the student to employ the characteristics the Poisson process in solving various problems this process. • Introducing the student to the heterogenec Poisson process	

45. Teaching and Learning Strategies

A- Knowledge and understanding

A1- Write a program to calculate the transition matrix, solve t profit analysis problem, or solve the traveling salesman problem

A2- That the student knows the counting process and mentions most prominent characteristics

A3- The student should know the Poisson process and mention most prominent characteristics

A4- The student should mention the distributions associated w the Poisson process

A5- To compare the structure of the Poisson process and t difference between two Poisson processes, whether they follow t Poisson distribution or not.

A6- The student should mention when the Poisson distribution the Binomel distribution

A7- Explain the nonhomogeneous Poisson process

B - Subject-specific skills

B1 - The student must prove the distribution mechanism of t Poisson process

B2 - The student should solve problems related to t homogeneous and heterogeneous Poisson process

B3 - To prove that the time between the occurrence of two Poiss distribution events is distributed exponentially

B4- Prove that the waiting time follows a kamma distribution

C- Thinking skills

C1- The student solves a real-life problem using the Poiss distribution

C2- The student should compare the solution methods

C3- To rearrange the solution method

C4- To plan how to use the appropriate method in the solution

D - General and transferable skills (other skills related employability and personal development).

D1- That the student implements the method used in the proof

D2- That the student improves the method used in the solution

D3- To verify the method

D4- Enabling the student to solve the results

46. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	Calculating the higher order transition matrix using MATLAB Calculate the initial distribution using MATLAB A program to compute a Markovian chain consisting of numbers A program to calculate a Markovian chain consisting of symbols Explain the topic of profit analysis and write a program to solve the problem	Lecture and discussion	Assignments and Observation (H.W)
2	4	A	Explain the subject of the traveling salesman problem and write a program for it Definition and examples about Counting Process	Lecture and discussion	Assignments and Observation (H.W)
3	4	A&B	Poisson process . Assumption of Poisson Process.	Lecture and	Assignments and

				Derivation the P. d. f. of a Poisson process (complete proof) .	discussion	Observation (H.W)
	4	**4**	A&B	Examples of Poisson Process	Lecture and problem solving	Written tests
	5	**4**	**B&A**	Distributions Related with Poisson process Theorem about the interval time between two events of a Poisson process has an exponential distribution (complete proof) .	Lecture and problem solving	Written tests
	6	**4**	**A & C**	Theorem about the waiting time has gamma distribution (complete proof) .	Lecture and discussion	Assignments and Observation (H.W)
	7	**4**	**B & C**	**Mid-term Exam** Properties of a Poisson process .	Lecture and discussion	Assignments and Observation (H.W)
	8	**4**	**A& C**	Additive property (complete proof) . Difference of two independent	Lecture and discussion	Assignments and Observation (H.W)

				Poisson process (complete proof)		
	9	**4**	**B & C**	Decomposition of a Poisson process (complete proof)	Lecture and problem solving	Presentation (power point)
	10	**4**	B	Poisson process and binomial distribution (with proof) .	Lecture and discussion	Assignments and Observation (H.W)
	11	**4**	D	Examples about the Properties of a Poisson process	Lecture and Project	Project(Report)
	12	**4**	**A&B**	Non – Homogeneous Poisson process. Exercises .		
	13	**4**	A &C	Some special stochastic processes Bernoulli Process Examples about Bernoulli Process	**Lecture and problem solving**	Assignments and Observation (H.W)
	14	**4**	**A& C**	Winer Process Examples about Winer Process	Lecture and discussion	Assignments and Observation (H.W)

	15	4	C&D	Preparatory week before the final Exam	Lecture and interrogation	TEST

47. Course Evaluation
Written tests Project(Report) Presentation (power point) Assignments and Observation (H.W)

48. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	Operation Resea (2011) gupta
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	www.gametheo net

Course Description Form

13– Course Name: fazzy logic (2)
14– Course Code: CMOR24-F3231
15– Semester / Year: 3nd
16– Description Preparation Date:1/2/2025
17- Available Attendance Forms: In presence
18- Number of Credit Hours (Total) / Number of Units (Total) 4/3
19- Course administrator's name (mention all, if more than one name)
Name: Neaam Hazim Ahmed Email: neam.alfahady@uomosul.edu.iq

20- Course Objectives	
Course Objectives	1. This course deals with the basic concept of fuzzy number and its properties. 2. Enable the student to identify the organic functions of fuzzy number and their formation. 3. Form a basic idea about the use of fuzzy number and why? 4. Identify the types of fuzzy number and its arithmetic operations. 5. Modeling the organic functions of fuzzy number. 6. Explain some life problems and work on making decisions and solving their problems.
21- Teaching and Learning Strategies	
Strategy	A: Knowledge and understanding 1A. The student knows the basic concept of fuzzy number and its properties 2A. Identify the organic functions of fuzzy number and their formation. 3A. The student has a basic idea about the use of fuzzy number and why? 4A. The student recognizes the types of fuzzy number and its arithmetic operations. 5A. Can model the organic functions of fuzzy number B- Subject-specific skills 1b- The student learns the concept of fuzzy number and its application in daily life to solve problems. 2b- Modeling fuzzy life decisions with fuzzy number. 3b- The student learns the fuzzy theory in making the best decision and uses it in solv fuzzy equations. 4b- Transforming life problems and treating them using the idea of fuzzy logic. C- Thinking skills 1c- The student learns how to determine the best method in fuzzy decision. 2c- The student applies fuzzy methods to real problem 3c- The student learns fuzzy equations and how to find and use them. 4c- The student learns the fuzzy system and its parts a finding the best decision. D - General and transferable skills (other skills related to employability and perso development). D1- The student implements different fuzzy methods. D2- The student knows how to model the fuzzy equation.

	D3- Write a computer program to find fuzzy organi functions. D4- Know the difference between fuzzy orga functions and their use.

22− Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	A	Properties of fuzzy se	Lecture discussion	Lecture a discussi
2	3	A	Properties of convex fuzzy sets	Lecture discussion	Lecture a discussi
3	3	A&	The concept of blurry periods	Lecture discussion	Lecture a discussi
4	3	A&	Properties of fuzzy se	Lecture problem solving	Lecture a proble solving
5	3	B&A	Properties o convex fuzzy sets	Lecture problem solving	Lecture a proble solving
6	3	A &	The concept blurry periods	Lecture discussion	Lecture a discussi
7	3	B &	Fuzzy sets of fuzzy number	Lecture discussion	Lecture a discussi
8	3	A&	Characterist of mathemat operations i fuzzy period	Lecture discussion	Lecture a discussi
9	3	B &	Triangular Fuzzy Numb	Lecture ar problem solving	Presentation (power point)
10	3	B	Operations with α-cu	Lecture discussion	Assignme and Observat (H.W)
11	3	D	Approximat of Triangu Fuzzy Num		
12	3	A&E	Fuzzy and class rules	Lecture ar Project	Project(Report)
13	3	A ,C&D	Fuzzy inference system	Lecture problem solving	Assignme and Observat (H.W)
14	3	A&	Mamdani method	Lecture discussion	Assignme and Observat (H.W)
15	3	C&	exam	Lecture interrogat	TEST

23- Course Evaluation
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc Written tests Project(Report) Presentation (power point) Assignments and Observation (H.W)

24- Learning and Teaching Resources	
Required textbooks (curricular books, if an	
Main references (sources)	1 Kwang H. Lee, "First Course on Fuzzy Theory and Applications" S. N. Sivanandam, S. Sumathi and N. Deepa "Introduction to Fu Logic using MATLAB"
Recommended books and references (scientific journals, reports…)	Sources from the Internet
Electronic References, Websites	http://www.pattern recobnition . Pdf.

Course Description Form

1. Course Name: Intelligent Techniques (2)
2. Course Code: CMOR24-F3241
3. Semester / Year: Second / 2025
4. Description Preparation Date: : 23-1-2025
5. Available Attendance Forms: : In presence
6. Number of Credit Hours (Total) / Number of Units (Total) 4/3
7. Course administrator's name (mention all, if more than one name)
Name: Assist. Prof. Dr. Niam Abdulmunim Abdulmajeed Email: niam.munim@uomosul.edu.iq
8. Course Objectives

Course Objectives	1-Learn about algorithms inspired by nature, including evolutionary algorithms, swarm intelligence, basic concepts and components, and the various applications they contain to solve many problems. 2- This course deals with the genetic algorithm, its components, particle swarm optimization, and basic concepts. 3- Employing genetic algorithm, particle swarm optimization, and applications to find the optimal solution in optimization and operation research.

9. Teaching and Learning Strategies

Strategy	1. Knowledge in the field of intelligent techniques and algorithms. 2. Employing intelligent techniques to serve society. 3. The student has knowledge of individual intelligent agents for modeling industrial, social, and biological systems. 4. Use evolutionary algorithms and heuristic and metaheuristic algorithms. 5. The student graduates as Agent. 6. Knowledge of modeling evolutionary algorithmic agents and social swarm intelligence agents in complex designs and problems. 7. Knowledge of evolutionary algorithms and swarm intelligence inspired by different natural systems. 8. The student has skills in using and developing intelligent individual agents to solve optimization problems with complex structures. 9. The student has skills in developing simulation models based on swarms of intelligent agents or agents. 10. Skills in using evolutionary algorithms (genetic algorithm) and swarm intelligence algorithms to solve operations research problems and real optimization problems

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4		Evolutionary algorithms - definition of evolutionary algorithms, concept of genetic algorithm, idea of genetic algorithm, basic (biological) terms of genetic algorithm, basic steps of genetic algorithm, flow chart	Lecture, discussion and interrogation	written tests
2	4		Elements of genetic algorithm, encoding and its types with examples	Lecture, discussion and interrogation	written tests
3	4		Fitness Function with examples	Lecture, discussion and interrogation	written tests
4	4		Selection and selection methods with examples	Lecture, discussion and interrogation	written tests

5	4		Crossover and its types with examples	Lecture, discussion and interrogation	written tests
6	4		Mutation and its types with examples, stopping measures	Lecture, discussion and interrogation	written tests
7	4		Applications and examples of genetic algorithm in operations research and optimization Applications in Matlab	Lecture, discussion and interrogation	written tests
8	4		Swarm Intelligence – basic concepts, idea of swarm intelligence, historical development of swarm intelligence	Lecture, discussion and interrogation	written tests
9	4		Principles of collective behavior in swarms, types of swarm intelligence	Lecture, discussion and interrogation	written tests
10	4		Particle swarm optimization algorithm – definitions, idea of PSO	Lecture, discussion and interrogation	written tests
11	4		Advantages, disadvantages and applications of particle swarm optimization algorithm	Lecture, discussion and interrogation	written tests
12	4		Basic components of the particle swarm optimization algorithm, basic concepts of the particle swarm optimization algorithm	Lecture, discussion and interrogation	written tests
13	4		Parameters of the particle swarm optimization algorithm Basic steps and flowchart of particle swarm optimization algorithm	Lecture, discussion and interrogation	written tests
14	4		Applications and problems in operations research and optimization Applications in Matlab	Lecture, discussion and interrogation	written tests
15	4		A week of preparation before the final exam		

11. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W.)

12. Learning and Teaching Resources

Required textbooks (curricular books any)	Lectures prepared by the lecturer
Main references (sources)	Xin-She Yang,2020, Nature-Inspired Optimization Algorith Second edition, Elsevier.

Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	https://www.youtube.com/watch?v=wQm9mFw02mU

Course Description Form

9. Course Name: (2)	
10. Course Code: **CMOR23-F4121**	
11. Semester	
12. Description Preparation Date:1/4/2024	
13. Available Attendance Forms: In presence	
14. Number of Credit Hours (3) / Number of Units (2)	
15. Course administrator's name (mention all, if more than one nam	
Name: Dr. Mohammed Ahmed Al-Kailany **Email**: alkailanym@uomosul.edu.iq	**Name**: M. Othman Attya Wardy **Email**: othman.attya@uomosul.edu.iq

16. Course Objectives

13. Managing Orders and Costs:
Inventory models deal with determining the optimal timing for placing orders and calculating the ideal order quantity while considering various factors, such as the cost of acquiring goods, the cost of holding one unit in inventory, and the potential cost of shortages. These models help achieve a balance between these costs to ensure efficient storage operations.

14. Reducing Total Costs:
The primary objective of studying inventory models is to identify the scientific principles and rules that enable management to reduce the total costs associated with the storage process. Through these models, management can improve decisions related to order quantities and replenishment periods, leading to lower storage and holding costs.

15. Ensuring Operational Continuity and Customer Satisfaction:
Inventory models help effectively meet customer demands while maintaining sufficient inventory levels to protect management from unexpected fluctuations in production or demand. This ensures the management's ability to respond quickly to

customer orders, while determining the Economic Order Quantity (EOQ) that balances storage costs with market needs.

16. Teaching and Learning Strategies

A- Knowledge and Understanding

A1: That the student states the meaning of inventory and the purpose of studying storage systems.

A2: That the student writes down the costs related to inventory systems.

A3: That the student describes the meaning of demand in inventory models an its classifications.

A4: That the student distinguishes between types of inventory based on the ty of material stored.

A5: That the student explains how to determine the economic order quantity a the reorder point.

A6: That the student summarizes the steps to determine the price break model

A7: That the student states the types of inventory models (probabilistic model

A8: That the student describes how to determine the economic order quantity the continuous model.

A9: That the student distinguishes between the single-period model and the unified
order setup cost, which equals zero.

A10: That the student explains the scientific method for controlling the distribution of ABC inventory.

A11: That the student summarizes the steps for studying the fixed model for multiple items, with the identification of shortage and form.

B- Subject-Specific Skills

B1: That the student applies the model to a real-life case.

B2: That the student identifies the error in the model.

B3: That the student presents the results in an organized table.

C- Thinking Skills

C1: That the student presents a real-world problem.

C2: That the student compares different problem-solving methods.

C3: That the student rearranges the solution approach to improve the results.

C4: That the student plans to use the appropriate method in solving the problem

D- General and Transferable Skills (Other Skills Related to Employabilit and Personal Development)

D1: That the student implements the method used with evidence.

D2: That the student improves the approach used in the solution.

D3: That the student verifies the correctness of the method employed.

D4: That the student is enabled to solve the results accurately.

17. Course Structure

Week	Hours	Learning Outcomes	Unit / Topic	Teaching Method	Assessment Method
1	4	A	Introduction to Inventory and Overview	Lecture and Discussion	Observation
2	4	A	Objectives, Concepts, and Inventory Control	Lecture and Discussion	Observation
3	4	A, B	Concepts and Characteristics of Inventory Systems	Lecture and Questioning	Oral Tests
4	4	A, B	Probabilistic Model	Lecture and Problem Solving	Written Tests
5	4	B, C	Continuous Model	Lecture and Discussion	Observation
6	4	B, C	Single-Period Model	Lecture and Discussion	Observation
7	4	B, C	Zero Setup Cost Model	Lecture and Discussion	Observation
8	4	D	ABC Distribution	Lecture and Discussion	Observation
9	4	A, B	Spare Parts Planning and Management	Lecture and Problem Solving	Presentation
10	4	B, C	Objectives of Spare Parts Management	Lecture and Discussion	Observation
11	4	B	ABC Inventory Control Method	Lecture and Project	Project
12	4	A, B	Inventory Constraints	Lecture and Problem Solving	Observation
13	4	A, C	Multi-Unit Inventory Systems	Lecture and Discussion	Observation
14	4	A, C	Static Multi-Item Model with Shortage Constraints	Lecture and Questioning	Tests
15	4	C, D	Special Case: Single Inventory Constraint	Discussion	Assignments
16	-	-	Pre-Exam Preparation Week	General Review	-

18. Course Evaluation

- Written tests
- Project(Report)
- Presentation (power point)
- Assignments and Observation (H.W)

19. Learning and Teaching Resources

Required textbooks (curricular books, if any)	

Main references (sources)	[1] "Operations and Production Management" – A book to support theoretical concepts. [2] "Operation Research" by Prem Kumar Gupta and D.S. Hira. Al-Shamrati, Hamed Saad Noor, & Al-Zubaidi, Ali Khalil (2007). Introduction to Operations Research. Hashemite Kingdom of Jordan: Majd Alawi Publishing & Distribution.
Recommended books and references (scientific journals, reports...)	3- Samanta, G. P. (2016). "A production inventory model with deteriorating items & shortages". Yugoslav Journal of Operations Research, 14(2). 4- Alfares, H. K. (2014)." Production-inventory system with finite production rate, stock-dependent demand, & variable holding cost". RAIRO – Operations Research, 48(1), 135-150. https://doi.org/10.1051/ro/2013058
Electronic References, Websites	6. **APICS (Association for Supply Chain Management)** o Website: https://www.apics.org o Description: APICS offers certifications, training, and resources on inventory management and supply chain practices. 7. **MIT OpenCourseWare - Supply Chain Management** o Website: https://ocw.mit.edu o Description: Free online courses from MIT that cover inventory management as part of supply chain topics. 8. **Investopedia - Inventory Management** o Website: https://www.investopedia.com o Description: Provides definitions and explanations of key inventory management concepts like EOQ, JIT, and ABC analysis. 9. **Harvard Business Review (HBR) Articles** o Website: https://hbr.org o Search for articles on inventory management, supply chain optimization, and related topics. 10. **Coursera and Udemy Courses** o Platforms: https://www.coursera.org | https://www.udemy.com o Description: Online courses on inventory management, supply chain, and logistics offered by universities and industry experts. **Software Tools for Inventory Management** 6. **SAP ERP** o Website: https://www.sap.com o Description: Enterprise resource planning software with robust inventory management features. 7. **Oracle NetSuite** o Website: https://www.netsuite.com o Description: Cloud-based inventory and supply chain management software. 8. **Fishbowl Inventory** o Website: https://www.fishbowl.com o Description: A popular inventory management solution for small and medium-sized businesses. 9. **TradeGecko (now QuickBooks Commerce)** o Website: https://www.tradegecko.com o Description: Inventory and order management software

	for e-commerce businesses. 10. **Zoho Inventory** ○ Website: https://www.zoho.com/inventory	

Course Description Form

49. Course Name: Regression Analysis (2)	
50. Course Code: **CMOR23-F3261**	
51. Semester / Year: Second course	
52. Description Preparation Date: 1/2/2025	
53.Available Attendance Forms: In presence	
54.Number of Credit Hours (Total) 3 / Number of Units (Total): 2	
55. Course administrator's name (mention all, if more than one name)	
Name: Salih Mooaed Shaker Email: salih.mooaed@uomosul.edu.iq	
56. Course Objectives	
Course Objectives	**1-Define the multiple linear regress model** **2- Estimating regression parameters for multiple model** **3-Additional sum of squares control** **4-Methods for choosing the b regression equation**
57. Teaching and Learning Strategies	
Strategy	1- Define the linear model 2- Parameter estimation, properties of estimators

	3- Create a variance analysis table 4- Identify the multiple partial correlation coefficient and t standard partial regression coefficient 5- Find the additional sum of squares 6- Methods for choosing the best regression equation 7- Significant or expressive variables 8- The case of a qualitative independent variable 9- Other multivariate methods 10- Path analysis

58. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	1	**Matrices, linear model**	Lecture and discussion	watching
2	3	2	**Parameter estimation, properties of estimators**	Lecture and discussion	watching
3	3	3	**Analysis of variance tab**	Lecture and exercises	watching
4	3	4	**Partial multiple correlation coefficient A the standard partial regression coefficient**	Lecture and exercises	watching
5	3	5	**ditional sum of squares And the coefficient of partial determination**	Lecture and exercises	Oral exams
6	3	6	**hoose the best equation Regression using severa criteria**	Lecture and exercises	watching
7	3	6	**Backword deletion met**	Lecture and exercises	watching
8	3	6	**Forward deletion meth**	Lecture and exercises	watching
9	3	6	**Stepwise regression method**	Lecture and exercises	watching
10	3	8	**Significant or expressiv variables**	Lecture and exercises	Written tests
11	3		**Mid Exame**		

12	3	7	**The general concept of function variables, in th condition of having one qualitative independent variable In the regression equation**	Lecture exercises	watching
13	3	9	**Some other methods ar multiple Variables, principal components analysis**	Lecture and exercises	watching
14	3	10	**Path analysis**	Lecture and exercises	watching

59. Course Evaluation
Written tests the report Assignments and Observation (H.W)

60. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Al-Rawi, Khashi Mahmoud, 198 Introduction to Regression Analys University of Mosul, Iraq.
Main references (sources)	1-Draper, N. R. and Smith H. 198 Applied Regression Analysis, 2nd.ED
Recommended books and references (scientific journals, reports…)	Richard B. Darlington & Andrew F. Hayes. (2017). "Regression Analysis and Lin Models", The GUILFORD PRESS, New York Londo
Electronic References, Websites	https://www.coursera.org/learn/predictive-modeling-model-fitting-regression-analysis

Course Description Form

1. Course Name: Decision Theory
2. Course Code: CMOR24-F3271
3. Semester / Year: 6/3nd
4. Description Preparation Date:10/02/2025
5. Available Attendance Forms: In presence

6. Number of Credit Hours (Total) / Number of Units (Total) 3/2	
7. Course administrator's name (mention all, if more than one name)	
Name: dr.Zahraa Abed Al-Aziz Al-nuaimi Email: zahraaalnuaimi2017@uomosul.edu.iq Name: Neam Hazim Ahmed Email: neam.alfahady@uomosul.edu.iq	
8. Course Objectives	
Course Objectives	**1. Topic Introduction:**Decision Theory **2. Identifying the Areas** in which the subject of decision theory is involved. **3. The student learns to connect** between calculus, statistics, and decision theory. **4. The student learns about the types of decisions.** **5. The student learns about the value table, the utility table, and the standard utility** which he creates based on the available data. **6. The student learns about the criteria used to make a decision.** **7. The student investigates the appropriate decision based on the data.** **8. The student learns to create a decision tree and how to use it in decision-making.**
9. Teaching and Learning Strategies	
Strategy	A: Knowledge and understanding 1A. The student learns how to understand the problem and convert the available information into tables or matrices upon which the appropriate decision is made. 2A. The student learns how to use probability theory and differential and integral calculus to find the expected value criterion. 3A. The student learns how to determine the appropriate decision 4A. The student learns how to use a decision tree. B- Subject-specific skills

1B- The student learns the concept of decision and its types

2B- The student is able to distinguish and identify different decision cases through real examples (certainty, uncertainty, risk)

3B- The student learns to make a decision based on the data before and after using the utility function, which is determined based on the issue

4B- The student learns about the decision tree, its types and uses in discrimination-

C- Thinking skills

1C- The student learns how to use the criteria

2C- The student applies the criteria to real issues

3C- The student thinks about giving the decision that achieves the highest profit in the case of investment and profit and the least loss in cases that deal with loss

4C. The student learns the decision tree and how to use it to make the best decision

D - General and transferable skills

(other skills related to employability and personal development).

D1- The student implements the different criteria

D2- Draws the decision tree

D3- Writes a computer program to calculate the expected value and variance

D4- Gives the final decision

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	A	Basic concepts in decision theory	Lecture discussion	Lecture ar discussio
2	3	A	States of nature an types of decisions, va	Lecture discussion	Lecture ar discussio

			function, utility functi utility table / standa utility table		
3	3	A&B	Regret table or regr function	Lecture discussion	Lecture ar discussio
4	3	A&B	Payback table	Lecture problem solving	Lecture ar problem solving
5	3	**B&A**	States of decision maker	Lecture problem solving	Lecture ar problem solving
6	3	**A &**	Decision making in case of complete certainty	Lecture discussion	Lecture ar discussio
7	3	**B &**	Criteria of decisio making	Lecture discussion	Lecture ar discussio
8	3	**A&**	Optimistic pessimisti criterion, Laplace criterion	Lecture discussion	Lecture ar discussio
9	3	**B &**	LOST opportuniti regret criteri Horus criter	Lecture and problem solving	Presentation (power point)
10	3	B	Expected value criter of payoff table,	Lecture discussion	Assignmer and Observati (H.W)
11	3	D	Mid-cours exam		
12	3	**A&B**	Random decision process, highest expected value criterion or lowest expected value principle	Lecture and Project	Project(Report)
13	3	A ,C&D	Using Bayes theory in decision making, investment portfolios	**Lecture problem solving**	Assignmer and Observati (H.W)
14	3	**A& C**	Decision tree	Lecture discussion	Assignmer and Observati (H.W)
15	3	C&D	General revie of all criteria	**Lecture interrogatio**	TEST

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	القرارات قبيس سعيد عبد الفتاح:دار الكتب للطباعة والنشر
Main references (sources)	محاضرات في نظرية اتخاذ القرار اعداد: د.دلفوف سفيان :2022
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	http://www.Decision Theory . Pdf.

Stage 4 Course 1

Course Description Form

1. Course Name :constrained optimization (1)
2. Course Code: CMOR24-F4111
3. Semester / Year:
4. Description Preparation Date:2024/2025
5. Available Attendance Forms: In presence
6. Number of Credit Hours (Total) / Number of Units (Total) 4 Hours / 3 Units
7. Course administrator's name (mention all, if more than one name)
Name: Eman tarik hamed Email: dr.emantarik@uomosul.edu.iq
8. Course Objectives

Providing the student with skills in solving constrai optimization problems with indirect method	**• Finding optimal strategies** **• How to build a competitive mo** **• Market competition rules**

9. Teaching and Learning Strategies
A- Knowledge and understanding A1- The student should mention the basic definitions A2-The student should write some optimization formulas A3- The student should describe the method A4- The student should distinguish between optimization methods A5- The student explains the mathematical formula of the method A6- The student should summarize the steps to solve the meth

B - Subject-specific skills
B1 - The student applies the method to a numerical problem
B2 - The student should reveal the error in the method.
B3 - The student tabulates the results

C- Thinking skills
C1- That the student chooses the best method.
C2-The student should compare the solution methods.
C3- That the student converts the method and steps for solvin the problem from one form to another.
C4- To plan how to use the appropriate method in the solutio

D - General and transferable skills (other skills related to employability and personal development).
D1- That the student can discover errors himself and solve them.
D2- That the student improves the method used in the solutio
D3- Enabling the student to analyze the results

10. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	Definition and principle of Lagrange function with equality	Lecture and discussion	Observation
2	4	A	some theory of global convergence with equality	Lecture and discussion	Observation
3	4	A&B	of Lagrange function with inequality sufficient and necessary	Lecture and interrogation	(H.W)
4	4	A&B	Find the convex and concave of Lagrange function with inequality	Lecture problem solving	Written tests
5	4	B&C	Solve of Lagrange	Lecture and discussion	Written tests

			function with equality		
6	**4**	B&C	Definition and principle of Lagrange function with inequality	Lecture and discussion	Observation
7	**4**	B&C	some theory of global convergence with inequality	Lecture and discussion	Observation
8	**4**	B&C	of Lagrange function with inequality sufficient and necessary	Lecture and discussion	Observation
9	**4**	A&B	**Lagrange function with inequality**	Lecture and problem solving	Observation
10	**4**	B&C	Find the convex and concave of Lagrange function with inequality	Lecture and discussion	(H.W)
11	**4**	B	Solve of Lagrange function with inequality	Lecture and project	Observation
12	**4**	D	some theory of global convergence with inequality and equality	Lecture and discussion	(H.W)
13	**4**	A&B	of Lagrange function with inequality and equality sufficient and necessary	Lecture and problem solving	Observation
14	**4**	A&C	Find the convex and concave of Lagrange function with inequality and equality	Lecture and discussion	Observation

	15	**4**	A&C	Solve of Lagrange function with inequality and equality	Lecture and interrogation	TEST

11. Course Evaluation	
Written tests Project(Report) Presentation (power point) Assignments and Observation (H.W)	
12. Learning and Teaching Resources	
Required textbooks (curricular books, if any) Operati Research (2011) gupta	
Main references (sources) Engineering optimizati theory and practice (2009) Rao	Operation Resear (2011) gupta
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	www.gametheory.ne

Course Description Form

61. Course Name: Queuing theory (1)
62. Course Code: **CMOR23-F4121**
63. Semester 1 / 2024
64. Description Preparation Date:1/4/2024
65.Available Attendance Forms: In presence
66.Number of Credit Hours (4) / Number of Units (3)
67. Course administrator's name (mention all, if more than one name)

Name: Asst. Prof. Dr. Ghazwan Hani Mahmood Em
ghazwan.alsoufi@uomosul.edu.iq
Name: Dr. Oday Abdulrahman Jarjies Email: odayjarjies@uomosul.edu

68. Course Objectives

20. Introduce the queuing theory.
21. To recognize the properties of queuing models.
22. To understand the efficiency metrics of queuing models.
23. To recognize the types of queuing models and Kendall's notation.
24. To realize pure birth and death process.
25. This course deals with two different models of queuing theory.
26. This is the basic subject for all types of queuing models.
27. To develop problem solving skills and an understanding of queuing theory through applying formulas to solve some examples.

- **Finding opti**
strategies
- **How to build**
competitive mod
- **Market**
competition rules

69. Teaching and Learning Strategies

A- Knowledge and understanding
A1- The student should mention the previous laws
A2- The student should write some terms
A3- The student should describe the model
A4- The student should distinguish between the models
A5- The student explains the mathematical formula
A6- The student summarizes the steps to solve the mathemati formula

B - Subject-specific skills
B1 - The student applies the model to a real situation
B2 - The student must reveal the error in the form.
B3 - The student tabulates the results

C- Thinking skills
C1- The student poses a problem based on reality
C2- The student should compare the solution methods
C3- To rearrange the solution method
C4- To plan how to use the appropriate method in the solution

D - General and transferable skills (other skills related to employability and personal development).
D1- That the student implements the method used by the proof
D2- That the student improves the method used in the solution
D3- Verify the method
D4- Enabling the student to solve the results

70. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	The properties of queuing models.	Lecture and discussion	Assignments and Observation (H.W)
2	4	A	The efficiency metrics of queuing models.	Lecture and discussion	Assignments and Observation (H.W)
3	4	A&B	Types of queuing models and Kendall's notation.	Lecture and discussion	Assignments and Observation (H.W)
4	4	A&B	Arrival process.	Lecture and problem solving	Written tests
5	4	B&A	Departure process.	Lecture and problem solving	Written tests
6	4	A & C	Differential-Difference equations of (M/M/1) :(GD/∞ / ∞) Model.	Lecture and discussion	Assignments and Observation (H.W)
7	4	B & C	Probability distribution of Pn.	Lecture and discussion	Assignments and Observation (H.W)
8	4	A& C	Expected number of units in queue and system.	Lecture and discussion	Assignments and Observation (H.W)
9	4	B & C	Expected waiting time in queue and system.	Lecture and problem solving	Presentation (power point)
10	4	B	Numerical examples.	Lecture and discussion	Assignments and Observation (H.W)
11	4	D	Differential-Difference equations of	Lecture and Project	Project(Report)

				(M/M/1) :(GD/N/ ∞) Model.		
	12	**4**	**A&B**	**Probability distribution of Pn.**		
	13	**4**	**A &C**	**Expected number of units in queue and system.**	**Lecture and problem solving**	**Assignments and Observation (H.W)**
	14	**4**	**A& C**	**Waiting time distribution in queue and system.**	**Lecture and discussion**	**Assignments and Observation (H.W)**
	15	**4**	**C&D**	**Numerical examples.**	**Lecture and interrogation**	**TEST**

71. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

72. Learning and Teaching Resources

Required textbooks (curricular books, if an		
Main references (sources)	**- جزاع، عبد ذياب. (1986). بحوث العمليات. وزارة التعليم العالي، جامعة بغداد. الطبعة الثانية.** **2- الشمرتي، حامد سعد نور. والزبي علي خليل. (2007). مدخل الى بح العمليات. المملكة الاردنية الهاشمية. مجدلاوي للنشر والتو**	Operation Research (2011) gupta
Recommended books and references (scientific journals, reports…)	1- Adan, I., & Resing, J. (2002). Queueing theory. 2- Sztrik, János, (2012). Basic queueing theory. *University of Debrecen, Faculty of Informatics*	
Electronic References, Websites	https://samehar.files.wordpre com/2022/03/queueing-theor 1.pdf	www.gan theory.ne

Course Description Form

1. Course Name: Neural Networks (1)	
2. Course Code: CMOR23-F4131	
3. Semester / Year: The first semester The fourth stage	
4. Description Preparation Date: 1/4/2024	
5. Available Attendance Forms: Recording the student's attendance in theoretical lectures	
6. Number of Credit Hours (Total) / Number of Units (Total): 60 hours of theory (4 hours per week for 15 weeks, 2 theory, 2 discussion)/number of units (3)	
7. Course administrator's name (mention all, if more than one name)	
Name: Hutheyfa Hazem Taha E-mail: Hutheyfa17@uomosul.edu.i	
8. Course Objectives	
Course Objectives	Simulating the human brain Neural networks aim to mimic the way the human brain processes information and makes decisions. 2- Improving machine learning and artificial intelligence Neural networks are used as the basis for many deep learning algorithms, helping to develop more efficient artificial intelligence systems. 3- Improving prediction and decision-making Neural networks are used to predict financial markets, identify future trends, and make data-driven decisions.
9. Teaching and Learning Strategies	

Strategy	How to give a lecture 1- Using the blackboard to explain differential equations and solve questions. 2- Continuous discussion by asking questions and answers in the hall a motivating the student to self-think and thus to self-learning. 3- Requesting assignments and discussions to be sent via the online class, Google Classroom. 4- Requiring the writing of scientific reports in the specialty, discussing th reports, and pointing out their strengths and weaknesses to achieve desired goal.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Artificial Neural Network	Examples wi exercises	Lecture using the blackboard	Short exams, and Quarterly and final
2	4	Define Artificial Neural network	Examples wi exercises	Lecture using The blackboard	Short exams, and Quarterly and final
3	4	Development stages Artificial Neural Network	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
4	4	Why The Neural Network	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
5	4	General description of how a neuron works	Examples with exercises	The blackboard The blackboard	Short exams, and Quarterly and final
6	4	Data processing method	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
7	4	Difference with neurons	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
8	4	Components of aneure cell	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
9	4	Back propagation network	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
10	4	Methods of learning neural networks	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
11	4	Network Learning algorithm	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final

12	4	The process of training or learning the network	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
13	4	Error Back Propagation methodology	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
14	4	Error Back Propagation algorithm	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final

11. Course Evaluation

Distributing the score out of 40 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

12. Learning and Teaching Resources

Required textbooks (curricular books, if an	
Main references (sources)	Descriptions Neural Network
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

73. Course Name: Modeling
74. Course Code: **CMOR23-F4141**
75. Semester / Year:
76. Description Preparation Date:2025/1/23
77.Available Attendance Forms: In presence
78.Number of Credit Hours (Total) 4 / Number of Units (Total) 3
79. Course administrator's name (mention all, if more than one name)
Name: asmaa abdulmunem abdullah

Email: asmaa.abd@uomosul.edu.iq

80. Course Objectives

Course Objectives	**• Finding opti strategies • How to build competitive model • Market competition rules**

81. Teaching and Learning Strategies

A- Knowledge and understanding

A1- To enable the student to understand the subject of modeling

A2- The goal of the modeling course is to introduce the student to mathematical
modeling and how to build the model using differential and differential equations
and practical applications on them.

B - Subject-specific skills

B1 - The student applies the model to a real situation

B2 - The student should be able to solve the model mathematically

C- Thinking skills

C1- The student takes a problem from reality

C2- The student should compare the methods of solving differential equations and differential equations for the same problem

C3- To plan how to use the appropriate method in the solution

**D - General and transferable skills (other skills related to employability
and personal development).**

D1- The student should implement the method followed by solving the models.

D2- The student improves the method used in the solution

D3- To verify the results of the method

82. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	An introductory introduction to models and modeling, types of models – scientific modeling, components of the model – types of models, mathematical modeling – classification of mathematical models, stages of building a mathematical model	Lecture and discussion	Assignments and Observation (H.W)
2	4	A	Using differential equations in building population models Thomas Malthus model	Lecture and discussion	Assignments and Observation (H.W)
3	4	A&B	Water heating modeling – Car accident modeling – Carbon decay modeling	Lecture and discussion	Assignments and Observation (H.W)

				(using differential equations)		
	4	4	A&B	Modeling Change with Difference Equations, Sequences and Dynamic Systems An easy model for modeling change – various examples	Lecture and problem solving	Written tests
	5	4	B&A	Difference equations – Solving difference equations – Examples	Lecture and problem solving	Written tests
	6	4	A & C	Case studies in deterministic modeling of change	Lecture and discussion	Assignments and Observation (H.W)
	7	4	B & C	Modeling Newton's law of cooling,	Lecture and discussion	Assignments and Observation (H.W)
	8	4	A& C	Home mortgage modeling	Lecture and discussion	Assignments and Observation (H.W)
	9	4	B & C	Savings Certificate Modeling	Lecture and problem solving	Presentation (power point)

	10	4	B	**Modeling the decay and half-life of radium**	Lecture and discussion	Assignments and Observation (H.W)
	11	4	D	**Mid-course exam**	Lecture and Project	Project(Report)
	12	4	**A&B**	**Drug modeling in blood**		
	13	4	A &C	**Logistics model with applications**	**Lecture and problem solving**	Assignments and Observation (H.W)
	14	4	**A& C**	**Application of the logistic model of growth in whale society**	Lecture and discussion	Assignments and Observation (H.W)
	15	4	C&D	**Exam**	**Lecture and interrogation**	TEST

83. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

84. Learning and Teaching Resources

Required textbooks (curricular books, if any) **مدخل الم** **النمذجة الرياضية بأستخدام ال matlb (الجزء الاول)** **مدخل الى النمذجة الرياضية بأستخدام الmatlb (الجزء الثاني)** **ب : الاستاذ الدكتور باسل يونس ذنون**	
Main references (sources): **كتاب** (نمذجة ومحاكاة) / جامعة افريقيا العالمية/ اعداد: رامي الطيب مصطفى البشير)	Operation Research (2011) gupt
Recommended books and references (scientific journals, reports…) **النمذجة والمحاكاة**	

تأليف : د. عدنان ماجد عبدالرحيم	
Electronic References, Websit https://www.arageek.com/l/%d8%a7%d9%84%d9%86%d9%85%d8%b0%d8%ac%d8%a9-%d9%88%d8%a7%d9%84%d9%85%d8%ad%d8%a7%d9%83%d8%7%d8	www.gameeory.net

Course Description Form

85. Course Name: Reliability theory	
86. Course Code: CMOR23-F4251	
87. Semester / Year:4th	
88. Description Preparation Date:2024/2025	
89.Available Attendance Forms: In presence	
90.Number of Credit Hours (Total) 3 / Number of Units (Total) 2	
91. Course administrator's name (mention all, if more than one name)	
Name: Lec. Ahmed N. Alkhateeb Email: ahmed.alkhateeb@uomosul.edu.iq	
92. Course Objectives	
Course Objectives	**• Finding optimal strategies** **• How to build a competi model** **• Market competition rules**
93. Teaching and Learning Strategies	
A- Knowledge and understanding A1- The student should mention the previous laws A2- The student should write some terms	

A3- The student should describe the model
A4- The student should distinguish between the models
A5- The student explains the mathematical formula
A6- The student summarizes the steps to solve the mathemati formula

B - Subject-specific skills

B1 - The student applies the model to a real situation
B2 - The student must reveal the error in the form.
B3 - The student tabulates the results

C- Thinking skills

C1- The student poses a problem based on reality
C2- The student should compare the solution methods
C3- To rearrange the solution method
C4- To plan how to use the appropriate method in the solution

D - General and transferable skills (other skills related to employability and personal development).

D1- That the student implements the method used by the proof
D2- That the student improves the method used in the solution
D3- Verify the method
D4- Enabling the student to solve the results

94. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	3	A	Concept of Reliability	Lecture and discussion	Assignments and Observation (H.W)
2	3	A	Elements of reliability	Lecture and discussion	Assignments and Observation (H.W)
3	3	A&B	Continuous distribution	Lecture and discussion	Assignments and Observation (H.W)
4	3	A&B	Reliability function	Lecture and problem solving	Written tests

5	3	B&A	Mean time to failure	Lecture and problem solving	Written tests
6	3	A & C	Hazard funciotn	Lecture and discussion	Assignments and Observation (H.W)
7	3	B & C	Cumulative function and failure rate	Lecture and discussion	Assignments and Observation (H.W)
8	3	A& C	Reliability condition	Lecture and discussion	Assignments and Observation (H.W)
9	3	B & C	Constant failure rate	Lecture and problem solving	Presentation (power point)
10	3	B	Failure model	Lecture and discussion	Assignments and Observation (H.W)
11	3	D	Half exam	Lecture and Project	Project(Report)
12	3	A&B	Exponentail Distribution		
13	3	A &C	Weibull Distribution	Lecture and problem solving	Assignments and Observation (H.W)
14	3	A& C	Types of systems	Lecture and discussion	Assignments and Observation (H.W)
15	3	C&D	Systems diagram	Lecture and interrogation	TEST

95. Course Evaluation

Written tests
Assignments and Observation (H.W)

96. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources): An introduction to reliability maintainability engineering by	Operation Resea (2011) gupta
Recommended books and references (scientific journals, reports…): Introduction to Reliability Analysis Probability Models and Statistical Method	
Electronic References, Websites	www.gametheory. et

Stage 4 Course 2

Course Description Form

1. Course Name :constrained optimization (2)
2. Course Code: CMOR24-F4211
3. Semester / Year:
4. Description Preparation Date:2024/2025
5. Available Attendance Forms: In presence
6. Number of Credit Hours (Total) / Number of Units (Total) 4 Hours / 3 Units
7. Course administrator's name (mention all, if more than one name)
Name: Eman tarik hamed Email: dr.emantarik@uomosul.edu.iq
8. Course Objectives

Providing the student with skills in solving constrai optimization problems with direct method	**• Finding optimal strategies** **• How to build a competitive mo**

	• **Market competition rules**

9. Teaching and Learning Strategies

A- Knowledge and understanding

A1- The student should mention the basic definitions
A2-The student should write some optimization formulas
A3- The student should describe the method
A4- The student should distinguish between optimization methods
A5- The student explains the mathematical formula of the method
A6- The student should summarize the steps to solve the meth

B - Subject-specific skills

B1 - The student applies the method to a numerical problem
B2 - The student should reveal the error in the method.
B3 - The student tabulates the results

C- Thinking skills

C1- That the student chooses the best method.
C2-The student should compare the solution methods.
C3- That the student converts the method and steps for solvi the problem from one form to another.
C4- To plan how to use the appropriate method in the solutio

D - General and transferable skills (other skills related to employability and personal development).

D1- That the student can discover errors himself and solve them.
D2- That the student improves the method used in the solutio
D3- Enabling the student to analyze the results

10. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	Definition and principle of sum method with equality	Lecture and discussion	Observation
2	4	A	Definition and principle of sum method with	Lecture and discussion	Observation
3	4	A&B	inequality	Lecture and interrogation	(H.W)

	4	**4**	A&B	Solve sum method with inequality	Lecture problem solving	Written tests
	5	**4**	B&C	Solve sum method with equality	Lecture and discussion	Written tests
	6	**4**	B&C	G.p.p method	Lecture and discussion	Observation
	7	**4**	B&C	S.p.p method	Lecture and discussion	Observation
	8	**4**	B&C	Q.p.p method	Lecture and discussion	Observation
	9	**4**	A&B	S.Q.p method	Lecture and problem solving	Observation
	10	**4**	B&C	S.L.p method	Lecture and discussion	(H.W)
	11	**4**	B	Cutting plan method	Lecture and project	Observation
	12	**4**	D	Solve sum method (equality) with MATLAB	Lecture and discussion	(H.W)
	13	**4**	A&B	Solve sum method (inequality) with MATLAB	Lecture and problem solving	Observation
	14	**4**	A&C	Solve sum method (inequality and equality) with MATLAB	Lecture and discussion	Observation
	15	**4**	A&C	Solve cutting plan with MATLAB	Lecture and interrogation	TEST

11. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any) Operati Research (2011) gupta	
Main references (sources) Engineering optimizati theory and practice (2009) Rao	Operation Resea (2011) gupta
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	www.gametheory.net

Course Description Form

97.	Course Name: Queuing theory (2)
98.	Course Code: **CMOR23-F4221**
99.	Semester 2 / 2024
100.	Description Preparation Date:1/4/2024
101.	Available Attendance Forms: In presence
102.	Number of Credit Hours (4) / Number of Units (3)
103.	Course administrator's name (mention all, if more than one name)
Name: Asst. Prof. Dr. Ghazwan Hani Mahmood Em ghazwan.alsoufi@uomosul.edu.iq Name: Dr. Oday Abdulrahman Jarjies Email: odayjarjies@uomosul.edu	
104.	Course Objectives

28. To develop problem solving skills and an understanding of queuing theory through applying formulas to solve some examples. **29. To recognize different kind of queuing models.** **30. To understand the efficiency metrics for different types of queuing models.** **31. To analysis some the queuing models.** **32. To perform some the queuing models.** **33. This is the advance subject for all types of queuing models.**	**• Finding opti strategies** **• How to build competitive mode** **• Market competition rules**

105.	Teaching and Learning Strategies

A- Knowledge and understanding

A1- The student should mention the previous laws

A2- The student should write some terms

A3- The student should describe the model

A4- The student should distinguish between the models

A5- The student explains the mathematical formula

A6- The student summarizes the steps to solve the mathemati formula

B - Subject-specific skills

B1 - The student applies the model to a real situation

B2 - The student must reveal the error in the form.

B3 - The student tabulates the results

C- Thinking skills

C1- The student poses a problem based on reality
C2- The student should compare the solution methods
C3- To rearrange the solution method
C4- To plan how to use the appropriate method in the solution

D - General and transferable skills (other skills related to employability and personal development).

D1- That the student implements the method used by the proof
D2- That the student improves the method used in the solution
D3- Verify the method
D4- Enabling the student to solve the results

106. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	Differential-Difference equations of (M/M/C) :(GD/∞ /∞) Model.	Lecture and discussion	Assignments and Observation (H.W)
2	4	A	Probability distribution of Pn.	Lecture and discussion	Assignments and Observation (H.W)
3	4	A&B	Expected number of units in queue and system.	Lecture and discussion	Assignments and Observation (H.W)
4	4	A&B	Waiting time distribution in queue and system.	Lecture and problem solving	Written tests
5	4	B&A	Numerical examples.	Lecture and problem solving	Written tests
6	4	A & C	Differential-Difference equations of (M/M/C) :(GD/N/ ∞) Model.	Lecture and discussion	Assignments and Observation (H.W)
7	4	B & C	Probability distribution of Pn and expected number of units in queue and system.	Lecture and discussion	Assignments and Observation (H.W)

	8	4	A& C	Waiting time distribution in queue and system.	Lecture and discussion	Assignments and Observation (H.W)
	9	4	B & C	Numerical examples.	Lecture and problem solving	Presentation (power point)
	10	4	B	Probability distribution of Pn for (M/M/1) :(GD/∞/N) Model	Lecture and discussion	Assignments and Observation (H.W)
	11	4	D	Expected number of units and waiting time in queue and system.	Lecture and Project	Project(Report)
	12	4	A&B	Numerical examples.		
	13	4	A &C	Probability distribution of Pn for (M/M/C):(GD/N/N) Model and expected number of units for model.	Lecture and problem solving	Assignments and Observation (H.W)
	14	4	A& C	Waiting time in queue and system and numerical examples.	Lecture and discussion	Assignments and Observation (H.W)
	15	4	C&D	Probability distribution of Pn for (M/M/∞) :(GD/∞/∞) Model and Numerical example.	Lecture and interrogation	TEST

107. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

108. Learning and Teaching Resources

Required textbooks (curricular books, if any		
Main references (sources)	- جزاع، عبد ذياب. (1986). بحوث العمليات. وزارة التعليم العالي، جامعة بغداد. الطبعة الثانية. 2- الشمرتي، حامد سعد والزبيدي، علي خليل. (2007). م	Operation Research (2011) gupta

	الى بحوث العمليات. المملكة الار الهاشمية. دار مجدلاوي لل والتو	
Recommended books and references (scientific journals, reports…)	1- Adan, I., & Resing, J. (2002). Queueing theory. 2- Sztrik, János, (2012). Basic queueing theory. *University of Debrecen, Faculty of Informatics*	
Electronic References, Websites	https://samehar.files.wordpr .com/2022/03/queueing- theory-1.pdf	www.ga theory.n

Course Description Form

13. Course Name: Neural Networks (2)
14. Course Code: CMOR23-F4231
15. Semester / Year: The second semester of The fourth stage
16. Description Preparation Date: 1/2/2025
17. Available Attendance Forms: Recording the student's attendance in theoretical lectures
18. Number of Credit Hours (Total) / Number of Units (Total): 60 hours of theory (4 hours per week for 15 weeks, 2 theory, 2 discussion)/number of units (3)
19. Course administrator's name (mention all, if more than one name)
Name: Hutheyfa Hazem Taha E-mail : Hutheyfa17@uomosul.edu.i
20. Course Objectives

Course Objectives	Hussein Efficiency of Interactive Systems 1- Neural networks are used in voice and image recognition systems, such as voice assistants (Siri, Google Assistant) and facial recognition systems. Human behavior analysis and future predictions. 2- Neural networks are used in analyzing user data to extract patterns and predict consumer behavior in marketing and e-commerce. 3- Unstructured data analysis Neural networks help in understanding and analyzing t audio and video data, enabling search engine optimiza and machine translation.

21. Teaching and Learning Strategies

Strategy	How to give a lecture 1- Using the blackboard to explain differential equations and solve questions. 2- Continuous discussion by asking questions and answers in the hall a motivating the student to self-think and thus to self-learning. 3- Requesting assignments and discussions to be sent via the online class, Google Classroom. 4- Requiring the writing of scientific reports in the specialty, discussing th reports, and pointing out their strengths and weaknesses to achieve desired goal.

22. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Statistical Neural Networks	Examples wi exercises	Lecture using the blackbo Neural Netwo ard	Short exams, and Quarterly and final
2	4	RBF Neural Networks	Examples wi exercises	Lecture using The blackboard	Short exams, and Quarterly and final
3	4	PNN Neural Networks	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
4	4	Method of PNN	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
5	4	GRNN Neural Networks	Examples with exercises	The blackboard The blackboard	Short exams, and Quarterly and final

6	4	Method of Logy GRNN	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
7	4	Comparison Between GRNN and RBF	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
8	4	شبكةperceptron	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
9	4	شبكة backpropagation	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
10	4	شبكةMcCulloch Pitts	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
11	4	شبكةWiddro Hoff	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
12	4	شبكةCompetitive	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
13	4	شبكةHebbian	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final
14	4	مناقشة النتائج	Examples with exercises	Lecture using The blackboard	Short exams, and Quarterly and final

23. Course Evaluation

Distributing the score out of 40 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

24. Learning and Teaching Resources

Required textbooks (curricular books, if an	
Main references (sources)	Descriptions Neural Network
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

109. Course Name: simulation
110. Course Code: **CMOR23-F4241**

111. Semester / Year:

112. Description Preparation Date:23/1/2025

113. Available Attendance Forms: In presence

114. Number of Credit Hours (Total) 4 / Number of Units (Total) 3

115. Course administrator's name (mention all, if more than one name)

Name: asmaa abdulmunem abdullah
Email: asmaa.abd@uomosul.edu.iq

116. Course Objectives

Course Objectives:--to enable the student to understand subject of simulation and its applications **Public life matters** **- How to build a simulation model and generate random numbe**	**• Finding optimal strategie** **• How to build a competi model** **• Market competition rules**

117. Teaching and Learning Strategies

A- Knowledge and understanding

A1- How to generate random numbers in different ways

A2- Facilitating the development of models for any problem, its solution, and creating simulations for it.and practical applications on them.

A3-- To learn how to apply and use programming in modeling a simulation

B - Subject-specific skills

B1 - The student applies the simulation model to a real situation

B2 - The student should be able to perform manual simulation

C- Thinking skills

C1- The student takes a problem from reality

C2- The student will compare between manual and computer simulation methods
C3- To plan how to use the appropriate method in the solution

D - General and transferable skills (other skills related to employability and personal development).

D1- That the student implements the methods used in solving th simulation
D2- The student should improve the method used in the solution
D3- To verify the results of the method

118. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	4	A	Knowing simulation, simulation using computer – –	Lecture and discussion	Assignments and Observation (H.W)
2	4	A	objectives of simulation, – advantages of simulation	Lecture and discussion	Assignments and Observation (H.W)
3	4	A&B	disadvantages of simulation models,	Lecture and discussion	Assignments and Observation (H.W)
4	4	A&B	The Monte Carlo method	Lecture and problem solving	Written tests
5	4	B&A	methods for generating random numbers	Lecture and problem solving	Written tests

	6	4	A & C	the mean method of multiplication	Lecture and discussion	Assignments and Observation (H.W)
	7	4	B & C	the mean square method	Lecture and discussion	Assignments and Observation (H.W)
	8	4	A& C	, the inverse method	Lecture and discussion	Assignments and Observation (H.W)
	9	4	B & C	Decision simulation, manual simulation – applied examples	Lecture and problem solving	Presentation (power point)
	10	4	B	Simulation method	Lecture and discussion	Assignments and Observation (H.W)
	11	4	D	Exam	Lecture and Project	Project(Report)
	12	4	A&B	Simulation method for inventory control, Monte Carlo integration simulation		
	13	4	A &C	One–dimensional Monte Carlo integration, acceptance and rejection method	Lecture and problem solving	Assignments and Observation (H.W)
	14	4	A& C	Multidimensional Monte Carlo integration	Lecture and discussion	Assignments and Observation (H.W)

	15	4	C&D	Exam	Lecture and interrogation	TEST

119. Course Evaluation

Written tests
Project(Report)
Presentation (power point)
Assignments and Observation (H.W)

120. Learning and Teaching Resources

Required textbooks (curricular books, if any): **مدخل الى ا مد** **الى النمذجة الرياضية بأستخدام ال matlb (الجزء الاول)** **مدخل الى النم** **الرياضية بأستخدام الmatlb (الجزء الثاني)** **تأليف : الاستا** **الدكتور باسل يونس ذنون**	
Main references (sources): **كتاب** **مذجة ومحاكاة) / جامعة افريقيا العالمية/ اعداد: رامي الطيب مصطفى البشير)**	Operation Research (201 gupta
Recommended books and references (scientific journals, reports…) النمذجة والمحاكاة تأليف : د. عدنان ماجد عبدالرحيم	
Electronic References, Websit https://www.arageek.com/l/%d8%a7%d9%84%d9%86%d9%8 % d8%b0%d8%ac%d8%a9- %d9%88%d8%a7%d9%84%d9%85%d8%ad%d8%a7%d9%8 d8%a7%d8	www.gametheo .net

Course Description Form

121. Course Name: English Language
122. Course Code: CMOR23-F4261
123. Semester / Year:2nd
124. Description Preparation Date:2024/2025
125. Available Attendance Forms: In presence
126. Number of Credit Hours (Total) / Number of Units (Total)
127. Course administrator's name (mention all, if more than one name)
Name: Zainab Qusay AL-Oraibi Email: Zainab.q@uomosul.edu.iq
128. Course Objectives

Course Objectives 1- To think in English and then speak. 2- To be able to talk in English. 3- To be able to compose freely a independently in speech and writing. 4- To be able to read books w understanding.	• **Finding optimal strategies** • **How to build a competitive mo** • **Market competition rules**

129. Teaching and Learning Strategies

- Speaking skill

A1- He must have the ability to think and speak in English

A2- The ability to speak English fluently

A3- The ability to formulate sentences correctly

B - Reading skill

B1 - The ability to read sentences correctly

B2 - Correct pronunciation of words.

C- Writing skill

C1- The ability to write sentences in English correctly

The ability to express ideas through writing

D - Listening skills.
D1- Developing the student's listening skill
D2-The ability to distinguish words while listening

130. Course Structure

Week	Hours	Required learning outcome	Unit or subject name	Learning method	Evaluation method
1	3	D	Introduction: about the study materials.	Lecture and discussion	Assignments and Observation
2	3	A	Grammar: Verbs and nouns. Passive and active voices, and practices.	Lecture and discussion	\Assignments and Observation
3	3	A&B	Second conditional, practices, questions, and short answers.	Lecture and discussion	Assignments and Observation
4	3	A&B	Grammar: might, If I were you.	Lecture and problem-solving	Observation
5	3	B&C	Vocabulary: phrasal verbs.	Lecture and problem-solving	Observation
6	3	A& B& D	social expressions, practices.	Lecture and discussion	Observation
7	3		Mid-term Exam		
8	3	B& D	Grammar: Present perfect continuous, practices.	Lecture and discussion	Assignments and Observation
9	3	A& B& D	Grammar: Words formation, adverbs, reading.	Lecture and problem-solving	Observation

	10	**3**	**A& B& D**	Social expressions: Everyday English (telephoning), practices.	Lecture and discussion	Assignments and Observation
	11	**3**	**A& B& D**	Tenses: Past perfect practices, grammar, and pronunciation.	Lecture and discussion	Observation
	12	**3**	**A&B**	Report statement, practices.	Lecture and discussion	Observation
	13	**3**	A &C	Hot verbs (bring, take, come, go).	**Lecture and problem–solving**	Assignments and Observation
	14	**3**	**A& C**	Social expressions about (saying goodbye), practices.	Lecture and discussion	Assignments and Observation
	15	**3**	C&D	Study the material review	Lecture	Observation

131. Course Evaluation

Written tests
Participate
Assignments and Observation

132. Learning and Teaching Resources

Required textbooks (Headway pre-intermediate plus student's b (John and Lize Soars))	
Main references (Headway pre-intermediate plus work's book)	Operation Resea (2011) gupta
Recommended books and references (scientific journals, reports…)	
Websites https://7esl.com/	www.gametheory.n