

Course Description Form 2022-2023

Review of the performance of higher education institutions (academic program review)

Course Description

This course description provides a concise summary of the main features of the course and the learning outcomes expected of the student, demonstrating whether the student has made the most of the learning opportunities available. It must be linked to the program description.

Course structure

Curricula of the Department of Operations Research and Intelligence Technologies
(2023/2022) for the academic year
First year - First course

عدد الوحدات	عدد الساعات			نوع المادة	رمز المادة	الاسم	ت	
	Sum	مناقشة	عملي					
3	4		2	نظري	اجباري كلية	CMOR22-F1111	Operations Research (1)	1
3	4	1		3	اجباري كلية	CMOR22-F1121	Calculus (1)	2
3	4		2	2	اجباري كلية	CMOR22-1131	Programming (1)	3
3	4		2	2	اجباري جامعة	CMOR22-F1141	Computer Applications	4
2	3	1		2	اجباري قسم	CMOR22-F1151	Linear Algebra (1)	5
2	2			2	اجباري جامعة	CMOR22-F1161	Human Rights	6
2	2			2	اجباري جامعة	CMOR22-F1171	Arabic Language	7
18	23	2	6	15			Sum	

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / First Stage

Annual vocabulary for the subject: Operations Research (1)

Number of weekly hours: Theoretical (2) Practical (2)

Number of units: 3

Chapter (1) Decision Making in Operations Research

1-1 The Art and Science of Operations Research.

2-1 Elements of a Decision Model.

3-1 Art of Modeling.

4-1 Types of OR Models.

5-1 Effect of Data Availability on Modeling.

6-1 Computations in OR.

7-1 Phases of OR study.

Chapter (2) Linear Programming:

Formulation and Graphical Solution

1-2A Two- Variable Model and Its Graphical Solution

1-1-2 Graphical Solution of LP Models

2-1-2 Sensitivity Analysis : An Elementary Presentation

2-2LP Formulations

3-2Additional LP Formulations

Problem

Reference:

Hamdy A. Taha University of Arkansas, Fayetteville

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / First Stage

Subject: Differential and Integral Calculus 1

Number of weekly hours: Theoretical 3 Practical 1

Number of units: 3

:First chapter

Groups, inequalities, Cartesian coordinate system and some basic concepts in analytical geometry

:Second chapter

Functions, algebraic operations on functions, composition of functions, inverse function, real functions, algebraic functions

:Second chapter

Goals, definition of the goal, theorems in goals, one-sided goals, infinite goals, goals in infinity

:Second chapter

Continuity, the concept of continuity, theorems in continuity, continuity in a number, continuity in an interval

:Chapter Five

Derivatives, Definition of Geometric Derivative, Derivative by Definition, Some Laws of Derivatives, Derivatives of Higher Order

Derivative of Complex Function (Chain Rule), Implicit Functions and Their Derivatives, Indeterminate Formulas (Undefined Mathematical Formulas)

and L'Hopital's Rule, Rolle's Theorem, Mean Value Theorem, Examples with Some Applications

:Chapter Six

Polar Coordinate System, Graph in Polar Coordinates, Equations in Polar Form, Relationship between Polar Coordinates and Cartesian Coordinates and

.Conversion between Them

:Sources

Principles of Mathematics, Differential and Integral Calculus by Dr. Ali Aziz • Ali and others

Differential and Integral Calculus by Dr. Ramadan Muhammad Juhayma and • Dr. Ahmed Abdel Ali 2002 Part One

.Differential and Integral Calculus by Thomas •

.Differential and Integral Calculus, Schaum Series •

University of Mosul
College of Computer Science and Mathematics
Department of Operations Research and Intelligent Technologies / First Stage /
First Course
Annual Vocabulary for the Subject: Computer Applications
(2) Number of Weekly Hours / Theoretical (2) Practical
Number of Units: 3

Chapter One: Computer Principles
Introduction to Computers
Information Technology
Types of Computers
Computer Parts
Factors Affecting Computer Operation
Computer Memory and Data Stores
Main Memory Sections
Measurement of Memory and Its Units
Input and Output Units
General Software Applications
Design and Production of Computer Software
Computer Networks and Their Types
Server and Clients
Chapter Two: The Internet and Its Uses
Intranet and Extranet
Concepts in Data Transfer
Information and Communications Technology in Our Lives
Electronic Services and Their Types
Health and Computers
Environment and Computers
Information Security
Viruses
Copyright and Computer Ethics
Chapter Three: Operating System
Tasks of the Operating System
Sections of Operating Systems
Functions of the Operating System
Types of Operating System
Software
Types Software
Systems Development
Multimedia
Data Communication
Data Communication Equipment
Types of Transmission Media
Chapter Four: Internet and Communications
World Wide Web
Website

Protocol and Site Map
Open and Close Web Browser
Chapter Five: Excel
(1) Introduction to Excel
(2) Introduction to Excel
How to Write Functions in Excel
Function (SUM, ACOUNT, AVARAGE,MAX, MIN)
How to Write Programs in Excel
Practical Applications in Excel

University of Mosul
College of Computer Science and Mathematics
Department: Operations Research and Intelligent Technologies
Stage: First
(1) Annual Vocabulary for the Subject: Linear Algebra
(1) Number of Weekly Hours: Theoretical (2) Discussion
Number of Units: 3

Chapter One
Basic Concepts and Definition of Matrices and Their Types 1-1
Arithmetic Operations on Matrices (Addition, Subtraction, Multiplication) and 2-1
Properties on Those Operations
Effect Matrix and its applications in mathematical operations 3-1
Complex numbers and mathematical operations on them with their properties 4-1
Using complex numbers in matrices (Hermitian and Hermitian heterogeneous) 5-1
The effect of the matrix and its applications in mathematical operations 6-1
Determinants and how to find the determinant for matrices with small capacities 7-1
Finding determinants for matrices with large capacities 8-1
Properties of determinants 9-1
Finding the inverse of a matrix using the definition 10-1
Finding the inverse of a matrix using elementary transformations 11-1
Finding the inverse of a matrix using Jacobi's method 12-1
Properties of inverse matrices 13-1

University of Mosul
College of Computer Science and Mathematics
Department of Operations Research and Intelligent Technologies / First Stage
Annual vocabulary for the subject: Programming in Matlab (1)
Number of weekly hours: Theoretical (2) Practical (2)
Number of units: 3
First semester

1. Introduction to Matlab language
2. Arithmetic operations and their priorities with programming examples
3. Logical operations and their priorities with examples
4. Input statements and their formulas
5. Application programs on input statements
6. Output statements and their formulas
7. Application programs on output statements
8. Ready functions

9. Conditional statements:
10. If statement and its formula with programming examples
11. Loops:
12. For statement with programs
13. While statement with programs

University of Mosul
 College of Computer Science and Mathematics
 Department of Operations Research and Intelligent Technologies / First Stage
 Annual Vocabulary for the Subject: Arabic Language
 Number of Weekly Hours: Theoretical (2)
 Number of Units: 2

1. Arabic Speech: Definition, Divisions, and Marks for Each Division.
2. The Arabic sentence: its definition, its divisions: nominal and verbal
3. The movements of inflection: original, subsidiary
4. The Arabic verb: in terms of soundness and defect
5. The Arabic verb in terms of necessity
6. The Arabic verb in terms of transitivity
7. The Arabic verb in terms of necessity
8. Number: reminder, and its feminization
9. Punctuation marks in speech
10. Rules for drawing the hamza
11. The tied and extended taa
12. Say and do not say: common mistakes among speakers and writers
13. The declarative style,
14. And the constructive style
15. Linguistic skills: developing linguistic taste, and improving the style of learners
16. End of semester exam

First year - Second course

عدد الوحدات	عدد الساعات			نوع المادة	رمز المادة	الاسم	ت	
	Sum	مناقشة	عملي					
3	4	—	2	نظري	اختياري كلية	CMOR22-F1211	Operations Research (2)	1
3	4	1	—	3	اختياري كلية	CMOR22-F1221	Calculus (2)	2
3	4	—	2	2	اختياري قسم	CMOR22-1231	Programming (2)	3
3	4	1	—	3	اجباري كلية	CMOR22-F1241	Elementary of Statistics	4
2	3	1	—	2	اختياري قسم	CMOR22-F1251	Linear Algebra (2)	5
2	2	—	—	2	اجباري جامعة	CMOR22-F1261	Democracy	6
2	2	—	—	2	اختياري جامعة	CMOR22-F1271	English Language (1)	7
18	23	3	4	16	Sum			

University of Mosul
 College of Computer Science and Mathematics
 Department of Operations Research and Intelligent Technologies / First Stage
 Annual vocabulary for the subject: Operations Research (2)
 Number of weekly hours: Theoretical (2) Practical (2)

Number of units: 3

Chapter Two

Chapter (1) Dual or Binary Model

- 1-1 Dual Model
- 2-1 Definition of the Dual Problem
- 3-1 Solution of the Dual Problem
- 4-1 Relationship Between Primal and Dual Objective Values
- 5-1 Dual Simplex Method
- 6-1 Economic interpretation of the corresponding model

Chapter (2) Sensitivity Analysis

- 1-2 Interpreting the Simplex Tableau : Sensitivity Analysis
- 2-2 Post optimal or Sensitivity Analysis
 - 1-2-2 Changes Affecting Optimality
 - 2-2-2 Changes Affecting Feasibility
 - 3-2-2 Changes Affecting Optimality and Feasibility
- 3-2 Parametric Linear Programming
 - 1-3-2 Changes in C
 - 2-3-2 Changes in B
 - 3-3-2 Changes in P_j
 - 4-3-2 Simultaneous Changes in C and b

Chapter (3) Revised Simplex Method

- 1-3 Mathematical Foundations
 - 1-1-2 Standard LP Model in Matrix Form
 - 2-1-2 Basic Solution and Bases
 - 3-1-2 The Simplex Tableau in Matrix Form
- 2-3 Revised (Primal) Simplex Method
 - 1-2-2 Product Form of the Inverse
 - 2-2-2 Steps of the Primal Revised Simplex Method

Reference:

- Frederick S. Hillier & Gerald J. Lieberman, Introduction to Operations Research, McGraw-Hill: Boston MA; 8th. (International) Edition, 2005
- Maurice W. Kirby, Operational Research in War and Peace, Imperial College Press, London, 2003
- Michael Pidd, Tools for Thinking: Modelling in Management Science, J. Wiley & Sons Ltd., Chichester; 2nd. Edition, 2003
- Hamdy A. Taha, Operations Research: An Introduction, Prentice Hall; 9th. Edition, 2011
- Wayne Winston, Operations Research: Applications and Algorithms, Duxbury Press; 4th. Edition, 2003

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / First Stage

Subject: Differential and Integral Calculus 2

Number of weekly hours: Theoretical (3) Discussion(1)

Number of units: 3

Chapter One:

Applications of derivatives: Increasing, decreasing and constant functions, critical points of a function, methods of determining intervals of increasing and decreasing a function with application, maximum and minimum values of a function, drawing function graphs, classifying critical points of a function using the first and second derivative.

Chapter Two:

Integration: Indefinite integration, basic formulas for integration, definite integration, properties of definite integration and how to find it, basic theory of calculus.

Integration methods.

Applications of definite integration: Calculating the area between the function curve and the x-axis, calculating the area between the curves of two functions.

Chapter Three:

Trigonometric functions: Types of trigonometric functions, their definition, their graph, their differentiation, their integration.

Exponential functions: general and special exponential functions, definition, properties, graphing, differentiation of exponential functions, integration of exponential functions.

Logarithmic functions: general and special logarithmic functions, definition, properties, graphing, differentiation of logarithmic functions, Integration of logarithmic functions.

Chapter Four:

Multivariable functions: Constants and variables, definition of a function in n variables with examples.

Functions in two variables: definition of a function in two variables with examples, finding the origin and range, graphing functions in two variables.

Chapter Five:

Partial derivatives: partial derivatives using the definition and using theorems for functions in two variables, partial derivatives of the second order, chain rule for functions in two variables.

Chapter Six:

Extreme Values: Maximum Values of Functions in Two Variables

Chapter Seven:

Integration of Functions in Two Variables: Double Integration) Definition, Properties (Methods of Finding Double Integration, Applications of Double n tegration ()Volume, Area, Mass, Moment.(

Sources:

- Principles of Mathematics, Differential and Integral Calculus by Dr. Ali Aziz Ali and others.
- Differential and Integral Calculus, Dr. Ramadan Muhammad Juhaymah and Dr. Ahmed Abdel-Ali 2002, Part One + Part Two
- Differential and Integral Calculus, Thomas.
- Differential and Integral Calculus, Schaum Series.

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / First Stage

Semester Terms for the Subject: Principles of Statistics

Number of Weekly Hours: Theoretical (3) Discussion (1)

Number of Units (3)

Chapter One:- Introduction

- The emergence and development of statistics
- Definition of statistics and its areas of application
- The statistical method in scientific research and research design method

Chapter Two:- Data collection, classification and tabulation

- Data collection methods (comprehensive registration, samples)- Data collection methods

(direct collection, questionnaire)

- Data classification and tabulation
- Selection of samples

Chapter Three:- Frequency distributions and data display methods

- Random variables (continuous and discrete)-(qualitative and quantitative)
- Tabular display of data (frequency distribution, relative frequency distribution)
- Double frequency distribution, distributions (clustered frequency)
- Geometric display (bar charts, rectangle (Graph, pie chart, line chart) (Histogram, polygon and frequency curve) (Aggregate frequency curves)
- The form of frequency distributions (symmetric and asymmetric)

Chapter Four:- Measures of central tendency

- Symbols of addition and multiplication
- The concept of averages and the purpose of calculating them
- The arithmetic mean (methods of calculating it, its advantages and disadvantages and characteristics)
- The weighted arithmetic mean
- The mode (methods of calculating it, its advantages and disadvantages)
- The median (methods of calculating it, its advantages and disadvantages)
- The relationship between the arithmetic mean, the median and the mode
- Choosing the appropriate measure of central tendency

Chapter Five:- Measures of dispersion

- The concept of dispersion and the purpose of calculating it
- The range
- The average deviation (methods of calculating it, its advantages and disadvantages)
- Variance and common variance
- Relative dispersion coefficients
- The coefficient of variation and the standard score

- 1- Statistics / Dr. Mahmoud Hassan Al-Mashhadani/ Amir Hanna Hormuz/ University of Baghdad
2. Introduction to Statistics/ Dr. Khasha Al-Rawi/ University of Mosul
3. Allan G. Bluman / 2012 /Elementary Statistics A Step by Step Approach/ eighth edition

University of Mosul

College of Computer Science and Mathematics

Department: Operations Research and Intelligent Technologies

Stage: First

Annual vocabulary for the subject: Linear Algebra(2)

Number of weekly hours: Theoretical (2) Practical(1)

Number of units: 2

Second semester

- 1-2Introduction to the system of simultaneous linear equations
- 2-2Using matrices in solving systems of linear equations
- 3-2Methods of solving systems of non-homogeneous linear equations using the Gauss and Gauss-Jordan method
And Cramer and when the determinant of the matrix is not equal to zero
- 4-2Methods of solving systems of non-homogeneous linear equations and when the determinant of the matrix is equal to zero
- 5-2Methods of solving systems of homogeneous linear equations
- 6-2Equivalent matrices and types of solutions for linear equations
- 7-2Finding the rank of matrices using equivalence
- 8-2The formal or suppressive formula
- 9-2The relationship between the rank and the set of homogeneous and non-homogeneous linear equations
- 10-2Definition of space Euclidean n and some special theorems
- 11-2Definition of linear combination, Euclidean length and Euclidean distance between two vectors in Euclidean space
 n and some special theorems
- 12-2Finding characteristic roots and characteristic vectors

University of Mosul

College of Computer Science and Mathematics

Department: Operations Research and Intelligent Technologies

Stage: First

Annual vocabulary for the subject: Programming (2)

Number of weekly hours: Theoretical (2) Practical (2)

Number of units: 3

Semester Two

1. Lesson One: General Introduction to Matrices
2. Lesson Two: Entering and Addressing Matrices
3. Lesson Three: Types of Matrices
4. Lesson Four: Operations on Matrices

5. Lesson Five: Solving Various Examples of Matrices
6. Lesson Six: Solving Various Examples of Matrices Using Conditional Statements "if" and "for".
7. Lesson Seven: Ready-made Functions with Matrices (Special).
8. Lesson 8: Generating Matrices
9. Lesson 9: Rotating and Reshaping Matrices
10. Lesson 10: Expanding Matrices
11. Lesson 11: Partial Matrices
12. Lesson 12: Changing Matrix Elements
13. Lesson 13: Drawing in MATLAB in Two Dimensions
14. Lesson 14: Drawing in MATLAB in Three Dimensions
15. Lesson 15: General Review

University of Mosul

College of Computer Science and Mathematics

Department: Operations Research and Intelligent Technologies

Stage: First

Annual Vocabulary for the Subject: English Language (1)

Number of Weekly Hours: Theoretical (2)

Number of Units: 2

Second Semester

1. Introduction: new headway pre-intermediate plus
2. Grammar: Tenses, wh- questions, practices.
3. Vocabulary- how to use a bilingual dictionary, reading about (communication)
4. Everyday English (social expressions), listening, practices.
5. Grammar: Present tenses, have and have got, practices.
6. Vocabulary about (daily life), listening, and match between vocabularies, and practices.
7. Mid-term Exam.
8. simple present and present continuous, practices, reading about living in the USA.
9. Social expressions about everyday English, practices.
10. Grammar: simple past and past continuous tenses, and practices.
11. Reading and listening, regular and irregular verbs, practices.
12. Vocabulary: about N.- V.- Adj. endings, practices, Everyday English (time expressions), practices.
13. Grammar: quantity (some, many, any, much, few,....), practice.
14. Grammar: about Something/someone/somewhere, practices.
15. Reading: about markets, practices.
16. Preparatory week before the final Exam

Second year - first course

عدد الوحدات	عدد الساعات			نوع المادة	رمز المادة	الاسم	ت	
	Sum	مناقشة	عملي					نظري
3	4	1		3	اجباري قسم	CMOR22-F2111	Integer and Dynamic Programming	1
3	4	1		3	اجباري قسم	CMOR22-F2121	Probability Theory (1)	2
3	4	—	2	2	اجباري كلية	CMOR22-F2131	Numerical Analysis (1)	3
2	4	2		2	اختياري كلية	CMOR22-F2141	Differential Equations	4
2	3	1	—	2	اختياري قسم	CMOR22-F2151	Quality Control	5
2	3	1	—	2	اجباري قسم	CMOR22-F2161	Game Theory	6
2	2	—	—	2	اجباري قسم	CMOR22-F2171	Sequencing Problems	7
18	24	5	2	17		Sum		

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Annual vocabulary for the subject: Correct and dynamic programming

Number of weekly hours: Theoretical (3) Discussion (1)

Number of units: 3

1. Illustrative Applications of Integer Programming
2. Dichotomies
3. Solution Methods of Integer Programming
4. Branch – and – Bound Algorithm
5. Cutting – Plane Algorithms
6. The Fractional (Pure Integer) Algorithm
7. The Mixed Algorithm
8. Zero – One Polynomial Programming
9. Chapter (2) Dynamic (Multistage) Programming
10. Elements of the DP Model : The Capital Budgeting Example
11. DP Model
12. Backward Recursive Equation
13. More on the Definition of the state
14. Examples of DP Models and Computations
15. Problem of Dimensionality in Dynamic Programming
16. Solution of Linear Programs by Dynamic Programming
17. Backward Recursive Equation

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Annual vocabulary for the subject: Probability Theory (1)

Number of weekly hours: Theoretical (3) Discussion (1)

Number of units: 3

Probability Theory – 1

Chapter One: Set theory

1-1 Introduction a Probability

1-2 Basic set theory

1-3 Some Fundamental theorems

1-4 Sequence and limits

1-5 Problems

Chapter Two: Techniques of counting

2-1 The fundamental principle of counting

2-2 Arrangement

2-3 Permutations

2-4 Combinations

2-5 Combinations and Binomial theorem

2-6 Problems

Chapter Three: Probability

3-1 Introduction

3-2 Random Experiment

3-3 Sample Space and Events

3-4 Kinds of Probability

3-5 problems

Chapter Four: Axiomatic approach of probability

4-1 Probability defined on events

4-2 Axioms of Probability

4-3 Independent events

4-4 Conditional Probability

4-5 Baye's theorem

4-6 problems

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

(1) First Course Vocabulary for the Subject: Numerical Analysis

(2) Number of Weekly Hours: Theoretical (2) and Practical

Number of Units: 3

Introduction to Numerical Analysis 1.1

Sources of Errors 2.1

Circular Intersection Error 3.1

Rounding and Intersection Error 4.1

Rounding a Decimal Number Using Rounding 5.1

Rounding Integers 6.1

Types of Errors 7.1

Absolute Error 8.1

Relative Error 9.1

Arithmetic Operations on Errors 10.1

Solving Nonlinear Equations Using Iterative Methods

Methods for Finding the Initial Point of Any Nonlinear Equation 11.1

Drawing Method - 12.1

Method of Changing the Sign (Algorithm - Flowchart - Application Example - 12.1.1

- Practical Program in Matlab)

Numerical Iterative Methods for Solving Nonlinear Equations 12.2.1

Bisection Method (Method Algorithm - Flowchart - Practical Example - -12.3.1
Practical Program)

Repetition and Recurrence Method (Solid Point Method) ((Method Algorithm -12.4.1
(- Flowchart - Practical Example - Practical Program in Matlab)

False Position Method (Method Algorithm - Flowchart - Practical Example - -12.5.1
Practical Program in Matlab)

Newton Raphson Method for Solving a Nonlinear Equation (Algorithm - -12.6.1
Flowchart - Practical Example - Practical Program in Matlab)

Disadvantages of Newton Raphson Method -

Finding the Square Root Using Newton Raphson (Applied Examples, Practical -
Program in Matlab)

The General Law for Finding the Reciprocal of a Number Using Newton Raphson --
(Applied Examples, Practical Program in Matlab)

Finding the Nth Root Using Newton Raphson (Examples Applied, practical --
program in Matlab language)

How to solve nonlinear polynomial equations —homes esthod 12.7.1

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Annual vocabulary for the subject: Differential Equations

Number of weekly hours: Theory (2) + Discussion (2) First Semester

Number of units: 2

First course

First Semester

- .1Re-explaining the methods of integrations (partial, fractional, radical).
- .2Defining differential equations (degree and rank).
- .3Finding the general solution and the specific solution of differential equations.

Chapter Two

- .1Proving the solution of the differential equation
- .2Finding the differential equation from the general solution
- .3Linear differential equations

Separable

Homogeneous

Complete

Incomplete

Chapter Three

- .1First-order and first-degree linear differential equations

.2Bernoulli's equation

Chapter Four

.1Reducing the order of the differential equation Differential equations of order n

.2Non-homogeneous linear coefficients of order n

.3Applications of differential equations

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Semester Vocabulary for the Subject: Quality Control

(1) Number of Weekly Hours: Theoretical (2) Discussion

(2) Number of Units

Vocabulary for the Subject of Quality Control

A Historical Overview of Quality Control -

Some Basic Concepts in Quality Control -

Changes and Deviations in Quality Control -

Inspection Policies -

Quality Control Charts and Their Working Idea -

Statistical Errors -

Modified Shewhart Charts -

Specification Limits -

The Normal Pattern of Point Distribution -

Qualitative Characteristics -

Classification of Control Charts -

Variable Control Charts •

Attribute Control Charts •

Variable Control Charts -

Single Values Chart •

(-) Average Chart •

Range Chart (-R) •

(-) Standard Deviation Chart •

Moving Average Chart (MA) •

Geometric Moving Average Chart (GMA board) •

Challenges in using qualitative control boards for variables -

Control boards for qualitative attributes -

Defective percentage board (P-board) •

Defective number board (number of defective units) (np-board) •

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Annual vocabulary for the subject: Game Theory

Number of weekly hours: Theoretical (2) Practical(1)

Number of units: 3

- 1 -Principles and concepts of game theory
- 2 -Elements of the game
- 3 -Classification of the game
- 4 -Types of games and methods of solving them
- 5 -Binary game model
- 6 -Minimization method
- 7 -Game value and saddle point
- 8 -Absolute strategy and meeting point
- 9 -Game analysis
- 10 -Multiple saddle point
- 11 -Maximin theory
- 12 -Non-zero sum game model
- 13 -Nash equilibrium
- 14 -Mixed strategy
- 15 -Review of lectures
- 16 -Arithmetic method
- 17 -Algebraic method
- 18 -Joint probability method
- 19 -Linear programming method
- 20 -Control laws
- 21 -Control theory
- 22 -Methods of solving the control model
- 23 -Poteragan conditions
- 24 -Differential game
- 25 -Game model and model solution method
- 26 -Bayesian game
- 27 -Methods of solving the Bayesian model

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies /

Second Stage

Annual vocabulary for the subject: Sequential Problems

Number of weekly hours / Theoretical (2) Practical (1)

Number of units: 2

Annual academic vocabulary for the subject of Sequential Problems

)Scheduling, Direct Loop Statement Model, Number of Processors, Process Time, Statement Structure, Heterogeneous and Heterogeneous Processors, Scheduling Types, Scheduling Criteria, Processor Scheduling, Optimization Criterion(

2-1Single Machine Scheduling Algorithms

1-2-1First Come First Served Algorithm FCFS

2-2-1Smallest Work First Scheduling Algorithm SJF

3-2-1 Precedence Scheduling Algorithm

4-2-1 Round Robin Scheduling Algorithm

5-2-1 Early Expected Time Scheduling Algorithm

6-2-1 Moore's Algorithm

3-1 Parallel Machine Scheduling Algorithms

1-3-1 Independent Work Scheduling Algorithms

1-1-3-1 Longest Processing Time Scheduling Algorithm

2-1-3-1 Algorithm Shortest Processing Time Scheduling Algorithm

2-3-1 Related Scheduling Algorithms without Communication Cost

1-2-3-1 Highest Level First Scheduling Algorithm with Time Estimation
HLFET

2-2-3-1 Smallest Level First Scheduling Algorithm with Time Estimation
SCFET

3-2-3-1 Critical Path/Most Direct Successors First Scheduling Algorithm
CP/MISF

4-1 Shop Scheduling

1-4-1 Flow Shop Scheduling

1-1-4-1 Johansen's Algorithm for the $n/2/F//F_{max}$ Problem

2-4-1 Open Shop Scheduling

3-4-1 Multi-Processor task Scheduling

Sources

- 1) P.K. Gupta & D.S.Hira, 2008, Operations Research, S.Chand & Company Ltd. New Delhi.
- 2) Kenneth R. Baker and Dan Trietsch, 2019, Principles of Sequencing and Scheduling, Second Edition, John Wiley & Sons, Inc.
- 3) S. French, 1981, Sequencing and Scheduling: An Introduction to the Mathematics of the Job-Shop.

4) P.Bruker,2006,Complex Scheduling, Springer, Germany.

5) P.Bruker,2007, Scheduling Algorithms, Springer, German

السنة الثانية – الكورس الثاني

عدد الوحدات	عدد الساعات				نوع المادة	رمز المادة	الاسم	C
	Sum	مناقشة	عملي	نظري				
3	4	1		3	اجباري قسم	CMOR22-F2211	Probability Theory (2)	1
3	4		2	2	اختياري كلية	CMOR22-F2221	Numerical Analysis (2)	2
3	4	1		3	اجباري قسم	CMOR22-F2231	Assignment Problems	3
3	4	1		3	اجباري قسم	CMOR22-F2241	Data Mining	4
2	4	2		2	اختياري قسم	CMOR22-F2251	Time Series	5
2	2			2	اختياري جامعة	CMOR22-F2261	Elementary of Economic	6
2	2			2		CMOR22-F2271	English Language (2)	7
18	24	5	2	17	Sum			

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Annual vocabulary for the subject: Probability Theory(2)

Number of weekly hours: Theoretical (3) Discussion(1)

Number of units: 3

Probability Theory – 2

Chapter One: Random variables and their distribution functions

1-1 The concept of Random variable

1-2 Distribution function

1-3 Discrete Random variable

1-4 Continuous Random variable

1-5 Probability mass function (p.m.f)

1-6 Probability density function (p.d.f)

1-7 Problems

Chapter Two: Same discrete distribution

2-1 Uniform discrete distribution

2-2 Bernoulli discrete distribution

2-3 Binomial discrete distribution

2-4 Poisson discrete distribution

2-5 Geometric discrete distribution

2-6 Negative Binomial distribution

2-7 problems

Chapter Three: Same continuous distribution

3-1 Uniform continuous distribution

3-2 Exponential continuous distribution

3-3 Normal continuous distribution

3-4 Gamma continuous distribution

3-5 Beta continuous distribution

3-6 problems

Chapter Four: Moments and Generating function

- 4-1 Generating function
- 4-2 Mathematical expectation
- 4-3 Variance
- 4-4 The moment and central moment
- 4-5 The moment generating function
- 4-6 problems

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Second Course Vocabulary for the Subject: Numerical Analysis(2)

Number of Weekly Hours: Theoretical (2) and Practical(2)

Number of Units: 3

- 1.2 Cramer's method (application examples - practical program)
- 2.2 Newton-Raphson method for solving a system of nonlinear equations using a Jacobi matrix (algorithm - flowchart - application examples - practical program in Matlab)
- 3.2 Improved Newton-Raphson method for solving a system of nonlinear equations (algorithm - flowchart - application examples - practical program in Matlab)
- 4.2 - Using numerical analysis to solve a linear system using indirect methods
- 5.2 - Trigonometric analysis method (method explanation - application examples)
- 6.2 - General Jacobi method (method explanation - application examples, practical program in Matlab)
- 7.2 - Special Jacobi method (trigonometric) (method explanation - application examples, practical program in Matlab)
- 8.2 - General Gauss-Seidel method (method explanation - application examples, practical program in Matlab)
- 9.2 - Gauss-Seidel special method (method explanation - practical examples, practical program in Matlab)
- 10.2 - Inclusion and interpolation
- 11.2 Polynomials (quadratic inclusion, cubic inclusion)
- 12.2 - Lagrange polynomial inclusion (method explanation, example, practical program in Matlab)

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Annual vocabulary for the subject: Time Series

Number of weekly hours: Theory (2) + Discussion (2) Second semester

Number of units: 2

- 1 .1Introduction to time series
 - Definition of time series
 - Graphical representation of time series
- .2Types of time series
 - Continuous time series
 - Intermittent time series
 - Statistical time series

- Time series components
- .3Time series models
- The additive model
- The multiplicative model
- .4Measuring the general trend
- The method of the two-half-series averages
- The method of least squares
- The method of moving averages
- .5The general non-linear trend
- Curves of the second and third degrees
- The exponential equation
- .6Excluding the effect of the general trend
- Excluding the effect of the general trend in the case of data governed by the multiplicative model
- Excluding the effect of the general trend in the case of data governed by the additive model
- .7Seasonal changes
- Simple average method
- Average-to-year method
- Trend-to-average method
- .8Cyclical changes
- Random changes • Trend-to-average method
- 8Cyclical changes
- 9Random changes

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Second Course Vocabulary for the Subject: Assignment Problems

Number of Weekly Hours: Theoretical (3) and Discussion (1)

Number of Units: 3

Annual Academic Vocabulary for the Subject of Assignment Problems

1-1 Transportation Problems

1-1-1 Definition and Formulation of the Transportation Problem (Model)

1-1-2 Methods of Finding the Initial Basic Solution to the Transportation Problem

1-1-2-1 Northwest Corner Method

1-1-2-2 Less Cost Method

1-1-2-3 Vogel's Method

1-1-3 Methods of Finding the Optimal Solution to the Transportation Problem

(Optimality Test)

1-1-3-1 Multipliers Method

1-1-3-2 Stepping Stone Method

1-2 Assignment Problems

1-2-1 Methods of Solving Assignment Problems

1-2-1-1 Counting Method Complete

1-2-1-2 Hungaretion Method

1-2-1-3 Linear Programming Method

1-2-1-4 Transfer Method

1-2-2 Special Cases of Assignment Problems

1-2-2-1 Maximization Problems

- 1-2-2-2 Unbalanced Problems
- 1-2-3 Special Cases of Assignment Problems (Handing unaccepted Assignment)
- 1-2-4 A job-Assignment Problem
- 1-2-5 Standard (Typical) Assignment Problem
- 1-2-6 Traveling Salesman Problem

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Annual Vocabulary for the Subject: Data Mining

Number of Weekly Hours: Theoretical (3) Discussion (1)

Number of Units: 3

1. Fundamentals of Data Mining
2. Classification
3. Clustering
4. Data Types
5. Samples, Variable Selection
6. Data Transformation
7. Distance Measurement
8. Similarity Measures
9. Skewness
10. Flatness
11. Mid-course Exam
12. Cluster Analysis (1)
13. Cluster Analysis (2)
14. Hierarchical Clustering
15. Non-Hierarchical Clustering

جامعة الموصل
 كلية علوم الحاسبات والرياضيات
 قسم بحوث العمليات والتقنيات الذكية / المرحلة الثانية
 المفردات السنوية لمادة: لغة إنكليزية (2)
 عدد الساعات الأسبوعية: نظري (2)
 عدد الوحدات: 2

1. Introduction: Review about Study materials. [2 hrs]
2. Quantities, wh- questions and answers.
3. Articles, reeding (about shopping).
4. Vocabulary: Shopping, prices.
5. Grammar: Verb patterns, making questions.
6. Mid-term Exam
7. Future: Going to/will, practices, reading (Hollywood kids).
8. Grammar: hot verbs, listening, everyday English: how do you feel?.
9. Grammar: What like? , Comparative and superlative adjectives big, bigger, practices.
10. Vocabulary: Synonyms and antonyms.
11. everyday English about directions, listening and reading, practices.
12. Present tense, simple present, present continuous, practices.

13. Grammar: for/ since, practices, questions.
14. Adverbs, word pairs, practices.
15. Everyday English about short answers (Question tags).
16. Preparatory week before the final Exam

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Second Stage

Annual Vocabulary for the Subject: Principles of Economics

Number of Weekly Hours: Theoretical(2)

Number of Units: 2

- 1General Economic Concepts
- 2The Economic Problem Subject of Economics
- 3Models of Solving the Economic Problem (Economic Systems)
- 4Production
- 5Economic Markets
- 6Investment
- 7Consumption and Saving
- 8Distribution
- 9Portfolios and Their Distribution Mechanism

Third year - first course

عدد الوحدات	عدد الساعات				نوع المادة	رمز المادة	الاسم	ت
	Sum	مناقشة	عملي	نظري				
3	4	1	—	3	اجباري قسم	CMOR22-F3111	Unconstrained Optimization (1)	1
3	4	1	—	3	اجباري قسم	CMOR22-F3121	Stochastic Processes (1)	2
3	4	1	—	3	اجباري قسم	CMOR22-F3131	Fuzzy Logic (1)	3
3	4	—	2	2	اختياري كلية	CMOR22-F3141	Intelligent Techniques (1)	4
2	3	1	—	2	اجباري قسم	CMOR22-F3151	Inventory Models (1)	5
2	3	1	—	2	اجباري قسم	CMOR22-F3161	Regression Analysis (1)	6
2	3	1	—	2	اجباري قسم	CMOR22-F3171	Decision Theory	7
18	25	6	2	17	Sum			

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies/First Stage

(1) Unconstrained Optimization Course Vocabulary

(1) Number of Weekly Hours: Theoretical (3), Discussion

Number of Units: 3 Units

Unconstrained optimization (1)

- Optimization
- Statement of an optimization problem
- One variable unconstrained optimization problem
- Concave and convex functions of a one variable
- Definition: local minimum value, local maximum value , global minimum value , global maximum value
- Necessary and sufficient conditions of a one variable functions.
- Methods of One variable unconstrained optimization problem
 1. Dichotomous method
 2. Interval halving method
 3. Fibonacci method
 4. Golden section method
 5. Quadratic interpolation method
 6. Cubic interpolation method
 7. Newton method
 8. Quasi newton method
 9. Secant method

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Third Stage

Annual vocabulary for the subject: Stochastic Processes 1

Number of weekly hours: Theoretical (3), Discussion(1)

Number of units: 3

1 Chapter One: Introduction

- Basic Review to Probability.
- Probability generating function of random variables.
- Probability generating function of sum of fixed number of random variables.
- Probability generating function of sum of random number of random variables.
- Probability generating function of bivariate distribution.

2 Chapter Two: Stochastic Processes

- Introduction to Stochastic Process and definition.
- Specification of Stochastic Processes.
- Classification of Stochastic Processes.
- Introduction to Markov Chain and definition.
- The Initial Distribution and Transition Matrix.
- Higher Order Transition Probability (Chapman Kolmogorov equation).
- Determination of Higher Transition Probability.
- Application and Example

Reference

- 1. Cox, d.r. & Miller, h. d. (1985) "Stochastic processes " .
- 2. Parzen (1982) "Stochastic processes " .
- 3. Bailey, N. T. J. "The elements of stochastic processes with applications to the natural sciences

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Third Stage

Annual Vocabulary for the Subject: Fuzzy Logic(1)

Number of Weekly Hours / Theoretical (3), Discussion(1)

Number of Units: 3

Chapter One: Classical and Fuzzy Sets

-The Concept of Fuzzy Logic

-Classical Sets

- Operations on Classical Sets
- Operations on Fuzzy Sets
- Depicting Classical Sets to a Function

-Fuzzy Sets

- Operations on Fuzzy Sets
- Properties of Fuzzy Sets

Chapter Two: Classical and Fuzzy Relations

- Cartesian Products of Some Relations
- Classical Relations
- Some Clear Basic Relations
- Operations on Some Basic Relations
- Properties of Some Basic Relations
- Fuzzy Relations

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies/Third Stage

Number of Weekly Hours / Theoretical (2) Practical(2)

Number of Units: 3

Annual Study Vocabulary for the Subject of Intelligent Technologies(1)

First Semester / Artificial Intelligence

- 1 -1Definitions and Basic Concepts
- 2-1Simon-Noel Model
- 3-1Representing Knowledge by Logic
- 4-1Logical Deduction
- 5-1Semantic Networks
- 6-1Search Methods
- 7-1Basic Concepts with Examples
- 8-1Problem 8-Puzzle
- 9-1Water Jug Problem

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies

Third Stage

Storage Models Course Vocabulary (1) / 2021-2022

Number of Hours (2) Theoretical (1) Discussion

Number of Units (2)

1- Storage Models (1)

- 1-Definition of inventory and model
- 2-Objective of inventory system
- 3- Concepts and characteristic of inventory system

A:unit cost

B:setup cost

C:holding cost

D:shortage cost

E:order quantity

F:reorder point

G:safety stock

H:lead time

I:demand

J:constraints

K: maximum level of shortage

4-Classification of inventory model:

A: Deterministic inventory model

B: Probabilistic inventory model

5-Deterministic inventory model:

5-A: Purchase without shortage model

5-B: Purchase with shortage model

5-C: Production without shortage model

5-D: Production with shortage model

5-E: Static order deterministic of one item

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Third Stage

Annual vocabulary for the subject: Regression Analysis(1)

Number of weekly hours / Theoretical (2) Discussion(1)

Number of units: 2

Chapter One: The concept of regression

- •Definition of regression analysis
- •Uses and relative relationship
- •Types of regression

•

Chapter Two: Simple linear regression

- •Analysis assumptions
 - •Estimation of regression parameters
 - .1 •In the event of non-repetition of observations x_i
 - * •Least squares method
 - •Properties of parameters estimated by the least squares method
 - •Estimation of community variance
 - •Sampling distributions for
 - •Hypothesis testing and confidence interval estimation
 - •Predicting new observations
 - .2 •In the event of repetition ((x_i, r_i) of times
 - * •Test of lack of fit
 - •Regression through the origin
 - •Correlation coefficient and its relationship to simple linear regression
 - * •Definition of correlation coefficient Simple and its properties
 - * •Coefficient of determination and exact coefficient of determination
 - •Testing hypotheses about the simple linear correlation coefficient
- Chapter Three: Violations and errors in the analysis hypotheses of the simple regression model and how to detect them
- •Test whether the relationship between Y, X
 - * •Using a graph
 - * •Using a statistical laboratory
 - •Testing the variance of the residual error is constant and homogeneous
 - * •Using a graph

- * •Using a statistical laboratory
- •Test whether the errors are independent or there is autocorrelation
- •Using a graph
- * •Using a statistical laboratory

University of Mosul
College of Computer Science and Mathematics
Department of Operations Research and Intelligent Technologies / Third Stage
Annual Vocabulary for the Subject: Decisions
Number of Weekly Hours: Theoretical (2), Discussion(1)
Number of Units: 2

Chapter One: Decision Theory

1-1 :Basic Elements in Decision Making Theory

2-1 :Cases of Nature

3-1 :The Decision or Parts

4-1 :Worth Function and Worth Table

5-1 :Utility Function and Utility Table

6-1 :Regret Function and Regret Table

Regret Function and Regret Table

1 :7 - Return Table

Chapter Two: Decision Criteria

2 :1 - Characteristics of Decision Making Cases

2 :2 - Decision Making Criteria in Case of Uncertainty

2 :3 - Pessimistic Criteria

2 :4 - Optimistic Criteria

2 :5 - Criteria Laplace

2 :6 - Lost Opportunities

2 :7 - Regret Criteria

2 :8 - Hurwicz Criteria

Chapter Three: Decision Criteria under Risk

1 :3 - Expected Pay off Criteria

2 :3 - Expected Value of Opportunity Loss Criteria

3 :3 - Expected Value of Variance Criteria

Combined Expected Value and Variance

Chapter Four: Randomized Decision Procedure

4 :1 - Maximum Expected Utilities Principle

4 :2 - Minimum Expected Utility Principle

Maxmin Expected Utility

Third year - second course

عدد الوحدات	عدد الساعات				نوع المادة	رمز المادة	الاسم	ت
	Sum	مناقشة	عملي	نظري				
3	4	1	—	3	اجباري قسم	CMOR22-F3211	Unconstrained Optimization (2)	1
3	4	1	—	3	اجباري قسم	CMOR22-F3221	Stochastic Processes (2)	2
3	4	1	—	3	اجباري قسم	CMOR22-F3231	Fuzzy Logic (2)	3
3	4	—	2	2	اجباري قسم	CMOR22-F3241	Intelligent Techniques (2)	4
2	3	1	—	2	اختياري قسم	CMOR22-F3251	Inventory Models (2)	5
2	3	1	—	2	اختياري قسم	CMOR22-F3261	Regression Analysis (2)	6
2	2	—	—	2		CMOR22-F3271	English Language (3)	7
18	24	5	2	17			Sum	

University of Mosul
College of Computer Science and Mathematics
Department of Operations Research and Intelligent Technologies
First Stage
Unconstrained Optimization Course Vocabulary(2)
Number of Weekly Hours: Theoretical (3), Discussion(1)
Number of Units: 3 Units
Unconstrained optimization (2)

- Multi variable unconstrained optimization
 - Hessian matrix
 - Test the matrix is positive , negative definite or indefinite
 - Concave and convex functions of multi variable functions
 - Definition: rth differential of function
 - Taylor's method
 - Necessary and sufficient conditions of a multi variable functions.
 - Methods of One variable unconstrained optimization problem
10. Steepest descent (Cauchy) method
11. Conjugate gradient methods
- a. Hestenes – Stiefel method (HS)
 - b. Fletcher – Reeves method (FR)
 - c. Polak – Ribiere method (PR)
12. Newton's method
13. Marquardt method
14. Quasi newton method
- a. Davidon – Fletcher – Powell method (DFP)
 - b. Broyden – Fletcher – Goldfarb – Shanno method (BFGS)

University of Mosul
College of Computer Science and Mathematics
Department of Operations Research and Intelligent Technologies / Third Stage
Annual vocabulary for the subject: Stochastic Processes (2)

Number of weekly hours: Theoretical (3) Discussion (1)

Number of units: 3

Chapter (1) : Poisson process

- Poisson process .
- Postulates for Poisson process .
- Derivation the P. d. f. of a Poisson process .
- Properties of a Poisson process .
- Additive property (complete proof) .
- Difference of two independent Poisson process (complete proof)
- Decomposition of a Poisson process (complete proof) .
- Continuous property .
- Poisson process and binomial distribution (with proof) .
- Autocorrelation between $(N(t))$, $(N(t+s))$ (with proof) .
- Exercises .
- Interarrival time .
- Theorems of interarrival time and waiting time upto the n –th occurrences with examples .
- Pure Birth process with postulations .
- Yule – Furry process .
- Birth – Death process with postulates .
- Determination the Probability of extermination .
- Chebychev's inequality .
- Convolution theorem and examples .

Chapter (2): Renewals Processes

- Distribution function and density function of total life time of n -th renewals $(G_n(t) , g_n(t))$.
- The density function of the total number of renewals $P_n(t)$.
- Relationships between $P_n(t)$ and $G_n(t)$ with examples .
- Renewal function (average number of renewals upto time t) .
- The expected number of renewals per unit time .
- Renewal theorem .
- Examples and exercises .

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Third Stage

Annual vocabulary for the subject: Intelligent Technologies(2)

Number of weekly hours / Theoretical (2) Practical(2)

Number of units: 3

First semester / Genetic Algorithm

- 1 -The concept of the genetic algorithm - The idea of the genetic algorithm - Application areas of the genetic algorithm
- 2 -Basic or biological terms for the genetic algorithm
- 3 -Basic steps in the genetic algorithm
- 4 -Types of genetic algorithms
- 5 -Elements and components of the genetic algorithm
- 6 -Encoding and its sections with examples
- 7 -Fitness Function with examples
- 8 -Selection and selection methods with examples
- 9 -Crossover (alternative interference) and its types with examples
- 10 -Mutation with examples
- 11 -Stopping measures
- 12 -Applications of the genetic algorithm in solving operations research and optimization problems.

Chapter Two / Particle Swarm Optimization Algorithm

- 1 -Swarm Intelligence
- 2 -Particle Swarm Optimization Algorithm - Basic Concepts and Terms
- 3 -Basic Steps of Particle Swarm Optimization Algorithm
- 4 -Applications of Particle Swarm Optimization Algorithm in Solving Operations Research and Optimization Problems.

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies/Third Stage Storage Models Course Vocabulary (2) / 2022-2023

Number of Hours (2) Theoretical (1) Discussion

Number of Units (2)

1 - Break price model

- 1-1 :Cases to find economic order quantity
- 1-2 : Case I
- 1-3 :Case II

2- A single period models

- 1-1 :A continuous demand
- 1-2 :A discrete demand

3- Probabilistic models

- 1-1 :A continuous model
 - 1-2 :Find total cost
 - 1-3 :Find economic order with shortage
 - 1-4 :Find economic order without shortage

4- Uniform demand setup cost equal to zero

5- Planning and management of spare parts

- 1-1 : General goals for planning and management of spare parts

1-2 : Scientific method to control of stock ABC distribution

6-Constraints storage

7-Multiple unit inventory system

7-A: Multiple item static model with shortage limitation and form

7-B:Formation the problem

1-1 :Case I

1-2 :Case II

8- Special case when we have only one constraint

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies/Third Stage

Annual Vocabulary for the Subject: Fuzzy Logic(2)

Number of Hours (3) Theoretical (1) Discussion

Number of Units(3)

.1Properties of Fuzzy Sets

.2Convex Fuzzy Logic

.3Concept of Fuzzy Number

.4Interval Operation

.5Exam

.6Properties of Arithmetic Operations in Closed Intervals

.7 α -Interval Cut Fuzzy Number

.8Fuzzy Number Operation

.9Fuzzy Triangular Number

.10Fuzzy Triangular Number Operation

.11Fuzzy Triangular Number Approximation

.12Classical and Fuzzy Rules

.13Fuzzy Logical Reasoning

.14Fuzzy Logic Rules in MATLAB

.15Exam

.16Preparatory Week Before the Final Exam

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies/Third Stage

Annual vocabulary for the subject: Regression Analysis(2)

Number of hours (2) Theoretical (1) Discussion

Number of units(2)

1. The basics of multiple linear regression, data description, graphic representation, The mathematical model.

2. analysis Assumptions for multiple linear regression, Estimating the parameters using the method of least squares, the sum of the corrected products.

3. Properties of least squares estimators.

4. Analysis of variance, create an analysis of variance table.

5. quizze(1)+Multiple correlation coefficient
 6. partial correlation coefficient. Standard partial regression coefficient for several partial coefficients
 7. Midterm Exam + estimation of a confidence interval for a simple linear function.
 8. Estimating a confidence interval for the average response.
 9. Additional sum of squares. Examples about Additional sum of squares.
 10. quizze(2)+Choosing the best regression equation using Regression procedure.
- Examples.
11. backward elimination method.
 12. The forward deletion method.
 13. quizze(3)+The method of stepwise regression.
 14. Principal component analysis.
 15. Path analysis.
 16. Preparatory week before the final Exam

University of Mosul
College of Computer Science and Mathematics
Department of Operations Research and Intelligent Technologies/Third Stage
(3) Annual Vocabulary for the Subject: English Language
Number of Hours (2) Theoretical
(2) Number of Units

1. Introduction: about the study materials
2. Grammar: Verbs and nouns. Passive and active voices, practices
3. Second conditional, practices, questions and short answers
4. Grammar: might, If I were you
5. Vocabulary: phrasal verbs
6. social expressions, practices
7. Mid-term Exam
8. Grammar: Present perfect continuous, practices
9. Grammar: Words formation, adverbs, reading
10. Social expressions: Everyday English (telephoning), practices
11. Tenses: Past perfect practices, grammar and pronunciation
12. Report statement, practices
13. Hot verbs (bring, take, come, go)
14. Social expressions about (saying goodbye), practices
15. Study the material review
16. Preparatory week before the final Exam

Fourth year - first course

عدد الوحدات	عدد الساعات				نوع المادة	رمز المادة	الاسم		ت
	Sum	مناقشة	عملي	نظري					
3	4	1		3	اجباري قسم	CMOR22-F4111	Constrained Optimization (1)	امثلية مقيدة (1)	1
3	4	1		3	اجباري قسم	CMOR22-F4121	Queuing Theory (1)	نظرية الطوبير (1)	2

3	4	1	—	3	اجباري قسم	CMOR22-F4131	Neural Networks (1)	شبيكات عصبية(1)	3
3	4	—	2	2	اجباري قسم	CMOR22-F4141	Modeling	نمذجة	4
2	3	1	—	2	اختياري قسم	CMOR22-F4151	Pattern Recognition	تمييز الانماط	5
2	3	1	—	2	اختياري قسم	CMOR22-F4161	Reliability Theory	نظرية الموثوقية	6
2	2	—	—	2	اجباري كلية	CMOR22-F4171	Scientific Search Method	منهج البحث العلمي	
18	24	5	2	17	Sum				

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies

Fourth Stage

Course Terms: Restricted Optimization(1)

Number of Hours (3) Theoretical Discussion(1)

- 1-Definitions and Basic Principles of the Lagrange Function for Non-Equal Constraints
- 2-Necessary Condition for the Lagrange Function for Non-Equal Constraints
- 3-Basic Theorems of Convergence of the Lagrange Function for Non-Equal Constraints
- 4-Condition and Coefficient for the Lagrange Function for Non-Equal Constraints
- 5-How to Find the Convexity and Concavity of the Lagrange Function for Non-Equal Constraints
- 6-Basic Definitions and Principles of the Lagrange Function for Equal Constraints
- 7-Necessary Condition for the Lagrange Function for Equal Constraints
- 8-Basic Theorems of Convergence of the Lagrange Function for Equal Constraints
- 9-Condition and Coefficient for the Lagrange Function for Equal Constraints
- 10-How to Find the Convexity and Concavity of the Lagrange Function for Equal Constraints Equality
- 11-Methods of solving problems for constraints of equality for constraints of inequality
- 12-Applications using MATLAB for constraints of inequality
- 13-Applications using MATLAB for constraints of equality
- 14-Applications using MATLAB for constraints of inequality and equality

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Fourth Stage

Annual vocabulary for the subject: Queuing Theory (1)

Number of weekly hours / Theoretical (3)

Number of units: 3

Ch.1 Introduction to Queueing Theory

- 1- Reasons of studying Queues.
- 2-Definition of queues.
- 3- Properties of queueing system.
- 4- Measures of effectiveness for queues.
- 5- Types of queueing system.
- 6- Basic elements of the queueing model.

Ch.2 The probability distributions for queues

- 1- Role of the Poisson and exponential distribution.

2- Pure birth (arrivals) and pure death (departures) processes (relationship between the exponential and poisson distributions).

3- Queues with combined arrivals and departures.

Ch.3 (M/M/1) : (FCFC/∞) model. ∞ /

- 1) Steady state distribution.
- 2) Differential-Difference equations.
- 3) Distribution of P_n .
- 4) Expected number of units in queue and system.
- 5) Waiting time distribution in queue and system.
- 6) Relationship between queue length and waiting time.
- 7) Examples.

Ch.4 (M/M/1) : (GD/N/∞) Model.

- 1) Steady state distribution.
- 2) Differential-Difference equations.
- 3) Distribution of P_n .
- 4) Expected number of units in queue and system.
- 5) Waiting time distribution in queue and system
- 6) Examples.

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Fourth Stage

Annual Vocabulary for the Subject: Artificial Neural Networks(1)

Number of Weekly Hours: Theory (2) + Discussion (2) First Semester

Number of Units: 2

First Course

First Semester

- 1 .Artificial Neural Networks
- 2 .Definition of Artificial Neural Networks
- 3 .Stages of Development of Artificial Neural Networks
- 4 .Why Neural Networks
- 5 .General Description of the Mechanism of Artificial Neurons
- 6 .Data Processing Method
- 7 .Difference with Neurons
- 8 .Components of Neurons

Second Semester

- 1 .Backpropagation Network
- 2 .Neural Network Learning Methods
- 3 .Network Learning Algorithm
- 4 .Artificial Neural Network Training or Learning Process
- 5 .Error Backpropagation Methodology
- 6 .Error Backpropagation Algorithm

University of Mosul

College of Computer Science and Mathematics

Section of Operations Research and Intelligent Technologies

First Course: Modeling

Fourth Stage

Theoretical Hours (2) Practical Hours(2)

Number of Units: 3

Introduction to Models and Modeling

-Types of Models-Scientific Modeling

-Model Components-Types of Models

-Mathematical Modeling-Classification of Mathematical Models

-Stages of Building a Mathematical Model

-Modeling Using Differential Equations

-Population Models

-Stages of Building a Mathematical Model for the Population (Thomas Malthus Model)

-Stages of Building a Pierre Verhulst Population Model

-Growth and Decay Models

-Modeling the Risk of Car Accidents Due to Drinking Alcoholic Beverages

-Modeling Water Heating with Model Development

-Modeling Radiocarbon Dating and Half-Life

-Modeling Change with Difference Equations

-Sequences and Kinetic Systems

-Easy Model for Modeling Change-Various Examples

-Difference Equations-Solving Difference Equations-Examples

-Case Study in Deterministic Modeling of Change

-Modeling Newton's Law For cooling

Modeling savings certificates

Modeling radium decay and half-life

Modeling dioxin or drug in blood

Logistic model with applications

Growth in whale society

Modeling the relationship between two animal societies

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Fourth Stage

Annual vocabulary for the subject: Pattern recognition

Number of weekly hours / Theoretical 3

Number of units: 2

Chapter 1: Introduction

1.1 Formulation of Pattern Recognition Problems

1.2 Major Categories of Pattern Recognition Problems

1.3 Automatic Pattern Recognition Systems

Chapter2: Review of Random Vectors and probability theory

2.1 Random Vectors and Their Distributions

2.2 The Quadratic Forms

2.3 Multi-Variate Normal Distribution

2.4 Linear Transformation

2.5 Orthonormal Transformation

2.6 Properties of Eigenvalues and Eigenvectors

Chapter 3: Clustering

3.1 Fisher Classifier

- 3.2 Bayes Threshold
- 3.3 Parametric Classifiers
- 3.4 Non-Parametric Classifiers
 - k Nearest Neighbor Density Estimate
- Chapter 3: Clustering
 - 3.1 Measure of Dissimilarity
 - 3.2 Hierarchical Methods
 - Single-Link Method
 - Complete-Link Method
 - Sum of Square Methods (k-means Clustering)
 - 3.3 centroid method
- Chapter 4: Decision Tree
 - 4.1 Definition of the Clustering
 - 4.2 Decision Tree Algorithm
 - 4.3 Type of the Decision Tree “Splitting Criteria”
 - 4.4 Rank of split
 - 1- Scoring Splits for Categorical Response Variable
 - Method of Calculating Impurity
 - The Information Gain
 - 2- Scoring Splits for Continuous Response Variable

University of Mosul
College of Computer Science and Mathematics
Department of Operations Research and Intelligent Technologies / Fourth Stage
Semester Terms for the Subject: Reliability Theory
Number of Weekly Hours: Theoretical (2) Discussion (1)
Number of Units (3)

Reliability

1: Basic Reliability concepts

Reliability function

Failure Rate

Average Failure Rate

Mean time to Failure

Design life

2: Failure Models

Exponential failure Model

Gamma Failure Model

Weibull Failure Model

Log Normal Failure Model

3: Reliability of system

Series system

Parallel system

Series –parallel system

K out of n system independent components

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies

Fourth Stage

Subjects: Scientific Research Methodology

Number of Hours (2) Theoretical

Number of Units: 2

1. Introduction - A part that explains the importance of the topic, the reasons for choosing it, and the objectives of the research.
2. Research Problem - The question or problem that the research seeks to solve.
3. Research Objectives - The goals that the researcher seeks to achieve through his study.
4. Importance of the research - The reasons that make the research of academic or practical value.
5. Research Hypotheses - Assumptions that the researcher sets to test their validity during the study.
6. Research Methodology - The scientific method that the researcher relies on in studying the problem (descriptive, experimental, analytical...).
7. Research Community - The group or category being studied.
8. Research Sample - A part of the research community that is chosen according to specific methods to conduct the study on it.
9. Research Tools - The means used to collect data (questionnaire, interview, observation...).
10. Statistical analysis – the computational methods used to extract results from the data.
11. Theoretical framework – the scientific background and concepts related to the research topic.
12. Previous studies – the research and sources that were referred to to support the study.
13. Results – what the research reached based on the analysis.
14. Recommendations – suggestions presented by the researcher based on the results he reached.
15. Conclusion – a summary of the most important findings of the research, and future directions.
16. References and sources – a list of scientific sources that were relied upon

Fourth year - second course

عدد الوحدات	عدد الساعات				نوع المادة	رمز المادة	الاسم		ت
	Sum	مناقشة	عملي	نظري					
3	4	1	—	3	اجباري قسم	CMOR22-F4111	Constrained Optimization (2)	امثلية مقيدة (2)	1
3	4	1	—	3	اجباري قسم	CMOR22-F4121	Queuing Theory (2)	نظرية الطوبير (2)	2
3	4	1	—	3	اجباري قسم	CMOR22-F4131	Neural Networks (2)	شبكات عصبية (2)	3
3	4	—	2	2	اجباري قسم	CMOR22-F4141	Modeling	محاكاة	4
2	2	—	—	2		CMOR22-F4151	Pattern Recognition	لغة انكليزية (4)	5
2	4	—	4	—	اختياري قسم	CMOR22-F4161	Search Project	مشروع التخرج	6
16	22	3	6	31			Sum		

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies

Fourth Stage

Course Terms: Restricted Optimization(2)

Number of Hours (4) Theoretical

- 1-Definitions and Basic Principles of Sequential Problems
- 2-Methods of Solving Sequential Problems for Inequalities
- 3-Methods of Solving Sequential Problems for Equal Constraints
- 4-Methods of Solving Sequential Problems for Inequalities for Equal Constraints
- G.p.p method-5
- q.p.p method-6
- s.p.p method-7
- 8-Methods of Solving Lagrange's Inflated Problems for Inequalities
- 9-Methods of Solving Lagrange's Inflated Problems for Equal Constraints
- 10-Methods of Solving Lagrange's Inflated Problems for Inequalities and Equal Constraints

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Fourth Stage

Annual vocabulary for the subject: Queuing Theory (2)

Number of weekly hours / Theoretical (3)

Number of units: 3

Ch.1 (M/M/1):(GD/ /N) Model.

- 1) Steady state distribution.
- 2) Differential-Difference equations.
- 3) Distribution of P_n .
- 4) Expected number of units in queue and system.
- 5) Waiting time distribution in queue and system.
- 6) Examples.

Ch.2 (M/M/C) :(GD/ ∞ / ∞) Model.

- 1) Steady state distribution.
- 2) Differential-Difference equations.
- 3) Distribution of P_n .
- 4) Expected number of units in queue and system.
- 5) Waiting time distribution in queue and system.
- 6) Examples.

Ch.3 (M/M/C) :(GD/N/ ∞) Model.

- 1) Steady state distribution.
- 2) Differential-Difference equations.
- 3) Distribution of P_n .
- 4) Expected number of units in queue and system.
- 5) Waiting time distribution in queue and system.
- 6) Examples.

Ch.4 (M/M/C) :(GD/N/N); $C < N$ Machine Servicing.

- 1) Steady state distribution.
- 2) Differential-Difference equations.
- 3) Distribution of P_n .
- 4) Expected number of units in queue and system.
- 5) Waiting time distribution in queue and system.
- 6) Examples.

Ch.5 (M/M/∞) :(GD/∞/∞) Self Service Model.

- 1) Steady state distribution.
- 2) Differential-Difference equations.
- 3) Distribution of P_n .
- 4) Expected number of units in queue and system.
- 5) Waiting time distribution in queue and system.
- 6) Examples.

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Fourth Stage

Annual vocabulary for the subject: Artificial Neural Networks(2)

Number of weekly hours: Theory (2) + Discussion (2) Second Semester

Number of units: 2

Second course

First semester-:

Statistical neural network

Radial basis function network

Probabilistic neural network

Probabilistic neural methodology

General regression neural network

General regression neural methodology

Comparison between general regression network and reverse broadcast network

Second chapter-:

Factors affecting the efficiency of training artificial neural network

Example 1

Discussion of results

Example 2

Discussion of results

University of Mosul

College of Computer Science and Mathematics

Department of Operations Research and Intelligent Technologies / Fourth Stage

Subject: Simulation

Theoretical hours (2) Practical hours(2)

Number of units: 3

Definition of simulation

Simulation using computer-Objectives of simulation

-Features of simulation-Areas of simulation application

-Simulation methods-Generating random numbers

Methods of generating random numbers

-Mean multiplication method

-Mean square method

-Inverse method. Algorithm. Application example

-Monte Carlo method for conducting simulation

A practical example of Monte Carlo

Manual simulation on a small grocery store

Simulation of a storage model
A practical example on a gas station
Simulation of a port system
Simulation of Monte Carlo integration
-One-dimensional Monte Carlo integration
Acceptance and rejection method
Multidimensional Monte Carlo integration
Simulation of a regression model

University of Mosul
College of Computer Science and Mathematics
Department of Operations Research and Intelligent Technologies
Fourth Stage
Subjects: English Language 4
Number of Hours (2) Theoretical
Number of Units: 2

1. Introduction: about the study materials.
2. Grammar: Verbs and nouns. Passive and active voices, practices.
3. Second conditional, practices, questions and short answers.
4. Grammar: might, If I were you.
5. Vocabulary: phrasal verbs.
6. social expressions, practices.
7. Mid-term Exam
8. Grammar: Present perfect continuous, practices.
9. Grammar: Words formation, adverbs, reading.
10. Social expressions: Everyday English (telephoning), practices.
11. Tenses: Past perfect practices, grammar and pronunciation.
12. Report statement, practices.
13. Hot verbs (bring, take, come, go).
14. Social expressions about (saying goodbye), practices.
15. Study the material review
16. Preparatory week before the final Exam