

University of Mosul



B.Sc. - Operations Research and Intelligent Technologies

بكالوريوس – علوم في بحوث العمليات والتقنيات الذكية



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1. Overview

This catalogue is about the courses (modules) given by the program of Operations Research and Intelligence Technologies to gain the Bachelor of Science degree. The program delivers (48) Modules with (6000 total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

2. Undergraduate Courses 2025-2026

Module 1

Code	Course/Module Title	ECTS	Semester
OR101	operations research (1)	6	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
Operations Research (OR) is a field in which people use mathematical and engineering methods to study optimization problems in Business and Management, Economics, Computer Science, Civil Engineering, Industrial Engineering, etc. This course introduces frameworks and ideas about various types of optimization problems in the business world. In particular, we focus on how to formulate real business problems into mathematical models that can be solved by computers. 1-1 Fundamentals of operations research and development 1-2 Scientific methods in operations research 1-3 Operations research and its relationship to decision-making 1-4 Linear programming of the general form 1-5 Building linear programming models 1-6 The canonical and standard form of linear programming 2-1 Simplex method 3-1 Special cases in linear programming 4-1 Big M method 5-1 Corresponding(dual) model 6-1 The relationship between the normal and the corresponding model 7-1 The corresponding(dual) optimal solution 8-1 The corresponding(dual) simplex method			

Module 2

Code	Course/Module Title	ECTS	Semester
OR102	Calculus (1)	6	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
Sets–set representation–general review on real numbers–intervals and their types – linear and nonlinear inequalities – functions – types of functions – algebraic operations on functions – composition of functions– inverse of functions – definition of limit – computing limits – the concept of continuity – theorems in continuity–continuity at a point– continuity on an interval– properties of continuous functions – derivatives-derivative rules– higher order derivatives– implicit functions and their derivatives– L'Hôpital's first and second rule– Rolle's theorem–Mean value theorem–critical points – extremes values – increasing and decreasing functions – first derivative test – second derivative test – concavity – inflection points – drawing curves – applications to extreme values– integration– integration rules– definite integral– the Fundamental Theorem of Calculus– applications of definite integral in finding the area.			

Module 3

Code	Course/Module Title	ECTS	Semester
OR103	Programming (1)	5	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	4	93	107
Description			
MATLAB is a high-level programming language and an integrated development environment (IDE) used in scientific and engineering computing. MATLAB is distinguished by its superior capabilities in numerical data processing, as it can be used to analyze and design dynamic systems, and perform statistical operations, factor analysis, and machine learning. The MATLAB language includes many specialized tools and functions, such as graphing, factor analysis, statistics, signal processing, and control. In addition, MATLAB supports object-oriented programming and functional programming. MATLAB is used in many scientific and engineering fields, such as mathematics, physics, chemistry, engineering, and computer science. It is widely used in scientific research, manufacturing industries, medicine, and other technical fields. Programs can be written in MATLAB using the Editor window, where the user can add commands and instructions and execute them. The program can also be run entirely or step-by-step using Debugging mode. MATLAB is characterized by its ease of use and its comprehensive and detailed documentation, which includes many examples and explanations.			

Module 4

Code	Course/Module Title	ECTS	Semester
OR104	Linear algebra	6	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
Matrices & Operations: Definition and types of matrices, basic arithmetic operations (addition, subtraction, multiplication) and their properties, as well as the matrix trace. Complex Numbers: Fundamental concepts, arithmetic operations on complex numbers, and their algebraic properties. Determinants & Inverses: Finding determinants of large-capacity matrices and their properties. Finding the inverse of matrices using elementary transformations (Gaussian elimination) and the properties of the inverse. Linear Systems & Rank: Solving non-homogeneous systems of linear equations using Cramer's rule (when the determinant is not zero $A \neq 0$), Gaussian, and Gauss-Jordan elimination. Using equivalent matrices and the echelon form to find the matrix rank and determine the types of solutions. Euclidean Space & Eigenvalues: Concepts of the n-dimensional Euclidean space (R^n), linear combinations, and calculating Euclidean length and distance. Finally, finding eigenvalues and eigenvectors .			

Module 5

Code	Course/Module Title	ECTS	Semester
UOM1040	Democracy & Human Rights	2	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	1	33	17
Description			
The subject of Human Rights is described as a legal discipline within its general framework and a rights-based discipline within its specific framework. It simultaneously integrates the essence of the rights that an individual must enjoy. These include basic and civil rights, such as the right to life, food, clothing, and shelter; social rights related to engaging in social life, freedom of expression, and freedom of belief, religion, and faith; and political rights, such as the right to vote and run for office. Furthermore, it encompasses other rights that evolve alongside human progress, such as the right to happiness and living in a clean environment, in addition to the right to protect these rights from violation and the guarantees for granting and safeguarding them against infringement. The ultimate goal of teaching this subject is to enlighten cognitive and academic thought regarding the harmonization of these rights with the demands of life across all levels.			

Module 6

Code	Course/Module Title	ECTS	Semester
UOM1021	English Language 1	2	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	1	33	17
Description			
The general methodological principles adopted for this course are based on integrating all four skills (reading, writing, speaking and listening) into highly motivational activities. Meaningful learning is brought to be through activities are based on the students' interests with the aim of fostering motivation. Another key methodological concept is that of the autonomous learner. Recently, due to the effects of changes in language teaching strategies, great importance has been given to the need for teachers to promote and motivate self study, through continuous evaluation. The student will have constant feedback on his/her progress with the aim of modifying, when necessary, his/her learning. Therefore, course contents will be made up of activities that consolidate the linguistic abilities of students, in such a way that they not only learning theoretical knowledge, but create for students the necessary tools for students to continue their language learning through self study techniques studied along the course.			

Module 7

Code	Course/Module Title	ECTS	Semester
OR107	operations research (2)	6	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
The course deals with the use of mathematical models for planning of corporate and governmental activities. Most of the planning problems will consist of an economic objective which we want to maximize under scarce resources. Operations Research consists of: - limiting and defining the current problem, - formulating a mathematical model of the problem, - calculating an optimal solution of the model, -and finally interpreting and implementing the found solution. Revised Simplex Method			

Module 8

Code	Course/Module Title	ECTS	Semester
OR108	Calculus (2)	6	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
In this course, the following will be studied: Trigonometric functions: differentiation of trigonometric functions, integral of trigonometric functions, inverse trigonometric functions, derivatives of inverse trigonometric functions, integrals resulting in inverse trigonometric functions. Exponential functions: derivatives of exponential functions, integration of exponential functions. Logarithmic functions: basic properties of logarithms, derivatives of logarithmic functions. Hyperbolic trigonometric functions: derivatives of hyperbolic trigonometric functions, integration of hyperbolic trigonometric functions. Integration methods: integration by parts, integration by partial fractions, integrals of powers of trigonometric functions, trigonometric substitutions, integrals of quadratic formulas, integration by substitution, other substitutions. Multivariable functions: functions in two variables, finding domain and range. Partial Derivatives: The partial derivative of functions in two variables. Double integration: applications of double integration (calculate volume, area, mass, centers of mass, and ...) Polar coordinates: polar coordinates, relationship between polar and cartesian coordinates, curves in polar coordinates, calculating areas using polar coordinates.			

Module 9

Code	Course/Module Title	ECTS	Semester
OR109	Programming (2)	8	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	4	93	107
Description			
MATLAB is a high-level programming language and integrated development environment (IDE) used in scientific and engineering computing. It is distinguished by its superior capabilities in processing numerical data, as it can be used to analyze and design dynamic systems, as well as perform statistical operations, factor analysis, and machine learning. MATLAB includes many specialized tools and functions, such as graphing, factor analysis, statistics, signal processing, and control systems. Additionally, MATLAB supports object-oriented programming and functional programming. MATLAB is used in many scientific and engineering fields, such as mathematics, physics, chemistry, engineering, and computer science. It is widely used in scientific research, manufacturing industries, medicine, and other technical fields. Programs can be written in MATLAB using the Editor window, where the user can add commands and instructions and execute them. The program can also be run entirely or step-by-step using Debugging mode. MATLAB is characterized by its ease of use and its comprehensive, detailed documentation that contains many examples and explanations.			

Module 10

Code	Course/Module Title	ECTS	Semester
OR110	Elementary of Statistics	5	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	47
Description			
In this course, the student is introduced to the fundamental concepts of the Principles of Statistics. This includes the general concept of statistics, its real-world applications, and its use in scientific research, as well as methods for data collection, tabulation, and understanding various types of samples and data. Additionally, the student learns key statistical concepts such as the arithmetic, geometric, harmonic, and quadratic means, including the relationships between them and their respective advantages and disadvantages. The course also covers the weighted arithmetic mean and how to calculate these measures for both grouped and ungrouped data, alongside variance and standard deviation. Students will also learn how to find the median and mode for grouped and ungrouped data, and how to represent data visually using histograms, frequency polygons, and pie charts. Furthermore, the course explores the concepts of symmetry and skewness in frequency distributions. Finally, the student studies permutations and combinations and the relationship between them, serving as an introduction to the probability concepts they will encounter in their second year.			

Module 11

Code	Course/Module Title	ECTS	Semester
UOM1011	اللغة العربية 1	2	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	1	32	18
Description			
The objective of this course is for the student to understand the parts of speech, namely nouns, verbs, and particles. It also covers identifying the Arabic sentence and its divisions into nominal and verbal sentences. Additionally, the course aims to teach students linguistic, grammatical, and expressive rules so that they can learn how to write a rigorous scientific research paper.			

Module 12

Code	Course/Module Title	ECTS	Semester
UOM1031	Computer 1	3	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	2	48	27
Description			
This course provides a comprehensive introduction to computer science, covering the fundamental principles of hardware and software and how their components interact to perform computing tasks. The course discusses the basic structure of computers, digital data representation, algorithms, operating systems, networks, cybersecurity, and programming fundamentals. It also offers an overview of modern trends in information technology, such as artificial intelligence and cloud computing.			

Module 13

Code	Course/Module Title	ECTS	Semester
OR201	Integer & Dynamic Programming	5	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	62
Description			
This course aims to introduce students to how to solve integer and dynamic programming models, through different methods of solving and how to deal with time in dynamic models. An integer programming problem, is an linear programming problem where in Some of all of the decision Variables are restricted to be integer valued pure integer programming, A pure Integer programing is one in which all the Variables are restricted to be integers. Mixed integer programming, A mixed Integer programming restricts Some of the variables to be integers while others can assume Continuous (fractional values). Methods of Integer programming problem 1-Branch and Bound method. 2- Cutting Plane method (Gomory's cutting plane) D Approximation Implicit enumeration method Methods of Integer programming problem 1- approximation method 2-Branch and Bound method. 3- Cutting Plane method (Gomory's cutting plane). 4-implicit enumeration method Dynamic Programming: Dynamic programming is a mathematical technique dealing with the optimization of multistage decision problems. The technique was originated in 1952 by Richard Bellman Dynamic programming problem (DPP) is a decision making problem in i variables, the problem being Subdivided into n sub problems.			

Module 14

Code	Course/Module Title	ECTS	Semester
OR202	Probability Theory (1)	6	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
This module covers the fundamental concepts of set theory, including subsets, complements, unions, intersections, and set partitioning. Exploring theorems and proofs deepens understanding. It extends to sequences, and limits, and introduces De Morgan's theory with compelling proofs. Combinatorics involves counting and tree diagrams, with the fundamental principle of counting and methods like arrangements, permutations, and combinations. Multinomial expansion enhances counting techniques. Probability topics include binomial theorems, connections to random experiments, and definitions of sample space and events. The Classical and Axiomatic approaches define probability, utilizing tools like dice and playing cards for independent events. Conditional probability, axioms, and practical calculation methods are covered. The introduction of Bayes' theory provides valuable tools for providing a firm basis for advanced work on probability and its applications.			

Module 15

Code	Course/Module Title	ECTS	Semester
OR203	numerical analysis (1)	6	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
In this course, a curriculum has been developed to enable the student to understand the topic of numerical analysis and its uses. And to clarify the types of numerical errors And to facilitate the solution of linear differential equations in different ways And solve nonlinear equations by numerical methods. And also to compare the analytical solution with the numerical solution of differential equations And to learn how to apply programming using numerical methods. In the beginning, we got to know the types of errors and how to derive them. And the use of simple methods in the numerical solution, such as drawing. Also, the use of the method of changing the sign in solving the differential equation. Newton Raphson's simple method for solving. And Newton Raphson's method for solving nonlinear equations. and find the value of the root. And find the reciprocal of the number using Newton Raphson's method.			

Module 16

Code	Course/Module Title	ECTS	Semester
OR204	Sequencing Problems	4	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	52
Description			
This course involves understanding scheduling problems, their types, and scheduling criteria, as well as prominent topics in the management and control of production operations, typically in situations where scarce resources must be allocated to activities over time. It focuses on deterministic scheduling models. Key topics include complexity results and important optimization and scheduling algorithms used in operations research and computer science for single-machine, parallel-machine, multiprocessor task, open shop, flow shop, and job shop problems. Additionally, it covers resource-constrained project scheduling for sequencing and real-life scheduling applications.			

Module 17

Code	Course/Module Title	ECTS	Semester
OR205	Differential Equations	5	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	62
Description			
In this course, we introduce many of the basic concepts and definitions that are encountered in a typical differential equations course. We will also take a look at direction fields and how they can be used to determine some of the behavior of solutions to differential equations. In this section some of the common definitions and concepts in a differential equations course are introduced including order, linear vs. nonlinear, initial conditions, initial value problem and interval of validity. In this section we discuss direction fields and how to sketch them. We also investigate how direction fields can be used to determine some information about the solution to a differential equation without actually having the solution. In this section we give a couple of final thoughts on what we will be looking at throughout this course. we will look at several of the standard solution methods for first order differential equations including linear, separable, exact and Bernoulli differential equations. We also take a look at intervals of validity, equilibrium solutions and Euler's Method. In addition we model some physical situations with first order differential equations.			

Module 18

Code	Course/Module Title	ECTS	Semester
UOM2050	Crimes of the Bath Regime in Iraq	2	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	1	32	18
Description			
This course aims to familiarize students with the crimes committed by the Baathist regime in Iraq and its catastrophic impacts on both society and the state, with a focus on the distinctions between democratic and dictatorial regimes. The curriculum covers mass grave atrocities, methods of torture and persecution, and environmental crimes such as the burning of oil wells and the draining of the marshes. Additionally, it addresses the verdicts issued by the Iraqi Supreme Criminal Tribunal against key figures of the former regime. It also sheds light on the crimes perpetrated in secret prisons, providing an analysis of the legal and humanitarian repercussions of these offenses. Ultimately, the course provides students with a profound understanding of transitional justice and its vital role in holding perpetrators accountable and ensuring that such violations are never repeated in the future.			

Module 19

Code	Course/Module Title	ECTS	Semester
UOM2022	English Language 2	2	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	1	33	17
Description			
This is a course for students have a solid foundation in the language. They may have recently completed an elementary course or they may be returning to language learning after a break and need to revise key language before being able to progress further. New language is introduced systematically, allowing students to extend and consolidate their knowledge of the language. New vocabulary is introduced regularly and this is followed by controlled practice activities, allowing students to immediately activate the language in a supported way. There are also freer practice activities where students can focus on their fluency, so that students feel able to actively participate in conversations and discussions. The course also aims at helping learners to achieve an overall English language proficiency leading to professing at language, and it also helps developing conversational skills, expressing ideas, and helping learners deal with problems and situations successfully.			

Module 20

Code	Course/Module Title	ECTS	Semester
OR207	Probability Theory (2)	6	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
This module covers the concept of random variables, including discrete and continuous ones, along with their associated probability functions and distribution functions. We learn how to obtain the probability mass function (p.m.f.) for discrete random variables and the probability density function (p.d.f.) for continuous random variables. Various examples of discrete distributions, such as the uniform, Bernoulli, binomial, Poisson, geometric, hypergeometric, and negative binomial distributions, are explored. Additionally, continuous distributions like the uniform continuous, exponential, normal, gamma, and beta distributions are discussed. The module also covers mathematical expectations, including definitions, properties, and calculations for both discrete and continuous distributions. Lastly, we explore moments, central moments, and their applications using the moment-generating function (MGF).			

Module 21

Code	Course/Module Title	ECTS	Semester
OR208	Numerical Analysis (2)	6	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
In this course, the student will increase and develop information on the topic of numerical analysis and its uses. And to facilitate the solution of a system of linear and nonlinear differential equations in different ways. Learn about improved methods in numerical analysis. And how to apply programming on numerical methods. And on how to improve the numerical methods to improve the output and reduce the number of iterations. And finding differential equations by giving data values and function values at the given points and using inclusion, interpolation and Lagrange formulas. And the use of trigonometric analysis by using matrices to solve. And the use of general and special methods to find the solution to the system of linear equations. And the use of matrices in special methods of solution, such as Jacobi's special method and Kaus Seidel's special method.			

Module 22

Code	Course/Module Title	ECTS	Semester
OR209	Assignment Problems	4	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	37
Description			
Understanding the transportation exercise, its types, methods for finding the initial solution, and optimality testing. It also explores assignment exercises and the various methods for solving them, along with identifying special cases within assignment exercises, formulating the assignment matrix, exploring different types of assignment exercises, and the Traveling Salesperson exercise.			

Module 23

Code	Course/Module Title	ECTS	Semester
OR210	Reliability theory	4	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	37
Description			
Describes the system's ability to complete the task for which it is responsible in a given time. It is the one that helps to improve the work of systems and reduce the chances of their failure, and these systems include aircraft, linear accelerators, health systems and any other product. It has been developed using probability and statistics. It was used in the nineteenth century in the field of marine navigation and the field of life insurance in exchange for sums of money from its customers. Even today, the failure rate and risk rate are still verbal. Similarly, this theory is used in cases of failure of mechanical devices such as ships, trains, and automobiles. Statistical models suitable for any of these topics are called "time-to-event" models, and failure or death cases are called the even			

Module 24

Code	Course/Module Title	ECTS	Semester
OR211	Game Theory	5	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	62
Description			
This course aims to introduce students to solving cooperative and non-cooperative game models, especially when time, cost, and quality are critical elements in the solution. It addresses various types of games, including cooperative (competitive) and non-cooperative (or non-competitive) games. There are different methods of solution; for instance, the arithmetic method is used when the game is competitive and the payoff matrix size is 2x2. However, if the game is cooperative and non-competitive, also with a 2x2 payoff matrix, the cooperative probabilities method is applied. If it is a competitive game where one player has two strategies and the other has more than two, the graphical method is used. If a game of the same dimensions is cooperative, the elimination method is employed to make the matrix square. Furthermore, if the payoff matrix is a 3x3 square and the game is competitive, the linear programming method is utilized, which is paralleled in cooperative, non-competitive games by the Nash method to find equilibrium, and so on for the rest of the methods.			

Module 25

Code	Course/Module Title	ECTS	Semester
UOM2012	Arabic Language 2	2	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	1	33	17
Description			
In this course, the student explores the relationship between language and society and its significance in our lives. The course also covers the study of languages and dialects, the differences between them, and how to distinguish between a speaker's style and their intended meaning.			

Module 26

Code	Course/Module Title	ECTS	Semester
UOM2032	Computer 2	3	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	2	48	27
Description			
This course is designed to provide students with a comprehensive understanding of fundamental computing tasks and their practical applications. Topics covered include: 1. Utilization of Computers for Fundamental Tasks: Students will gain proficiency in performing basic computing functions such as file management, operating system navigation, and utilizing essential software tools to complete everyday tasks efficiently. 2. Identification and Discussion of Hardware Components: This section focuses on familiarizing students with the key hardware components of a computer system, including the central processing unit (CPU), memory units, storage devices, input/output peripherals, and network interfaces, alongside their respective functions and interactions within the system. 3. Document Creation and Presentation Development: Students will develop skills in creating, formatting, and editing documents using a word processor, as well as designing effective presentations using presentation software. Emphasis will be placed on both technical proficiency and effective communication through these mediums. 4. Conducting Internet-Based Research: Students will be introduced to advanced research techniques using the internet, including the use of academic databases, search engines, and online resources. Critical evaluation of information sources will also be emphasized to ensure quality and reliability in research findings. 5. Introduction to Artificial Intelligence: An introductory overview of artificial intelligence (AI) concepts will be presented. Topics will include the fundamentals of machine learning, natural language processing, and problem-solving techniques, with a focus on the potential applications and ethical considerations surrounding AI technologies.			

Module 27

Code	Course/Module Title	ECTS	Semester
OR301	Unconstrained optimization (1)	6	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
Basic concepts: Optimization, Statement of an optimization problem, One variable unconstrained optimization problem, Definition: local minimum value, local maximum value , global minimum value , global maximum value, Concave and convex functions of a one variable, Necessary and sufficient conditions of a one variable functions , Taylor' s series expansions . Methods of One variable unconstrained optimization problem. Dichotomous method, introduction , Algorithm, examples. Interval halving method , introduction , Algorithm, examples. Fibonacci method, introduction , Algorithm, examples. Golden section method , introduction , Algorithm, examples. Quadratic interpolation method , introduction , Algorithm, examples. Cubic interpolation method , introduction , Algorithm, examples. Newton method , introduction , Algorithm, examples. Quasi newton method , introduction , Algorithm, examples. Secant method , introduction , Algorithm, examples.			

Module 28

Code	Course/Module Title	ECTS	Semester
OR302	Inventory Models(1)	6	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
The main purpose of studying inventory models is to determine the rules and foundations through which the management can use them to minimum total costs of inventory that result from the storage process to cover customer demands, and the presence of an amount of inventory that protects the management from any unexpected decrease in the volume of production, as it remains able to respond to customer requests By addressing Definition of Inventory and Model, Objective of Inventory System ,Concepts and characteristic of inventory system and type of storage Knowing the meaning of demand in inventory models and its classifications ,Identify all costs related to inventory systems: 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 and inventory control hypotheses and Classification of inventory model and definition of Deterministic inventory model included Model(1) purchase model without shortage, Model(2) purchase model with shortage ,Model(3) production model without shortage ,Model (4) production model with shortage, and static order deterministic of one item.			

Module 29

Code	Course/Module Title	ECTS	Semester
OR303	Intelligent Techniques (1)	5	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	62
Description			
Understanding the term Artificial Intelligence (AI), its fundamental concepts, components, and its diverse applications in solving numerous exercises in operations research and optimization. It explores concepts such as knowledge representation using logic. Additionally, this course examines search methods and algorithms (or computer programs) that simulate human cognitive abilities or other behavioral patterns, thereby equipping the computer with the capacity to learn and deduce outcomes for situations it has not been explicitly taught. Finally, it involves the use of metaheuristic algorithms to find the optimal solution for operations research and optimization exercises			

Module 30

Code	Course/Module Title	ECTS	Semester
OR304	Fuzzy logic (1)	5	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	62
Description			
In this Course we study the generalize traditional two-value logic, to infer in uncertain circumstances. And an easy way to describe and represent the human experience through one of the mysterious theories and techniques through which systems can be built, which are expert systems or artificial intelligence, and they are used as a better way to process data in programming systems and deal with inaccurate human-like information, in a way that reflects people's thinking as a model for our sense of words that we trade and use, enabling us to decide and give a closer picture of how these things are represented in computer software. It is how the degree of affiliation is determined. It also offers practical solutions to realistic problems, as effective and reasonable solutions, compared to other solutions that provide other technologies.			

Module 31

Code	Course/Module Title	ECTS	Semester
OR305	Regression Analysis (1)	5	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	37
Description			
This course covers the basic concepts of regression analysis through definition of regression analysis, uses of regression analysis, causal relationship, types of regression, general model, assumptions of analysis, estimation of regression parameters, Least Square. In addition, the characteristics of the regression line equation will be entered, and what is related to errors, unbiasedness, estimation of community variance, estimation of regression coefficient variances, estimation of variance of the average response and covariance. Analysis of variance, Confidence intervals, Regression through the origin, Coefficient of Determination, Correlation coefficient, Hypothesis testing will also be discussed. The irregularities or imbalances in the analysis Assumptions will also be understood, A test of lack of fit, Test of homogeneity of error variance, Test of autocorrelation between errors with application.			

Module 32

Code	Course/Module Title	ECTS	Semester
OR306	Modeling and simulation	6	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	22
Description			
In this course, the student will be able to understand the topic of modeling and simulation and its applications in public life matters. The aim of the modeling and simulation course is to introduce students to mathematical modeling and how to build a model using differential and differential equations and practical applications on it. And how to generate random numbers in different ways Facilitating the development of models for any problem, its solution and simulation. To learn how to apply and use programming on modeling and simulation.			

Module 33

Code	Course/Module Title	ECTS	Semester
OR307	Unconstrained optimization (2)	6	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
Basic concepts: Unconstrained optimization , Multi variable unconstrained optimization , Hessian matrix , Test the matrix is positive , negative definite or indefinite, Concave and convex functions of multi variable functions , Necessary and sufficient conditions of a multi variable functions. Definition: rth differential of function , Taylor's method . Methods of Multi variables unconstrained optimization problem. Steepest descent (Cauchy) method. Conjugate gradient methods. Hestenes – Stiefel method (HS). Fletcher – Reeves method (FR). Polak – Ribiere method (PR). Newton's method. Marquardt method. Quasi newton method. Davidon – Fletcher – Powell method (DFP). Broyden – Fletcher – Goldfarb – Shanno method (BFGS)			

Module 34

Code	Course/Module Title	ECTS	Semester
OR308	Inventory Models (2)	6	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
Definition of Inventory Models ,Objective of Inventory System ,Concepts and characteristic of inventory system Knowing the meaning of demand in inventory ABC distribution ABC Analysis classifies inventory items into three categories based on their value and importance to the business: A (high-value items), B (medium-value items), and C (low-value items). The A items typically the most expensive and most important should be managed with extra care and attention. ,Planning and management of spare parts, General goals for planning and management of spare parts, Scientific method to control of stock ABC distribution and find economic order quantity in Break price model, Probabilistic model ,Review inventory (A continuous model) and single period model,Uniform demand setup cost equal to zero and examples ,Constraints storage and represented The Constraints for investment capital, the Constraints for storage space, the Constraints for the number of orders,an addition to other restrictions represented in the holding cost, the cost of preparing the order, and the cost of one unit, whether it is the cost of consumption or production ,Multiple unit inventory system, Multiple item static model with shortage limitation and form Special case when we have only one constraint .			

Module 35

Code	Course/Module Title	ECTS	Semester
OR309	Intelligent Techniques (2)	5	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	62
Description			
Providing an overview of evolutionary algorithms, including the Genetic Algorithm, its concepts, components, and applications, as well as the topic of Swarm Intelligence (SI), including behavioral swarm intelligence and SI applications. Students will learn various swarm intelligence algorithms inspired by natural systems, such as bird flocks. Additionally, students will implement these algorithms and apply them to solve real-world exercises in operations research and optimization.			

Module 36

Code	Course/Module Title	ECTS	Semester
OR310	Fuzzy logic(2)	5	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	37
Description			
In this Course we study the generalize traditional two-value logic, to infer in uncertain circumstances. And an easy way to describe and represent the human experience through one of the mysterious theories and techniques through which systems can be built, which are expert systems or artificial intelligence, and they are used as a better way to process data in programming systems and deal with inaccurate human-like information, in a way that reflects people's thinking as a model for our sense of words that we trade and use, enabling us to decide and give a closer picture of how these things are represented in computer software. It is how the degree of affiliation is determined. It also offers practical solutions to realistic problems, as effective and reasonable solutions, compared to other .solutions that provide other technologies			

Module 37

Code	Course/Module Title	ECTS	Semester
OR410	Regression Analysis (2)	5	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	37
Description			
This course includes the basic concepts of multiple linear regression, Teach the student all the skills of multiple regression analysis, as there will be several independent variables in the regression model, The student will be taught data description, graphical representation, mathematical model, understanding of analysis assumptions of multiple linear regression, parameter estimation using the least squares method, understanding the properties of least squares estimators, analysis of variance table, explanation of the multiple correlation coefficient, partial correlation coefficient, Standard partial regression coefficient, estimation of a confidence interval for a linear function, simple for several partial coefficients, estimation of a confidence interval for the average response, Additional sum of squares, selection of the best regression equation using several criteria, reverse elimination method, forward elimination method, gradient regression method, principal component analysis Path analysis.			

Module 38

Code	Course/Module Title	ECTS	Semester
OR312	Time series	4	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	37
Description			
Defining and illustrating time series and their types, as well as time series models and related topics. This includes measuring linear and non-linear general trends and the complete process of removing the trend effect. Furthermore, it covers seasonal variations, cyclical variations, and random variations within time series..			

Contact

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