



جمهورية مصر العربية

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research



المعهد العالى للحاسبات وتكنولوجيا المعلومات
مدينة الشروق - القاهرة
شعبة علوم الحاسب

Course specification

Course Code: *BS 205*

Course Title: Operations Research

Academic Year: 2023 /2024

Course specification
(BS 205 Operations Research)

Course Outline	
Faculty:	<i>HICIT- (Higher Institute for Computers & Information Technology-El Shorouk Academy)</i>
Programme(s) on which the course is given:	Undergraduate program in Computer Science
Major or minor element of programme:	Compulsory
Department offering the program	Department of Computer Science
Department offering the course:	Department of Computer Science
Level	First Level
Date of specification approval	--/--/2023

Basic Information			
Code:	<i>BS 205</i>	Title:	<i>Operations Research</i>
Prerequisites:	<i>BS 101 Calculus</i>		
Weekly Hours:			
Lecture: 2	Exercise: 2	Practical :	Total: 3 credit hours

Professional Information
<u>Course Aims:</u>
<p>Upon successful completion of BS 205, students should be: -</p> <ul style="list-style-type: none"> - have a working knowledge of the principal techniques and methods of operations research. - understand how to formulate problems, construct, and solve mathematical models, and apply the systems approach to problem solving. - be able to apply the general concepts of optimization to solve these models.

Program ILOs Covered by Course			
Knowledge and understanding	Intellectual Skills	Professional and practical skills	General and Transferable skills
A4, A21	B1, B2, B4, B7, B8, B13	C6, C16	D11

Intended learning outcomes of course (ILOs)

a. Knowledge and Under-Standing:

- a1. Clarify the characteristics of different types of decision-making environments and the appropriate decision-making approaches and tools to be used in each type. [A4]
- a2. Identify and solve Linear Programming models by using various techniques. [A4, A21]
- a3. Identify the Post Optimality analysis and Duality. [A4]
- a4. Clarify how to build and solve the Transportation models. [A4, A21]
- a5. Describe how to build and solve the Assignment models. [A4, A21]
- a6. Describe how to build and solve the Network models using “CPM and PERT” techniques. [A4, A21]

b. Intellectual Skills:

- b1. Develop analytical skills of problem formulation into appropriate decision models. [B1, B4, B13]
- b2. Design new simple model like: CPM, PERT to improve decision-making. [B1, B2, B4, B7, B8, B13]
- b3. Develop critical thinking and objective analysis of decision problems. [B2, B4, B7, B8, B13]

c. Professional and practical skills

- c1. Practicehand-out experience of computer packages dealing with quantitative techniques. [C6, C16]
- c2. Implement practical cases. [C6, C16]

d. General and transferable skills

- d1. work in a group to design and write programs to solve OR problems. [D11]

Contents		
Topic	Contact Hours	
	lecture	Lab
Introduction to Linear Programming		
• Introduction.	٦	٦

<ul style="list-style-type: none"> • Construction of the LP Model. 		
Graphical LP Solution. <ul style="list-style-type: none"> • Solution of a Maximization Model. • Solution of a Minimization Model. • Slack, Surplus, and Unrestricted Model. Graphical Sensitivity Analysis. <ul style="list-style-type: none"> • Changes in the Objective Function Coefficient. • Unit Worth of a Resource. Computer Solution of Linear Programming Problems. Analysis of Selected Linear Programming Model.	4	4
The Simplex Method <ul style="list-style-type: none"> • Introduction. • Standard Linear Programming Form and Its Solutions. <ul style="list-style-type: none"> ▪ Standard Linear Programming Form. ▪ Determination of Basic Solutions. ▪ Unrestricted Variables and Basic Solution. • The Simplex Algorithm. • Simplex Method Application. • Special Cases in Simplex Method Application. <ul style="list-style-type: none"> ▪ Degeneracy. ▪ Alternative Optima. ▪ Unbounded Solution. • Infeasible Solution. 	8	8
Duality <ul style="list-style-type: none"> • Introduction. • Definition of the Dual Problem. • Relationship between the Optimal Primal and Dual. 	2	2
Transportation Model. <ul style="list-style-type: none"> • Definition of the Transportation Model. • The Transportation Algorithm. <ul style="list-style-type: none"> ▪ Determination of the Starting Solution. ▪ Iterative Computation of the Algorithm. • The Assignment Model. 	6	6
Network Models <ul style="list-style-type: none"> • Scope of Network Application. • Network Definitions. • Shortest Route Problem. • Maximal Flow Model. • CPM and PERT. <ul style="list-style-type: none"> ▪ Network Representation. ▪ Critical Path Computation. • Construction of the Time Schedule. 	8	8
Selected Topic (Minimal Spanning Tree Algorithm)	2	2

Teaching and learning methods	
Teaching and learning methods	Used
Active Learning	
Lectures (blending learning – online learning using virtual classroom)	√
Tutorial Exercises (hybrid learning – online learning)	√
Practical Lab (blending learning – online learning)	-
Exercises	√
Discussions.	√
Self – Learning strategy	
Reading material	-
Websites search	√
Research and reporting	√
Self-studies	√
Experimental strategy	
Group work	-
Presentation	-
Problem solving strategy	
Problem solving/problem solving learning based	√
Case study	√
Synchronous E-Learning	
Virtual lab	-
Virtual class	-
Chat Room	√
Video lectures	√
Asynchronous E-Learning	
E-Learning	√

Student assessment methods & Schedule			
Methods	Assessment	Used	Week#
Electronic Midterm Exam	To assess the knowledge and understanding achieved by the student during the previous weeks. (Online on e-learning hub)	√	8
Pencil-to-Paper Final Exam	To evaluate what the student gain at the end of the course, and to assess the knowledge and understanding, general skills, and intellectual skills.	√	16
Course Project	To allow students work in team, and to evaluate knowledge, understanding, intellectual, and transferable skills. (Online on e-learning hub, FTF)	-	3-14

Electronic Course Work & Quizzes	To keep the student always in the course, and to evaluate knowledge, understanding, intellectual, and transferable skills. (Online on e-learning hub)	√	2-14
Practical Exam	To measure the ability of students to design and implement a software program (FTF).	-	15
Participation	To assess the knowledge and understanding achieved by the student during the previous weeks.	√	3-14

Assessment Weight	
Assessment	Weight %
Participation	5 %
Electronic Mid Term Exam	10 %
Final Exam	80 %
Electronic / hard copy Course Work & Quizzes	5 %
Total	100 %

Course Work & Quizzes
Short Exams, Assignments, Research, Reports, Presentations on e-learning hub
Class / Project discussion in a virtual classroom

List of references	
Essential books (textbooks)	<ul style="list-style-type: none"> Winston, Wayne L. <i>Operations research: applications and algorithms</i>. Cengage Learning, 2022. Taha, Hamdy A., and Hamdy A. Taha. <i>Operations research: an introduction</i>. Vol. 7. Upper Saddle River, NJ: Prentice hall, 2003.
Course	
Recommended books	<ul style="list-style-type: none"> Operational Research: The Science of Better: Promoting the knowledge and use of Operational Research in the UK International Federation of Operational Research Societies Operations Research Custom Search Engine Mathematics of Operations Research INFORMS OR/MS Resource Collection: a comprehensive set of OR links. Operations Research: The Science of Better: Initiative by INFORMS to promote OR. Operational Research: The Science of Better: Promoting the knowledge and use of Operational Research in the UK Winston, Wayne L. <i>Operations research: applications and algorithms</i>. Cengage Learning, 2022. Miranda, Jaime P. <i>Handbook of operations research in</i>

	<p>natural resources. Vol. 99. Springer Science & Business Media, 2007.</p> <ul style="list-style-type: none"> • Leimkuhler, Ferdinand F. "Introduction to operations research." (1968): 410-411. • Hillier, Frederick S., and Camille C. Price. "International Series in Operations Research & Management Science." (2001). • Hillier, Frederick S. "Introduction to operations research." (1967). • Operations Research: The Science of Better: Initiative by INFORMS to promote OR.
Periodicals, website	

Required Facilities		
Tools & SW (Technology facilities):	<ul style="list-style-type: none"> - Data show and PC computer. - Microsoft TEAMS to create virtual classrooms for lectures and tutorials. - Portal (MOODLE) to make electronic quizzes and electronic midterm exam. - Portal (MOODLE) to upload project deliverable and assignment. - Academy portal (MOODLE) to upload electronic material. 	
Teaching facilities:	Whiteboard	√
	Computer Lab	√
	Data show	√
	E-Learning	√
	Videos	√
	Website	√

Course Content/ILO Matrix												
Course Contents	Knowledge & understanding						Intellectual skills			Professional and practical skills		General
	a1	a2	a3	a4	a5	a6	b1	b2	b3	c1	c2	d1
Introduction to Linear Programming	x			x			x	x				
Graphical LP Solution	x		x	x		x	x				x	

The Simplex Method	x		x	x		x	x				x	
Duality		x	x		x	x		x	x	x	x	
Transportation Model		x			x	x		x	x	x		x
Network Models		x			x		x	x	x	x		x
Selected Topic(Minimal Spanning Tree Algorithm)		x			x					x		

Learning Method /ILOs Matrix

Learning Methods	Knowledge and understanding						Intellectual skills			Professional and practical skills		General
	a1	a2	a3	a4	a5	a6	b1	b2	b3	c1	c2	d1
Lectures	x	x	x	x	x	x	x	x	x	x	x	
Tutorial Exercises	x	x	x	x	x	x	x	x	x	x	x	x
Reading material			x	x	x		x	x	x	x		
Websites search			x	x	x		x	x	x			x
Research and reporting			x	x	x							x
Problem solving / problem solving learning based							x	x	x			
Group work										x	x	x
Presentations												
Practical Lab												
Discussions.							x	x	x	x	x	x

Assessment Methods /ILOs Matrix

Assessment Methods	Knowledge and understanding						Intellectual skills			Professional and practical skills		General
	a1	a2	a3	a4	a5	a6	b1	b2	b3	c1	c2	d1
Electronic Mid Term Exam	x	x	x	x	x	x	x	x	x			
Final Exam	x	x	x	x	x	x	x	x	x			
Electronic Course Project												
Electronic Course Work & Quizzes	x	x	x	x	x	x	x	x	x	x	x	x
Practical Exam												

Course ILOs Vs Program ILOs												
Prog ILOs Course ILOs		Knowledge and understanding		Intellectual skills						Professional and practical skills		General
		A1	A4	B1	B2	B4	B7	B8	B13	C6	C16	D11
Knowledge and Understanding	a1	x										
	a2	x	x									
	a3	x										
	a4	x	x									
	a5	x	x									
	a6	x	x									
Intellectual skills	b1			x		x			x			
	b2			x	x	x	x	x	x			
	b3			x	x	x	x	x	x			
Professional and practical skills	c1									x	x	
	c2									x	x	
General skills	d1											x

Course Coordinator : Dr. Farouk Shaaban ()

Head of Department : Dr. Ahmed El-Abbassy ()

Date: --/--/2023