Course specification

(1206 Operations Research)

Faculty:	*HICIT - **Higher Institute for Computers & Information Technology** – El-Shorouk Academy*
Programme(s) on which the course is given:	Undergraduate program in Computer Science
Major or minor element of programme:	Compulsory
Department offering the programme	Department of Computer Science
Department offering the course:	Department of Computer Science
Year / Class	1st Year – 2nd Semester
Date of specification approval	1/8/2022

A- Basic Information

Title: **Operations Research**	***Code:*** *1206*		
Weekly Hours:			
Lecture: 3	**Exercise: 2**	**Practical:**	**Total:** 5

B- Professional Information

1- Course Aims:

Upon successful completion of CS1206, students should be: -

- 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.

2- Program ILOs Covered by Course

Program Intended Learning Outcomes			
Knowledge and understanding	**Intellectual Skills**	**Professional and practical skills**	**General and Transferable skills**
A4, A21	**B1, B2, B4, B7, B8, B13**	**C6, C16**	**D11**

3- 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]

4- Contents

Topic	Hours	Lec.	Exc/Lab
Introduction to Linear Programming • Introduction. • Construction of the LP Model.	10	6	4
Graphical LP Solution. • Solution of a Maximization Model. • Solution of a Minimization Model. • Slack, Surplus, and Unrestricted Model. **Graphical Sensitivity Analysis.** • Changes in the Objective Function Coefficient. • Unit Worth of a Resource. **Computer Solution of Linear Programming Problems.** **Analysis of Selected Linear Programming Model.**	15	9	6
The Simplex Method • Introduction. • Standard Linear Programming Form and Its Solutions. ▪ Standard Linear Programming Form. ▪ Determination of Basic Solutions. ▪ Unrestricted Variables and Basic Solution. • The Simplex Algorithm.	10	6	4

• Simplex Method Application.
• Special Cases in Simplex Method Application.
  ▪ Degeneracy.
  ▪ Alternative Optima.
  ▪ Unbounded Solution.
• Infeasible Solution.			

Duality • Introduction. • Definition of the Dual Problem. • Relationship between the Optimal Primal and Dual.	5	3	2

Transportation Model.
• Definition of the Transportation Model.
• The Transportation Algorithm.
  ▪ Determination of the Starting Solution.
  ▪ Iterative Computation of the Algorithm.
• The Assignment Model.
	10	6	4

Network Models
• Scope of Network Application.
• Network Definitions.
• Shortest Route Problem.
• Maximal Flow Model.
• CPM and PERT.
  ▪ Network Representation.
  ▪ Critical Path Computation.
• Construction of the Time Schedule.
	5	3	2

Selected Topic	5	3	2

5- 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	√

6- Student assessment methods

Methods	Assessment	Used
Electronic Midterm Exam	To assess the knowledge and understanding achieved by the student during the previous weeks. (Online on e-learning hub)	√
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.	√
Course Project	To allow students work in team, and to evaluate knowledge, understanding, intellectual, and transferable skills. (Online on e-learning hub, FTF)	-

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)	√
Practical Exam	To measure the ability of students to design and implement a software program (FTF).	-
Participation	To assess the knowledge and understanding achieved by the student during the previous weeks.	√

Assessment Schedule

Assessment	Week #
Participation	**3 - 14**
Electronic Mid Term Exam	**8**
Final Exam	**16**
Electronic / hard copy Course Work & Quizzes	**2 - 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

7- 6- List of references

Essential books (textbooks)	• Winston, Wayne L. *Operations research: applications and algorithms*. Cengage Learning, 2022. • Taha, Hamdy A., and Hamdy A. Taha. *Operations research: an introduction*. Vol. 7. Upper Saddle River, NJ: Prentice hall, 2003.
Recommended books	• 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. Operations research: applications and algorithms. Cengage Learning, 2022. • Miranda, Jaime P. Handbook of operations research in natural resources. Vol. 99. Springer Science & Business Media, 2007. • 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	• PowerPoint presentations of all course materials • All tutorials material [https://moodle.sha.edu.eg/course/view.php?id=2247]

8- Required Facilities

To assess professional and practical skills given the following facilities:

a. Tools & SW (Technologies facilities):

- 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.

b. Teaching facilities:

	Lecture	*class*	*Lab*
Whiteboard	used	used	-
Pc / laptop	used	used	-
Data show	used	used	-
Webinars	MS TEAMS	MS TEAMS	-
Social Media	Facebook Page for 1st year	Facebook Page for 1st year	-
Chat Room	Chat Teams	Chat Teams	-
Videos	Stream-MOODLE	Stream-MOODLE	-
Website	MOODLE	MOODLE	-

9- Course Matrices

a. Course Content / ILOs 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		

b. Learning Method / ILOs Matrix

Learning Methods	Knowledge & 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

c. Assessment Methods / ILOs Matrix

Assessment Methods	Knowledge & 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												

d. Course ILOs Vs Program ILOs

Course ILOs \ Prog ILOs		Knowledge & understanding		Intellectual skills						Professional and practical skills		General skills
		A4	A21	B1	B2	B4	B7	B8	B13	C6	C16	D11
K&U	a1	x										
	a2	x	x									
	a3	x										
	a4	x	x									
	a5	x	x									
	a6	x	x									
Int.	b1			x		x			x			
	b2			x	x	x	x	x	x			
	b3				x	x	x	x	x			
P. &P.	c1									x	x	
	c2									x	x	
General	d1											x

Course Coordinator: Dr. Farouk Shaaban **( )**
Head of Department: Dr. Ahmed El-Abbassy **( )**
Date: 1/8/2022