Sana'a University
Faculty of Engineering
Mechanical Engineering Department
Mechanical Engineering Program

59. Course Plan of Industrial Operation Research

I. Information about Faculty Member Responsible for the Course:

Name of Faculty Member	Assoc. Prof. Dr. Amin Alkhulaidi	Office Hours					
Location& Telephone No.		SAT	SUN	MON	TUE	WED	THU
E-mail							

II. Course Identification and General Information:

1.	Course Title:	Industrial Operation Research.				
2.	Course Code & Number:	ME462.				
3.	Credit hours:	C.H				TOTAL CR. HRS.
		Th.	Seminar/Tu	Pr	Tr.	
		2	-	-	2	3
4..	Study level/ semester at which this course is offered:	Fifth Year–First Semester.				
5.	Pre –requisite (if any):	Linear Algebra .				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered:	Mechanical Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	System of Study:	Semesters				
10.	Mode of delivery:	Lecture and Tutorial.				
11.	Location of teaching the course:	Mechanical Engineering Department.				

III. Course Description:

The objective of this course is to teach the operations research methodologies in manufacturing. The students will know how to apply operations research techniques to solve real industrial problems. This course focuses on the application of linear programming techniques. The models included in this course are: Transportation and Assignment; Waiting line theory; Queuing Model and their applications in industry also included in this course.

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IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop**:**

1. Recall the mathematical background to develop a systematic procedure of linear programming, assignment, transportation and queuing modeling that used to solve industrial problems.
2. Illustrate an understanding of the operation research analytical tools used to solve service or manufacturing industry problems.
3. Create mathematical models of linear programming, assignment modeling and transportation models to solve industrial problems.
4. Explore appropriate quantitative tools of operation research to solve real industrial problems.
5. Use operation research tools to improve manufacturing systems in an optimal way.
6. Use the operation research tools to provide an optimal solution for real mechanical/industrial system problems within them constrains.
7. Cooperate as a part of a team in discussion group for a real problem industrial study.
8. Deliver and present reports of manufacturing systems real case study..

V. Course Content:

- Distribution of Semester Weekly Plan Of course Topics/Items and Activities.

A – Theoretical Aspect:

Order	Topics List	Sub Topics List	Week Due	Contact Hours
1	Introduction to Operations Research	- The Origins and Applications of Operations Research - System Modeling Principles - Software for Operations Research - Illustrative Applications	1st week	2
2	Linear Programming	- The Linear Programming Model - The Art and Skill of Problem Formulation - Graphical Solution of Linear Programming Problems - Preparation for the Simplex Method - Standard Form of a Linear Programming Problem - Solutions of Linear Systems - The Simplex Method - Initial Solutions for General Constraints - Artificial Variables - The Two-Phase Method (M-method) - Information in the Tableau - Multiple Optimal Solutions - Unbounded Solution (No Optimal Solution) - Degenerate Solutions - Analyzing the Optimal Tableau: Shadow Prices - Software for Solving Linear Programming - Illustrative Applications	2nd to 6th weeks	10
3	Transportation Problem.	- Introduction - Northwest Corner Rule - Minimum Cost Method - Minimum "Row" Cost Vogel's Methods	7th week	2

		- Optimality Test: (Approach to Optimal Solution) - Stepping stone method of optimality test		
4	Mid-Term Exam	- All Previous Topics	8th week	2
5	Transportation Problem.	- Introduction - Northwest Corner Rule - Minimum Cost Method - Minimum "Row" Cost Vogel's Methods - Optimality Test: (Approach to Optimal Solution) - Stepping stone method of optimality test	9th , 10th weeks	4
6	Assignment Model	- Introduction - Assignment Problem and Stable Matching - Stable Matching - Assignment method application in plant layout.	11th and 12th weeks	4
7	Queuing Model	- Introduction - Queuing system or process - Service Mechanism or Service Facility - Queuing Problems - Designing queue and symbols used in queueing modeling - Distribution of arrival and service time. - Queue models - Software for Queueing Models - Queueing Models in Manufacturing	13th and 14th weeks	4
8	Review	- All Topics	15th week	2
9	Final Exam	- All Topics	16th week	2
Number of Weeks /and Units Per Semester			**16**	**32**

B – Tutorial Aspect:

Order	Topics List	Week Due	Contact Hours

1	Introduction to Operations Research	1st , 2nd weeks	4
2	Linear Programming	3nd to 7th weeks	10
3	Transportation Problem.	8th to 10th weeks	6
4	Assignment Model	11th and 12th weeks	4
5	Queuing Model	13th and 14th weeks	4
Number of Weeks /and Units Per Semester		**14**	**28**

VI. Teaching strategies of the course:

- Lectures.
- Tutorials.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Linear Programming Graphic Method	a1,a2,b1,b2,c1,c2,d1,d2	4th week	2
2	Linear Programming Simplex Method	a1,a2,b1,b2,c1,c2,d1,d2	5th week	2
3	Linear Programming, Optimum Solution, M-method	a1,a2,b1,b2,c1,c2,d1,d2	7th week	2
4	Transportation Problems, West Corner, the Least Cost and Vogel's Method.	a1,a2,b1,b2,c1,c2	8th week	2
5	Transportation Problem. the Optimum Solution, Moving Stone Method	a1,a2,b1,b2,c1,c2	9th week	2
6	Assignment Model/ Plant Layout Application	a1,a2,b1,b2,c1,c2	10th week	2
7	Queuing Model Selected Cases	a1,a2,b1,b2,c1,c2	11th week	3
	Total			**15**

VIII. Schedule of Assessment Tasks for Students During the Semester:

Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Exercises & Homework	4th -11th weeks	15	10 %
2	Quizzes (3)	4th , 10th and 13th weeks	15	10 %
3	Mid-Term Exam	8th week	30	20 %
4	Final Exam (Theoretical)	16th week	90	60%
Total			**150**	**100%**

IX. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. Taha, H. A. 2016, Operations Research: An Introduction, 10 th Edition, Prentice Hall (ISBN- 978-0134444017).
2. Winston, W. L. ,2003, Operations Research: Applications and Algorithms, 4 th Edition, Duxbury Press (ISBN- 978-0534380588).

2- Essential References.

1. R. Rama Murthy, 2007, Operation Research, New Age International (P) Ltd., Publisher

3- Electronic Materials and Web Sites *etc*.

Web sites free download software related to operation research topics:

1. LP, transportations, assignment software EXCEL and LINDO.
2. Software for Queueing Models.

I. Course Policies:

1	**Class Attendance:** - The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and be considerd as an exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic.
2	**Tardy:**

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	- For lateness in attending the class, the student will be initially notified. If he repeates late in attending class he will be considered absent.
3	**Exam Attendance/Punctuality:** - The student should attend the exam on time. He is permitted to attend the exam half one hour from exam beginning, after that he/she will not be permitted to take exam and he/she is considered absent in the exam.
4	**Assignments & Projects:** - In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after giving the assignment
5	**Cheating**: - For cheating in exam, the student is considered as failure. In case the cheating is repeated three times during study the student will be disengaged from the Faculty
6	**Plagiarism**: Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Affair Council of the university.
7	**Other policies:** - The mobile phone is not allowable to be used during class lecture. It must be switched off, otherwise the student will be ordered to leave the lecture room. - The mobile phone is not allowed to be taken during the examination time. - Lecture notes and assignments may be given directly to students using soft or hard copy.

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