Course Specification
(Bachelor)

Course Title:	**Introduction to Operations Research**
Course Code:	**MAT 1254**
Program:	**Bachelor of Science in Actuarial and Financial Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**None**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☐College	☒ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 4 / Year 2					
4. Course general Description:					
This course describes the most important ideas, theoretical results, and examples of an introduction to operations research. The course includes the essential fundamentals of linear and integer programming. The emphasis is on calculations, and some applications are mentioned.					
5. Pre-requirements for this course (if any):					
MAT 1224					
6. Co-requisites for this course (if any):					
None.					
7. Course Main Objective(s):					
After finishing this course, the student should be able to formulate a real problem with a linear program (if possible) and to solve it with the appropriate method (Simplex algorithm, Dual Simplex algorithm, special algorithms for transportation or assignment problems, or algorithms for integer programming) by hand (if possible) or by using TORA software.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	30
5.	**Others (specify)**	0
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Identify a Linear Programming Problem and its formulation.**	**K1**	**• 2 lecture hours\week • 2 tutorial hours\ week Self-study**	**Direct: • Regular Exams • Assignments • Short Quizzes**
1.2	**Recall techniques of operations research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.**	**K3**	**• 2 lecture hours\week • 2 tutorial hours\week • Self-study**	**Direct: • Regular Exams • Assignments • Short Quizzes**
2.0	**Skills**			
2.1	**Produce solutions for real-life problems by applying the methodology and tools of Operations Research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.**	**S3**	**Self-study Real-life problems**	**Direct: Participations Short Quizzes**
2.2	**Construct by using mathematical language understandable operational research problems from the verbal description of the real system.**	**S3**	**Self-study Real-life problems**	**Direct: Participations Short Quizzes**
2.3	**Use TORA software to solve operations research problems.**	**S3**	**Self-study Real-life problems**	**Direct: Participations Short Quizzes**
2.4	**Analyze linear programming problems using appropriate techniques and optimization solvers.**	**S3**	**Self-study Real-life problems**	**Direct: Participations Short Quizzes**
3.0	**Values, autonomy, and responsibility**			
3.1	**Generate initiatives with independence.**	**V2**	**Class discussion**	**Direct: Participation**
3.2	**Debate in groups.**	**V2**	**Class discussion Teamwork**	**Direct: Homework and Mini projects**

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to Linear programming:** Overview, Linear programming formulations, Graphical Linear Programming Solution, Graphical Sensitivity analysis.	**8**
2.	**The Simplex Method:** Standard Linear Programming, Determination of Basic Feasible Solutions; The Simplex Algorithm.	**8**
3.	**Special Cases of the Simplex:** Degeneracy, Alternative optimum, Unbounded solution, Infeasibility.	**6**

4.	**Duality and Sensitivity Analysis:** Formulation of the Dual Problem, Relationship between Optimal Primal and Optimal Dual Solutions, Economic interpretation of Duality, Dual Simplex and Sensitivity Analysis.	**10**
5.	**Special linear programming models:** The transportation model, The assignment model, Application to the Traveling Salesman Problem.	**8**
6.	**Introduction to Integer Linear Programming:** Illustrative applications, Branch and Bound algorithm.	**10**
7.	**Tora Software:** Use of TORA software to solve exercises and problems from all course chapters.	**10**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Homework, Quizzes, Mini-projects**	**During the term**	**10%**
2.	**First Midterm**	**Week 5-6**	**25%**
3.	**Second Midterm**	**Week 10-11**	**25%**
4.	**Final Exam**	**Week 16**	**40%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	***Operations Research: An Introduction***, H. Taha, Prentice Hall, 8th Edition, 2006. **(Main Reference)**
Supportive References	***Introduction to Operations Research***, F. Hillier and G. Lieberman, 7th Edition, McGraw Hill, 2001. ***Operations Research: Applications and Algorithms***; 3rd Edition, Wayne L. Winston, Inc. Thomson Learning, 2004.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each classroom should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology equipment (projector, smart board, software)	**The rooms should be equipped with data show and Smart Board.**

Items	Resources
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Effectiveness of Students' assessment	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
The extent to which CLOs have been achieved	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Other	**None**	

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**8/1446**
Date	**05/04/1446 (08/10/2024)**