هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title:	**Introduction to Operations research**
Course Code:	**MAT 1253**
Program:	**Bachelor of Science in Physics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**08/10/2024**

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 6-8 / Year 3-4					
4. Course general Description:					
This course covers key operations research techniques, focusing on linear programming, the Simplex Method, duality, and sensitivity analysis. Students will explore special models like transportation and assignment problems, as well as integer linear programming applications, including the Traveling Salesman Problem. Practical problem-solving is emphasized through the use of TORA software.					
5. Pre-requirements for this course (if any):					
MAT 1222					
6. Co-requisites for this course (if any):					
None.					
7. Course Main Objective(s):					
The Introduction to Operations Research course plays a vital role in the BSc degree program in Applied Mathematics by equipping students with essential optimization techniques and decision-making tools. It enhances their analytical skills and prepares them for practical applications in fields like economics, engineering, and logistics.					

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	3lecture hours\week 2tutorial hours\week Self-study	Regular Exams Assignments Short Quizzes
1.2	Summarize techniques of operations research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.	K1, K2	3lecture hours\week 2tutorial hours\week Self-study	Regular Exams Assignments Short Quizzes
2.0	**Skills**			
2.1	Solve proposed real-life problems by applying the methodology and tools of Operations Research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.	S1, S2	Self-study Real-life problems	Participations Short Quizzes
2.2	Model in mathematical language understandable operational research problems from the verbal description of the real system.	S4	Self-study Real-life problems	Participations Short Quizzes
2.3	Use of TORA software to solve and online solver to solve some to solve the proposed models..	S5	Self-study Real-life problems	Participations Short Quizzes
2.4	Employ clearly, the best strategy Solve linear programming problems	S3	Self-study	Participations

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	using appropriate techniques and optimization solvers.		Real-life problems	Short Quizzes
3.0	**Values, autonomy, and responsibility**			
3.1	work individually.	V1, V3	Class discussion	Participation
3.2	Relate well to others and maintain good relationships;	V1, V2	Class discussion Team work	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.	**8**
6.	**Introduction to Integer Linear Programming:** Illustrative applications, Branch and Bound algorithm, Application to the Traveling Salesman Problem.	**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.	HomeWorks, 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 15	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
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions. • **Laboratories:** Feature computers with internet access, enabling hands-on activities and exploration of Linear programing methods.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential linear programing
Other equipment (depending on the nature of the specialty)	• **Computers:** For mini-project and homework and practical applications in laboratories. • **Advanced Calculators:** For computations and problem-solving and supporting the study of discrete optimization. • **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student and teaching staff	Surveys and Questionnaires
Effectiveness of Students assessment	Course Coordinator	Peer Reviews

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	Students and teaching staff	Classroom Observations
The extent to which CLOs have been achieved	Student Representatives	Student Performance Evaluations (exams, projects) CLOs Excel sheet.
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)**