

King Saud University
College of Science
Department of Mathematics

Course specification

Introduction to Mathematical Programming, MATH456
(An elective course)

1432H/2011G

Institution: King Saud University
College/Department: College of Science /Department of Mathematics

A Course Identification and General Information

1. Course title and code: Introduction to Mathematical Programming, MATH456
2. Credit hours: 3 (2+1+0)
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Bachelor of Science in Mathematics
4. Name of faculty member responsible for the course Dr Omar M.S. Hamed / for males omshamed@ksu.edu.sa Dr. Abir Alharbi / for females
5. Level/year at which this course is offered Fifth level
6. Pre-requisites for this course (if any) Linear Algebra ,MATH246
7. Co-requisites for this course (if any) None
8. Location if not on main campus At Diriya, Main campus: College of Science, Building No. 4 for males At Malaz for females.

B Objectives

Students enrolled in this course will:

1. Learn mathematical modeling for optimization problems
2. Learn the different algorithms for solving optimization problems
3. Apply special algorithms for many linear programming applications
4. Write computer algorithms to implement these methods for solving certain mathematical problems using computer.

1. Summary of the main learning outcomes for students enrolled in the course.

After studying this course, the student is expected to be able to:

- Model optimization problems
- Solve optimization problems graphically and algebraically
- Use sensitivity analysis
- Utilize duality theorem
- Apply knowledge to many applications

2. Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field)

1. Encourage students to read certain books about some applications of numerical methods.

2. Encourage students to use internet to look for related websites, computer softwares, and references.

3- Train students to write and implement computer algorithms for different problems.

C. Course Description (Note: General description in the form to be used for the Bulletin or Handbook should be attached)

1 Topics to be Covered (see reference books)		
List of Topics	No of Weeks	Contact hours
Modeling of real life optimization problems	1	2
Convex sets & polyhedral approach and geometrical approach	2	4
Exchange method & the structure of matrices	2	4
Simplex method & variants (2 phase; revised, degeneracy Bland rule etc)	3	6
Duality theory and application	3	6
Transportation Problem	2	4
Networks & Flow problems	2	4

2 Course components (total contact hours per semester):

Lecture:	Tutorial:	Laboratory	Practical/Field work/Internship	Other:
30	30			

3. Additional private study/learning hours expected for students per week. (This should be an average :for the semester not a specific requirement in each week)

6 hours weekly for independent study and doing homework assignments

4. Development of Learning Outcomes in Domains of Learning

For each of the domains of learning shown below indicate:

- A brief summary of the knowledge or skill the course is intended to develop;
- A description of the teaching strategies to be used in the course to develop that knowledge or skill;
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.

a. Knowledge

(i) Description of the knowledge to be acquired

After studying this course, the student will acquire the following knowledge :

- Be able to model optimization problems
- Solving linear optimization problems geometrically
- Solving linear optimization problems algebraically
- Know the duality theory
- Use sensitivity analysis
- Solve many application problems

(ii) Teaching strategies to be used to develop that knowledge

- Introducing the topics in the lectures
- Discussions in the class
- Homework assignments
- Independent study

(iii) Methods of assessment of knowledge acquired

- Homework assignments
- Short exams
- Mid-term exams and a final exam

b. Cognitive Skills

(i) Description of cognitive skills to be developed

- The ability to apply the linear programming methods to solve mathematical problems.
- The ability to write and run algorithms to solve the linear programming problems using computers.
- The ability to apply the linear programming methods in solving some mathematical models appearing frequently in the daily life situations.

(ii) Teaching strategies to be used to develop these cognitive skills

- Lectures
- Discussions in the lectures
- Homework assignments
- Independent study

(iii) Methods of assessment of students cognitive skills

- Follow up homework assignments
- Short exams
- Discussions with the students in the class
- Mid-Term and final exams

c. Interpersonal Skills and Responsibility

(i) Description of the interpersonal skills and capacity to carry responsibility to be developed

- To participate in the discussion and take initiative in asking and answering questions during the lecture.
- To be able to do homework assignments independently.

(ii) Teaching strategies to be used to develop these skills and abilities

- The discussion with the students and asking questions during the lecture.
- Homework assignments.

(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

<ul style="list-style-type: none"> • Instructor's assessment of student's performance through discussions during lectures • Follow up the homework assignments.
d. Communication, Information Technology and Numerical Skills
<p>(i) Description of the skills to be developed in this domain.</p> <p>Students should be able to:</p> <ul style="list-style-type: none"> • Write algorithms and solve mathematical problems numerically • Discuss and compare special methods for special important applications • Use available information technology to access the supporting materials and references.
<p>(ii) Teaching strategies to be used to develop these skills</p> <ul style="list-style-type: none"> • Computer assignments. • Encourage students to train on the available software concerning the course topics.
<p>(iii) Methods of assessment of students numerical and communication skills</p> <ul style="list-style-type: none"> • Follow up the homework assignments and discussing it with students.
e. Psychomotor Skills (if applicable)
<p>(i) Description of the psychomotor skills to be developed and the level of performance required</p> <p>Not applicable</p>
<p>(ii) Teaching strategies to be used to develop these skills</p> <p>Not applicable</p>
<p>(iii) Methods of assessment of students psychomotor skills</p> <p>Not applicable</p>

5. Schedule of Assessment Tasks for Students During the Semester			
Assessment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Proportion of Final

			Assessment
1	First midterm	6	20%
2	Computer assignments	Monthly	6%
3	Quizzes	Monthly	4%
4	Second midterm	12	20%
5	Final examination	16	50%

D. Student Support

1. Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week)

- 10 scheduled office hours per week
- 5 hours weekly for academic advice through the academic guidance unit in the department.

E Learning Resources

1. Required Text(s)

Al Olian Ibraheem, Introduction to Linear programming ,
Publications of King Saud University.

2. Essential References

Al Olian Ibraheem, Introduction to Linear programming ,
Publications of King Saud University.

3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List)

Any available text book on linear programming.

4-.Electronic Materials, Web Sites etc

- Computer softwares such as: Basic, Excel. Maple, Mathematica and MATLAB.
- Web sites involving computational mathematics.

5- Other learning material such as computer-based programs/CD, professional standards/regulations

In order to do the computer assignments one of the following computer software must be available for the student:

Basic, Excel, Maple, Mathematica, MATLAB.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.)

1. Accommodation (Lecture rooms, laboratories, etc.)

- Classroom to accommodate 25 students equipped with usual blackboard or smart board.
- Computer laboratory equipped with hardware and software.
- Available texts and references in the main library and the bookshop center.

2. Computing resources

Computer lab equipped with computers, printers, and internet points.

3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list)

None

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching

Course evaluation by the students at the end of the semester

2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Analysing the course evaluation conducted by students at the end of the semester
- Observations of the group of faculty teaching the course.
- Discussions within the specialized committee in the department.

3 Processes for Improvement of Teaching

- Workshops on teaching and learning methods conducted by the deanship of

skills development.

- Discussing the teaching methods by the group of faculty members teaching the course at the beginning of each semester.

4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)

- Unified exams and common marking if there is more than one group.
- Check the marking of a sample of student answer sheets in the final exam by an independent faculty member.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

Reviewing the course contents every five years

Updating the text book and references

**King Saud University
College of Science
Mathematics Department**

COURSE SPECIFICATION

MATH456: Introduction to Mathematical Programming

Kingdom of Saudi Arabia

**The National Commission for Academic Accreditation &
Assessment**

Introduction to Mathematical Programming

Math 456

COURSE SPECIFICATION

Introduction to Mathematical Programming, MATH456

Institution	King Saud University
College/Department	Mathematics

A Course Identification and General Information

1. Course title and code: Introduction to Mathematical Programming, MATH456
2. Credit hours 3 (2+1+0)
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Mathematics students
4. Name of faculty member responsible for the course Dr Omar M.S. Hamed omshamed@ksu.edu.sa http://faculty.ksu.edu.sa/OmarHamed
5. Level/year at which this course is offered Fifth level
6. Pre-requisites for this course (if any) MATH246 (Linear algebra)
7. Co-requisites for this course (if any) NA
8. Location if not on main campus NA

B Objectives

1. Summary of the main learning outcomes for students enrolled in the course. <ul style="list-style-type: none">• Real life optimization problems
2. Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field) <ul style="list-style-type: none">• Utilization of LMS (Moodle or WebCT or whatever the university provide) at the moment WebCT is tested. This will require<ul style="list-style-type: none">○ Build a constructionist cyberclass○ Build a "real" database of questions to be utilized in<ul style="list-style-type: none">▪ Formal exams (Online)▪ Self assessments quizzes (Online & weekly)

C. Course Description (Note: General description in the form to be used for the Bulletin or Handbook should be attached)

1 Topics to be Covered (see reference books)		
List of Topics	No of Weeks	Contact hours
Modelling of real life optimization problems	1	2
Convex sets & polyhedra approach and geometrical approach	2	4
Exchange method & the structure of matrices	2	4
Simplex method & variants (2 phase: revised, degeneracy Bland rule etc)	3	6
Duality theory and application	3	6
Transportation Problem	2	4
Networks & Flow problems	2	4

2 Course components (total contact hours per semester):				
Lecture: 30	Tutorial:	Laboratory 30	Practical/Field work/Internship	Other: Cyberclass ANY TIME ANY WHERE

3. Additional private study/learning hours expected for students per week. (This should be an average: for the semester not a specific requirement in each week)

Cyberclass ANY TIME ANY WHERE

4. Development of Learning Outcomes in Domains of Learning

For each of the domains of learning shown below indicate:

- A brief summary of the knowledge or skill the course is intended to develop;
- A description of the teaching strategies to be used in the course to develop that knowledge or skill;
- The methods of student assessment needed to be used in the course to evaluate learning outcomes in the concerned domain.

a. Knowledge
(i) Description of the knowledge to be acquired Mathematical modelling of real life problems Mathematical theory foundations Problem solving Creating optimal slaves for solving the practical problems
(ii) Teaching strategies to be used to develop that knowledge Constructionism approach
(iii) Methods of assessment of knowledge acquired Cyberclasses + formal traditional methods
b. Cognitive Skills
(i) Description of cognitive skills to be developed Critical thinking Problem solving Deduction & induction thinking
(ii) Teaching strategies to be used to develop these cognitive skills Constructionism
(iii) Methods of assessment of students cognitive skills
c. Interpersonal Skills and Responsibility
(i) Description of the interpersonal skills and capacity to carry responsibility to be developed
(ii) Teaching strategies to be used to develop these skills and abilities
(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility
d. Communication, Information Technology and Numerical Skills
(i) Description of the skills to be developed in this domain. <ul style="list-style-type: none"> • Writing & chatting on cyberclass • Computer communications
(ii) Teaching strategies to be used to develop these skills <ul style="list-style-type: none"> • Learning through teaching • Play the role of an slave to be trained to solve a problem

(iii) Methods of assessment of students numerical and communication skills

- Cyberclass peers assessment & self assessment

e. Psychomotor Skills (if applicable)

(i) Description of the psychomotor skills to be developed and the level of performance required

(ii) Teaching strategies to be used to develop these skills

(iii) Methods of assessment of students psychomotor skills

5. Schedule of Assessment Tasks for Students During the Semester

Assessment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Proportion of Final Assessment
1	Formal 1 st exam	5	20%
2	Formal 2 nd exam	10	20%
3	Assignments	4&12	10%
4	Final	16	50%

D. Student Support

1. Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week)

Anywhere Anytime cyber class forums, e-rooms, e-office hours + Skype

E Learning Resources

1. Required Text(s) reference books + course site page on the coordinator home page

2. Essential References

LMS knowledge

3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List)

As on the cyberclass & coordinator home page

4-.Electronic Materials, Web Sites etc

As on the cyberclass & coordinator home page

5- Other learning material such as computer-based programs/CD, professional standards/regulations

Learning through playing e.g. crosswords as on cyberclass.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Lecture rooms, laboratories, etc.) Good computer labs 5 labs each with 50 PC all connected to internet & intranet.
2. Computing resources IT supports personal to supervise labs and administrative work for cyberclasses.
3. Other resources (specify –e.g. If specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching <ul style="list-style-type: none">• Log file on the LMS• Contribution on LMS Forums, chat, self assessment quizzes, Formal online quizzes.
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department <ul style="list-style-type: none">• SPSS utilization for analysis of data stored on LMS
3 Processes for Improvement of Teaching <ul style="list-style-type: none">• Teachers or lecturers have to change to "Guides on the side" that is learning environment providers.• Students have to be called "Explorers" and they have to be the main players on the stages of their cyberclasses.
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution) <ul style="list-style-type: none">• Semester report obtained from 2 above should be submitted to the department at the end of semester meeting. Approval of the department must be obtained.• Evaluation of staff performance should be submitted to the chairman of the department.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. <ul style="list-style-type: none">• On line conference with staff through "Teachers Forum" as on Moodle should be active.• Face-to-face 2 meetings<ul style="list-style-type: none">○ 1st one week before course begins.○ 2nd last week of the semester.