

King Saud University  
College of Science  
Mathematics Department

## **COURSE SPECIFICATION**

**Math 280: Introduction to Real Analysis**

**March 2011**

# Course Specification

Institution : **King Saud University**

College/Department : **College of Science / Department of Mathematics.**

## A. Course Identification and General Information

1. Course title and code: **Math 280, Introduction to Real Analysis.**

2. Credit hours **4 (3+1)**

3. Program(s) in which the course is offered : **Actuarial and Finance Mathematics**

4. Name of faculty member responsible for the course

**Several faculty members of the Department of Mathematics**

5. Level/year at which this course is offered: **Fifth level**

6. Pre-requisites for this course (if any): **Math 201**

7. Co-requisites for this course (if any): **None**

8. Location if not on main campus

## B. Objectives

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

**This course aims to give the student an introduction to real analysis. By this stage the student should have studied differential and integral calculus in one and in several variables as well as sequences and series, and therefore can now study these topics from a more general analytical point of view generalizing the computational method used previously.**

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)

- Exploring computers in teaching to support presenting the material.
- Providing a website for the material accessible for all students.
- Giving homework assignments periodically and providing graders to mark them, in order to keep the students following the course.

**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		
List of Topics	No of Weeks	Contact hours
<b>Real numbers and their bounded subsets.</b>	<b>1</b>	<b>5</b>
<b>Supremum, Infimum and Completeness axiom.</b>	<b>1</b>	<b>5</b>
<b>Sequences and their convergence, Cauchy's criterion, Subsequences.</b>	<b>2</b>	<b>10</b>
<b>Series of numbers and Generalized convergence tests.</b>	<b>1</b>	<b>5</b>
<b>Limits of functions, Continuous functions on intervals, Intermediate value property.</b>	<b>2</b>	<b>10</b>
<b>Extrema, Differentiability, Mean-value theorem and its consequences, Taylor's theorem.</b>	<b>3</b>	<b>15</b>
<b>Riemann's integral.</b>	<b>2</b>	<b>10</b>
<b>Uniform convergence of sequences and series of functions , Uniform convergence tests.</b>	<b>2</b>	<b>10</b>
<b>Power series.</b>	<b>1</b>	<b>5</b>

2 Course components (total contact hours per semester):

Lecture: <b>45 hours</b>	Tutorial: <b>30 hours</b>	Laboratory	Practical/Field work/Internship	Other:
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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)

**5 hours a week for homework and revision.**

#### 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

- **Real numbers, Bounded sets, Completeness property**
- **Supremum, Infimum and Completeness axiom.**
- **Sequences and their convergence, Cauchy's criterion, Subsequences.**
- **Series of numbers and Generalized convergence tests.**
- **Limits of functions, Continuous functions on intervals, Intermediate value property.**
- **Extrema, Differentiability, Mean-value theorem and its consequences, Taylor's theorem.**
- **Riemann's integral.**
- **Uniform convergence of sequences and series of functions , Uniform convergence tests.**
- **Power series.**

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

- **Consulting instructors through office hours.**
- **Activity within tutorial sessions.**
- **Homework assignments.**
- **Proposing typical problems from textbooks to be solved.**

(iii) Methods of assessment of knowledge acquired

- **Quizzes in tutorial classes.**
- **Two mid-term exams.**
- **Final exam.**
- **Evaluation of activities during lectures and tutorials.**

## **b. Cognitive Skills**

(i) Description of cognitive skills to be developed

- **Pointing out the main goals of the course and connecting previous knowledge to the lectures material.**
- **Providing typical practical examples for various concepts of the material.**

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

- **Orienting the students to how to think about formulating mathematical models through discussions during the lectures.**
- **Learning them how to come up with original solutions to problems.**
- **Homework assignments and mini-projects.**
- **Using sophisticated technology (computers).**

(iii) Methods of assessment of students cognitive skills

- **Oral exams.**
- **Exams, Efforts in tutorial sessions, Quizzes.**
- **Discussions and approaches to deal with problems.**

## **c. Interpersonal Skills and Responsibility**

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

- **Learning the students how to deal with a given problem and how to provide independent related approaches.**
- **Helping them to learn how to expose and freely discuss any encountered problems.**
- **Learning them how to write and present homework solutions (and even exam copies) in a readable form.**

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

- **Exploring various sophisticated resources related to the material.**
- **Correcting homework assignments and orienting students to adequate presentations of homework solutions.**

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

**Routine check of students comprehension of the course. Encouraging students to participate in educational competitions.**

**d. Communication, Information Technology and Numerical Skills**

(i) Description of the skills to be developed in this domain.

- **Exploration of computational resources (computers....etc).**
- **Editing and exposing homework solutions by means of text editors.**
- **Participating in online scientific forums.**

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

- **Encouraging students to benefit from various available facilities and to update their computational skills, namely that it has been developing crazily fast nowadays.**
- **Guiding them to explore various available internet resources serving the course.**

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

**Mainly through forums and educational competitions. In other words, one may evaluate the provided efforts during educational competitions, which must be encouraged and supported by offering prizes to distinguished participants.**

**e. Psychomotor Skills (if applicable)**

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

**Not applicable.**

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

**Not applicable.**

(iii) Methods of assessment of students psychomotor skills

**Not applicable.**

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	<b>First midterm exam.</b>	<b>6<sup>th</sup> Week</b>	<b>20%</b>
2	<b>Second mid term exam.</b>	<b>10<sup>th</sup> Week</b>	<b>20%</b>
3	<b>Homework and tutorial activities</b>	<b>Over all weeks</b>	<b>10%</b>
4	<b>Final exam</b>	<b>By the end</b>	<b>50%</b>

#### 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)

**Two office hours.**

#### E. Learning Resources

1. Required Text(s):

**An introduction to real analysis, Part one, M. Al-Gwaiz, S. Elsonosi, Second edition, King Saud University Press, Riyadh, 1418 H.**

2. Essential References:

**Introduction to Real Analysis, Robert G. Bartle, Donald R. Sherbert, Third Edition, John Wiley and Sons, 2000.**

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

**A big deal of online internet resources.**

4- Electronic Materials, Web Sites etc

**Faculty websites.**

**More generally, search engines (google, Yahoo...) provide almost all needed material.**

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

## 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.) <b>A maximum of 25 student in each classroom.</b>
2. Computing resources <b>Computer labs equipped with sophisticated machines. Increasing the capacity of the internet network in order to accommodate more users.</b>

## G. Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching <b>Discussing with the instructors of subsequent courses requiring the relevant course, mainly regarding the ability of the students to take these courses.</b>
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department <b>Discussions and Forums.</b>
3 Processes for Improvement of Teaching <b>Organizing Workshops and training periods for teachers about sophisticated teaching methods. Developing teaching skills of instructors by encouraging problem solving seminars.</b>
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)
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. <b>Updating the course contents and providing periodic evaluations of students abilities.</b>