Kingdom of Saudi Arabia
The National Commission for Academic Accreditation & Assessment

COURSE SPECIFICATION

Numerical Analysis
Course Specification

Institution: Majmaah University

College/Department : College of Science in Zulfi/ Mathematics department

A Course Identification and General Information

1. Course title and code: Numerical Analysis  Math 351
2. Credit hours: 4(3+1)
3. Program(s) in which the course is offered. Mathematics
4. Name of faculty member responsible for the course: Mohamed Ahmed Elsayed Herzallah
5. Level/year at which this course is offered: Fifth
6. Pre-requisites for this course (if any) MATH 242
7. Co-requisites for this course (if any)
8. Location if not on main campus

B Objectives

1. Summary of the main learning outcomes for students enrolled in the course.
The student has the knowledge of
1- Numerical methods for solving nonlinear equations ( bisection – iteration – Newton - false position ... )
2- errors and rates of convergence
3- Direct methods for solving linear systems (Gauss elimination,LU decomposition) and iterative methods (Jacobi –Gauss Seidel – Relaxation)- errors
4- iteration matrices and convergence of iterative methods
5- – Polynomial interpolation (Lagrange-Newton’s methods: divided differences-forward and backward differences) and analysis of errors- Numerical differentiation and integration- errors and accuracy
6- Gaussian integration formulas.
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)
- Looking for any new papers and research in this course and looking for new good references
- Making seminars in the department in this field.

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

<table>
<thead>
<tr>
<th>1. Topics to be Covered</th>
<th>List of Topics</th>
<th>No of Weeks</th>
<th>Contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Numerical methods for solving nonlinear equations (bisection – iteration – Newton - false position … )- errors and rates of convergence</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Direct methods for solving linear systems (Gauss elimination,LU decomposition) and iterative methods (Jacobi –Gauss Seidel – Relaxation)-errors-iteration matrices and convergence of iterative methods– Polynomial interpolation (Lagrange-Newton’s methods: divided differences– forward and backward differences) and analysis of errors</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>– Numerical differentiation and integration- errors and accuracy–</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Gaussian integration formulas. And Revision</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

2. Course components (total contact hours per semester):

<table>
<thead>
<tr>
<th></th>
<th>Lecture: 42</th>
<th>Tutorial:</th>
<th>Laboratory</th>
<th>Practical/Field work/Internship 14</th>
<th>Other:</th>
</tr>
</thead>
</table>

2. 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)

At least 6 hours per week study at home independently
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

We expect from the student to have the knowledge of:

1. Numerical methods for solving nonlinear equations (bisection – iteration – Newton - false position ... )
2. Errors and rates of convergence
3. Direct methods for solving linear systems (Gauss elimination, LU decomposition) and iterative methods (Jacobi – Gauss Seidel – Relaxation) - errors
4. Iteration matrices and convergence of iterative methods
5. Polynomial interpolation (Lagrange-Newton's methods: divided differences- forward and backward differences) and analysis of errors- Numerical differentiation and integration- errors and accuracy

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

a) Each topic begins with the explanation of various basic ideas giving plenty of examples so that the students can understand the ideas and solve some exercises. Provided with a problem sheets at the beginning of the semester and ask the students to solve these exercises
b) Students are encouraged to ask questions during the lectures and in the tutorial classes to come on the board and solve some given problems
c) Students are advised to go to the Library and consult the relevant books on the topic

(iii) Methods of assessment of knowledge acquired

a) Sometime surprise quizzes are given in the class room
b) Homework
c) Two Mid Term exams are conducted one after 5 to 6 weeks of teaching and the other after 12 to 13 weeks of teaching
d) Final Semester examinations
### b. Cognitive Skills

(i) Cognitive skills to be developed
   
   a) Things are tried to explain in the perspective of the students earlier acquired knowledge
   b) In each lecture it is thoroughly explained as to why the current topic is being discussed
   c) What relationship the current topic has with the previous topic and what should be the natural subsequent topic

(ii) Teaching strategies to be used to develop these cognitive skills
   
   Generally diagrams, pictorial notation wherever possible are given to explain the complete and clear ideas

(iii) Methods of assessment of students cognitive skills
   
   Please refer to method of assessments of knowledge

### c. Interpersonal Skills and Responsibility

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

N/A

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

N/A

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

N/A

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

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

Please refer to earlier item 4a knowledge (i) (ii) (iii)
(ii) Teaching strategies to be used to develop these skills

Please refer to earlier item 4a knowledge (i) (ii) (iii)

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

Please refer to earlier item 4a knowledge (i) (ii) (iii)

e. Psychomotor Skills (if applicable)

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

N/A

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

N/A

(iii) Methods of assessment of students psychomotor skills

N/A

5. Schedule of Assessment Tasks for Students During the Semester

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Assessment task (eg. essay, test, group project, examination etc.)</th>
<th>Week due</th>
<th>Proportion of Final Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Mid Term Examination</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>2</td>
<td>Second Mid term Examination</td>
<td>12</td>
<td>15%</td>
</tr>
<tr>
<td>3</td>
<td>Tutorial over the whole semester</td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>4</td>
<td>Final Semester Examination</td>
<td>16</td>
<td>60%</td>
</tr>
</tbody>
</table>

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)

students are encouraged to come during the office hours (4 hours per week) to discuss their mathematical problems and difficulties they face
### E Learning Resources

1. **Required Text(s)**

2. **Essential References**
   Any books in the library having the same topics

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

4. **Electronic Materials, Web Sites etc**
   - [http://www.siam.org/](http://www.siam.org/)
   - [http://www.lms.ac.uk/](http://www.lms.ac.uk/)
   - [http://mathforum.org/advanced/numerical.html/](http://mathforum.org/advanced/numerical.html/)
   - [http://www.ingentaconnect.com/content/](http://www.ingentaconnect.com/content/)
   - [http://www.ma.hw.ac.uk](http://www.ma.hw.ac.uk)
5- Other learning material such as computer-based programs/CD, professional standards/regulations
N/A

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.)
   Lecture rooms must be suitable to the number of students

2. Computing resources
   Computer and Projector

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

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching

At the end of the semester feedback is taken from the students on a prescribed Performa

2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department
   Departmental meetings, frequent meetings/ consultation among the teaching staffs, meeting between course coordinators and the tutors

3 Processes for Improvement of Teaching

This may be done from time to time by the course coordinator in consultation with other faculty members teaching this course, and expert opinion may be taken
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)

The course material and knowledge acquired by the students are periodically reviewed and changes if necessary are approved by the department

Please refer to The Salient features

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

The chairman and the faculty implement the proposed changes, if any.