Kingdom of Saudi Arabia

The National Commission for Academic Accreditation & Assessment

Course Specification

Institution: **University of Dammam**

College/Department: **College of Sciences / Department of Mathematics**

A. Course Identification and General Information

1. Course title and code: **Numerical Analysis Math 411**
2. Credit hours: **3**
3. Program(s) in which the course is offered: **Mathematics program**
4. Name of faculty member responsible for the course: **A specific team from the mathematics department**
5. Level/year at which this course is offered: **7th level/4th year**
6. Pre-requisites for this course (if any): **Math 211 – Math233**
7. Co-requisites for this course (if any): **N/A**
8. Location if not on main campus: **College of Sciences – Girls Campus – Rayan City**

9. Mode of Instruction (mark all that apply)

a. traditional classroom	X	What percentage?	50%
b. blended (traditional and online)		What percentage?	
c. e-learning	X	What percentage?	25%
d. correspondence	X	What percentage?	25%
f. other		What percentage?	

Comments: **The e-learning concerns the use of blackboard, flip teaching, online assessment, ect.**

B Objectives

What is the main purpose for this course?

On successful completion of this course students will be able to:

Demonstrate knowledge and understanding of numerical methods to solve systems of linear equations, to compute quadratures and to solve Ordinary and Partial Differential Equations;
Analyze a mathematical problem and determine which numerical technique to use to solve it;
Show logical thinking in coding a mathematical problem in algorithmic form; Use (Matlab or Mathematica) , its instructions and its programming language;

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

- **Create, improve and complete (beamer or power point) presentations.**
- **Update the course by comparing to the contents at other universities.**
- **Follow up on the latest books to select the most appropriate to update the contents.**
- **Create a question bank.**
- **Find web sites related to the topic.**
- **Use a new applications on smart devises to inter active the learning.**

C. Course Description (Note: General description in the form used in Bulletin or handbook) Course Description:

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Errors and Numbers representation	1	3
Numerical solutions of Nonlinear equations(Bisection, Fixed point, Secant , and Newton methods)	3	9
Lagrange Interpolating Polynomials, Divided-difference methods, Newton forward-difference and Backward Differences formulas	3	9
Numerical Differentiation and Integration	2	9
Numerical solution of Linear Systems(Direct Methods- Iterative Techniques)	3	9
Numerical solutions for Ordinary Differential Equations	2	6

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

	Lecture	Tutorial	Laboratory or Studio	Practical	Other: Office hours	Total
Contact Hours	**2*15=30**	**0**	**0**	**2*15=30**	**4*15=60**	**120**
Credit	**2*15**	**0**	**0**	**1*15**	**0**	**45**

3. Additional private study/learning hours expected for students per week.
60

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code	NQF Learning Domains	Course Teaching	Course Assessment

#	And Course Learning Outcomes	Strategies	Methods
1.0	**Knowledge**		
	The student remembers the types of errors in numerical calculations. The student knows the methods of interpolation using polynomials. The student determines that the numerical integration and differentiation. The student recognizes the linear algebra and matrix analysis. The student remember the numerical solution of Ordinary Differential Equations	Interactive learning process through questions and answers in class. Worked examples through a sequential delivery of surveying lectures. Homework consisting in solving selected exercises.	Exams and homework are used to assess the acquired knowledge on the subject.
2.0	**Cognitive Skills**		
	Students will be able to compute a Taylor polynomial and bound its error term. Students will be able to apply iterative methods, including Bisection, Newton, Secant and Fixed Point, to compute solutions of nonlinear equations to within a specified tolerance Students will be able to construct polynomial and piecewise polynomial interpolants of functions of one or two variables in a variety of ways including Lagrange Interpolants, Divided Differences. Students will be able to derive approximation formulae for derivatives using Taylor's Theorem and use these formulae and their error bounds. Students will be able to solve Numerical Differentiation	Lectures are covered by different worked examples. Engage students in discussions with questions and answers. Homework consisting in solving selected exercises. Encourage and develop self education.	Homework include problems, solution of which requires scientific thinking, and applications of essential theorems and results of the course Oral and written tests. Explain and communicate the corrected answers of the exams and quizzes. Research projects.
3.0	**Interpersonal Skills & Responsibility**		
	Knowledge and understanding of the content and techniques of a chosen discipline at advanced levels that are internationally recognised The ability to locate, analyse, evaluate and synthesise information from a wide variety of sources in a planned and timely manner An ability to apply effective, creative and innovative solutions, both independently and cooperatively, to current and future problems	Discussion. Explanation. Guidance and supervision of the group assignments for research projects. Assignments are given to the students at regular intervals for them to solve and submit	Class attendance of students at the beginning of the lecture is recoded. Recording of submission of assignment Observations, interviews, and peer evaluations.

	Skills of a high order in interpersonal understanding, teamwork and communication. A commitment to continuous learning and the capacity to maintain intellectual curiosity throughout life.	on time.	
4.0	**Communication, Information Technology, Numerical**		
	Ability to communicate in written and in oral. Ability to write reports in English Ability to explain each step in the problem solving process. Ability to apply course concepts to mathematical problem solving model. Ability to use information technology in communication and research projects. Interact with life problems using different methods of thinking and problem solving.	Research projects. Oral presentations.	Periodic written and oral tests. Discussion. Observation.
5.0	**Psychomotor**		
	N/A	N/A	N/A

5. Map course LOs with the program LOs. (Place course LO #s in the left column and program LO #s across the top.)

Course LOs #	**Program Learning Outcomes (Use Program LO Code #s provided in the Program Specifications)**						
	Metric spaces	**Normed spaces**	**Banach spaces**	**Spaces of continuous functions**	**Fundamental theorems in functional analysis**	**Hilbert spaces**	**Adjoint operators and compact operators**
Knowledge	**Recall**	**Recall**	**Recall**	**Remember**	**Remember**	**Recall**	**Recall**
Comprehension	**Discuss**	**Discuss**	**Discuss**	**Summarize**	**Summarize**	**Discuss**	**Explain**
Application	**Assess**	**Assess**	**Assess**	**Use**	**Use**	**Assess**	**Utilize**
Analysis	**Conclude**	**Conclude**	**Conclude**	**Conclude**	**Conclude**	**Conclude**	**Conclude**
Synthesis	**Categorize**	**Categorize**	**Categorize**	**Validate**	**Validate**	**Categorize**	**Categorize**
Evaluation	**Judge**	**Judge**	**Judge**	**Judge**	**Judge**	**Judge**	**Judge**

6. Schedule of Assessment Tasks for Students During the Semester

	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	**Black board home work**	**3 times**	**5%**

2	**Mid-term1**	**10**	**10%**
3	**Mid-term2**	**15**	**15%**
4	**Team work**	**Every week**	**10%**
5	**Research project**		**10%**
7	**Final exam**	**As scheduled**	**50%**

D. Student Academic Counseling and Support

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

4 hrs/week for students' consultation and academic advice.

E Learning Resources

1. List Required Textbooks

"Numerical Analysis", Richard L. Burden & J. Douglas Faires**,** Brooks/Cole, Cengage Learning,(2011)
"An introduction to numerical methods, A matlab approach", A. Kharab, R. B. Guenther,
Chapman and Hall/CRC, (2011)
A First Course in Numerical Analysis: Second Edition, A. Ralston and P. Rabinowitz, McGraw Hill Inc, (2001).

2. List Essential References Materials (Journals, Reports, etc.)

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

4. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

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

Mathematica , Some applications in Smart Devices (IPad)

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) **Lecture room with 30 seats. Smart class.** **Smart devices**
2. Computing resources (AV, data show, Smart Board, software, etc.) **Computer room with at least 10 systems** **Computer room with 30 seats**
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

Student course evaluation at the conclusion of the course. Sample of assignments and tests. Observations and discussions during the semester.

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

Faculty assessment of the course and effectiveness of teaching delivery. Periodic self-assessment of the program.

3 Processes for Improvement of Teaching

Participate to workshops on evaluation approaches and effective teaching methods to enable instructors to improve their teaching skill.
Teaching method will focus on students' learning and on course learning outcomes.

4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)

A Committee reviews samples of student work in this course to check on the standard of grades and achievements.
An external faculty member evaluates the course material and the students' work to compare the standard of grades and achievements with those at his university.

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

Carry out Self- assessment at every two years and external assessment invited faculty members every four years. The feedback received from these assessments will be used to plan for further improvement in the course syllabus, teaching method, and delivery of course materials.