

King Fahd University of Petroleum and Minerals
(Department of Mathematical Sciences)¹

Title: Development of online course of Math. 260
"Linear Algebra & Differential Equations"

Proponents

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¹Online Course Proposal submitted to Deanship of Academic Development.

Course Title: Introduction to Linear Algebra and Differential Equations
(Credits 3)

Catalog Description:

Systems of linear equations. Rank of matrices. Eigenvalues and eigenvectors. Vector spaces, subspaces, bases, dimensions. Invertible matrices. Similar matrices. Diagonalizable matrices. Block diagonal and Jordan forms. First order differential equations: separable and exact. The homogeneous differential equations with constant coefficients. Wronskian. Non-homogeneous differential equations. Methods of undetermined coefficients and variation of parameters. Systems of differential equations. Non-homogeneous systems

Prerequisites MATH 201

This course introduces elementary differential equations and linear algebra to students of Computer Science, Computer Engineering, Systems Engineering, and Earth Sciences.

Course Objectives: This course introduces elementary differential equations and linear algebra to students of Computer Science, Computer Engineering, Systems Engineering, and Earth Sciences.

Student Learning Outcome

Objectives

1. Students will demonstrate the ability to use effectively the Gauss and Gauss-Jordan elimination techniques to solve systems of algebraic equations and use eigenvalues and eigenvectors to solve systems of first order linear differential equations.
2. Students will demonstrate the basic understanding of the properties of vector space and subspace.
3. Students will demonstrate the ability to use the basic techniques to solve linear differential equations and some class of first order differential equations.

Introduction

The use of technology as teaching aid to improve efficiency and quality of teaching is now well recognized. Many leading universities all over the world are now using web based courses to serve the time and domain needs of the teacher and the taught. The success of usage of web based technology largely depends upon various factors such as choice of the Target Group, geographical location of the Target Group, student access to computers, content of individual courses and commitment of the faculty to the adoption of new technology. Some of the questions one may ask before entering into this venture is that how this way of delivery is going to student-instructor interaction, and overall improve learning outcome. In selecting the MATH 260 as an online course these things have been given due consideration. The course contents and students in this course are traditionally computer friendly and are more likely to benefit from Web based course delivery technology.

Rationale

Why (rational and justification) offering this course online?

- Nature of the topics of this course is suitable for providing an excellent on-line environments. The solutions of differential equations and linear algebra concepts can be effectively introduced using simulation and visualizations.
- This course consists of concepts and methods which offer an ideal combination for illustration through online tools.
- The concepts can be easily and efficiently grasped by demonstrations
- The methods can be easily learned and enforced by examples and simulations.
- Background material on demand bases can be provided

What is the impact on the educational objectives of the course?

Having the course online and through the use of visualizing and simulation, the outcomes of the course will be enhanced:

- Not only to solve the DE but to have an understanding of the solution and their dependence on parameters appearing in the differential equations
- For the Linear Algebra the student will have a live understanding of some of the abstract concepts such as linearly independence, basis of vector space and diagonalization of matrices
- The student will have an experience in using a mathematical package (MATLAB). This needs extra time in conventional way of delivery of the courses.

What are the expected benefits of offering this course online?

- Giving more demonstrations on the models. Visualization of affects of modeling parameters can be more intuitive and help student to understand their role.
- Better platform to integrate MATLAB with the course.
- Learning and practicing with a mathematical Package.
- Projects and study case can be introduced

Statement of the Work/Approach

It is proposed to carefully study the following aspects about the tasks involved in the development of the course.

- **How will the material be designed to compensate for the absence of the instructor? To this end following will be ensured:**
 1. Selection and delivery of proposed reading material in an effective way enhanced by visual demonstrations.
 2. Provide helpful links to online resources.
 3. Suggest multimedia resources to help make the material in this course alive.
 4. Provide online discussion sessions with students.
- **What is the plan for submittal/assessment?**
 The proposed assessment scheme of the course includes all the basic ingredients of a web-based testing system. Precisely, the evaluation and assessment plan consists of the following components.
 1. **Assessment requirements of the course.**
 Student's assessment will be carried out through:
 - a. Class attendance and online participation in discussions etc.
 - b. Quizzes
 - c. Home-works and assignments
 - d. Projects
 - e. Major examinations
 - f. Final examination

2. Information about assessment procedure

- Class attendance and online participation in discussions will be based on:
 - a. Substantial in-class and online contribution about class topics and discussion questions
 - b. Response to other students posts/emails
 - c. Contribution in discussion and chat sessions
- Quizzes
 - a. Quizzes will be of type *multiple choice, fill-in-the-blank or matching*.
 - b. These will be available online and will be graded interactively; providing automatic feedback.
- Home works and assignments
 - a. The assignments/home-works may be of *multiple choice type or comprehensive type*.
 - b. The *multiple choice type* will be submitted and graded online.
 - c. The *comprehensive type* will be available online but submission will be carried out electronically in the form of a file (scanned or composed), via email attachment or other means.
 - d. The grades and detailed discussion of assignments (of both types) will be accessible online from the assigned area, after the submission deadline.
- Projects
 - a. Projects will be submitted electronically as email attachment.
 - b. The presentation, discussion and grading will be available online.
- Major and final examinations
 - a. These will be comprehensive examinations held on-campus or off-campus on dates fixed at the start of the course, and will be proctored examinations.

3. Time table and further details

- Quizzes:
 - b. Quizzes will be held periodically and graded online.
 - c. The tests will be made available online for a short period of time, providing only one time access to take the quiz.
 - d. The questions of the quiz will be generated randomly from a test bank.
- Home works and assignments
 - a. The assignments/home-works of *multiple choice type* will be received, acknowledge and graded online, automatically.
 - b. The assignments/home-works of *comprehensive type* will be acknowledged within 24 hours of receipt by email, and returned with grades.
- Projects
 - a. Will be assigned in the mid-part of the course and should be completed and submitted before the end of the course.
- Major and final examinations
 - a. Major examination(s) and final comprehensive examination will be held respectively during the course and at the end of the course.
 - b. These will be conducted in a supervised/proctored testing environment at a fixed time and place announced in the beginning of the course.

- **What will be the available communication means?**

Internet, emails, list-servers/email groups, online discussion boards, conference and chat rooms.

- **What software for LMS?**

WebCT software.

Task 1. Identification of:

- a. course components
- b. concepts and skills
- c. computational and visualization components
- d. assessment requirements
- e. background and preparation needed
- f. learning activities
- g. communication methods

Task 2. Syllabus design

Task 3. Course components authoring

Task 4. Demonstrations preparation

Task 5. Uploading to WebCT

- **Revised Management Plan**

Information about team

Dr. Fiazud Din Zaman	(Professor Math. Sc.)	Principal Investigator:
Dr. Ashfaque H. Bokhari	(Associate Professor Math. Sc.)	Co-Investigator
Dr. Khaled M. Furati	(Associate Professor Math. Sc.)	Co-Investigator
Dr. Tahir Mustafa	(Assistant Professor Math. Sc.)	Co-Investigator
Dr. Tawfiq Hattan	(Assistant Professor Math. Sc.)	Co-Investigator
Mr. B. Yashau	(Lecturer Math. Sc.)	Co-Investigator
Mr. Ibrahim	(Computer Assistant Math. Sc.)	(Research Assistant)

- **Members Contributions**

- **Group Coordination**

Zaman

- **Identification**

Content Providers: Bokhari, Furati, Zaman.

Instructional Designer : Hattan, Mustafa

Programming: Hattan, Yashau.

Graphic Design: Yashau, Ibrahim

Deliverables: Ibrahim (software)
Others (relevant team members)

Revised Schedule

Task	Months														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Identification	■	■	■												
Syllabus Design		■	■	■	■	■	■								
Course components authoring				■	■	■	■	■	■	■	■	■	■	■	
Web Authoring						■	■	■	■	■	■	■	■	■	
Visual Effects and Animation								■	■	■	■	■	■	■	
Preparation of Deliverables														■	■
														■	■

Revised Budget

No	ITEM	Amount per month	Total for 15 months
1	Principal Investigator	1,200	18,000
2	Co-Investigator - 1	1,000	15,000
3	Co-Investigator - 2	1,000	15,000
4	Co-Investigator - 4	1,000	15,000
5	Co-Investigator - 4	1,000	15,000
6	Co-Investigator - 5	800	12,000
7	Research Assistant	600	9,000
8	Secretary	1000 (once)	1,000
	TOTAL		100,000

● Deliverables

At the end of the project we will deliver;

1. A CD containing complete course contents;
2. A course pack in Web CT format;
3. Course plan describing strategy for implementations;
4. Additional material.

