



**ATTACHMENT 2 (e)**

**Course Specifications**

**Kingdom of Saudi Arabia**

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

**Course Specifications  
(CS)**

**Linear Algebra And Differential Equations  
MATH 310**



## Course Specifications

|   |                |          |
|---|----------------|----------|
| Institution : Majmaah University                                      | Date of Report | 1/8/1435 |
| College/Department <b>Faculty of Science / Mathematics Department</b> |                |          |

### A. Course Identification and General Information

|  |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
|--|-------------------------------------|-------------------------------------|-----------------------------------|-----------------------------------|-------------------------------------|--------------------------|------------------|----------------------|---------------|--------------------------|------------------|----------------------|-------------------|--------------------------|------------------|----------------------|----------|-------------------------------------|------------------|----------------------------------|
| 1. Course title and code: Linear Algebra And Differential Equations , MATH 310   |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| 2. Credit hours <b>4 Hours</b> ( 3+0+2)  |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| 3. Program(s) in which the course is offered.<br>(If general elective available in many programs indicate this rather than list programs)  |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| 4. Name of faculty member responsible for the course <b>KAMAL NAZMI</b>  |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| 5. Level/year at which this course is offered <b>Fifth</b>   |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| 6. Pre-requisites for this course (if any) <b>MATH 220</b>   |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| 7. Co-requisites for this course (if any)  |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| 8. Location if not on main campus <b>Main Campus , Zulfi city</b>  |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| 9. Mode of Instruction (mark all that apply)<br><table><tr><td>a. Traditional classroom</td><td><input checked="" type="checkbox"/></td><td>What percentage?</td><td><input type="text" value="90 %"/></td></tr><tr><td>b. Blended (traditional and online)</td><td><input type="checkbox"/></td><td>What percentage?</td><td><input type="text"/></td></tr><tr><td>c. e-learning</td><td><input type="checkbox"/></td><td>What percentage?</td><td><input type="text"/></td></tr><tr><td>d. Correspondence</td><td><input type="checkbox"/></td><td>What percentage?</td><td><input type="text"/></td></tr><tr><td>f. Other</td><td><input checked="" type="checkbox"/></td><td>What percentage?</td><td><input type="text" value="10%"/></td></tr></table> | a. Traditional classroom            | <input checked="" type="checkbox"/> | What percentage?                  | <input type="text" value="90 %"/> | b. Blended (traditional and online) | <input type="checkbox"/> | What percentage? | <input type="text"/> | c. e-learning | <input type="checkbox"/> | What percentage? | <input type="text"/> | d. Correspondence | <input type="checkbox"/> | What percentage? | <input type="text"/> | f. Other | <input checked="" type="checkbox"/> | What percentage? | <input type="text" value="10%"/> |
| a. Traditional classroom   | <input checked="" type="checkbox"/> | What percentage?                    | <input type="text" value="90 %"/> |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| b. Blended (traditional and online)  | <input type="checkbox"/>            | What percentage?                    | <input type="text"/>              |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| c. e-learning  | <input type="checkbox"/>            | What percentage?                    | <input type="text"/>              |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| d. Correspondence  | <input type="checkbox"/>            | What percentage?                    | <input type="text"/>              |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| f. Other   | <input checked="" type="checkbox"/> | What percentage?                    | <input type="text" value="10%"/>  |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |
| Comments:  |                                     |                                     |                                   |                                   |                                     |                          |                  |                      |               |                          |                  |                      |                   |                          |                  |                      |          |                                     |                  |                                  |



## B Objectives

1. What is the main purpose for this course?
  1. Offers a range of ways for the students to develop their skills and knowledge.
  2. Introduces several specialized areas of mathematics and its applications.
  3. Enables the students to examine how the principal results are related to real-world problems.
  4. Operate and manipulate matrices and determinants; and solve systems of linear equations using matrices and determinants
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)
  - 1- Access to research and recent studies related topics and benefit from
  - 2- Establishment of workshops within the department
  - 3- Cooperate with other educational institutions to find how they deal with the subject.
  - 4- Re- new the course references frequently.
  - 5- Frequently check the latest discovery in science to improve the course objectives.
  - 6- The course needs the use of computers.
  - 7- Posting some course material on the websites to help the students.
  - 8- Focusing on generic skills.



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

| <b>Topics to be cover</b>  |              |               |           |     |              |                  |             |         |          |             |       |
|--|--------------|---------------|-----------|-----|--------------|------------------|-------------|---------|----------|-------------|-------|
| List of Topic  | No. of Weeks | Contact hours |           |     |              | Total of contact | Self- Study |         |          | Discussions | total |
|  |              | Lecture       | tutorials | Lab | Office Hours |                  | Internet    | Library | Homework |             |       |
| a) System of linear equations<br>b) Matrices , Determinants, inverse of a matrix   | 3            | 12            | 6         |     |              | 18               | 1           | 1       | 2        | 1           | 23    |
| a) Linear dependence and independence of vectors<br>b) Rank of a set of vectors, Rank of a matrix<br>c) Abstract and geometric representation of vectors                   | 2            | 8             | 4         |     |              | 12               | 1           | 1       | 2        | 1           | 17    |
| <b>Mid-term 1</b>  |              | 2             |           |     |              | 2                |             |         |          |             | 2     |
| a) Scalar/Inner product, Vectorial Product, The Gram-Shmiditt Process<br>b) The Eigen Value Problem , the Eigen Vectors<br>c) Caley_Hamilton theorem and its Applications, | 3            | 12            | 6         |     |              | 18               | 1           | 1       | 2        | 1           | 23    |
| a) Differential Equations: Basic Concepts: First Order Differential Equations<br>b) Homogeneous & Exact , integrating factor , reducible to linear (Bernoulli)             | 3            | 12            | 6         |     |              | 18               | 1           | 1       | 2        | 2           | 24    |
| <b>Mid-term 2</b>  |              | 2             |           |     |              | 2                |             |         |          |             | 2     |
| a) High Order and First Degree Differential Equations (With constant coefficients)<br>b) Independent Solutions and the Wronskian, D-operator & Inverse D-operator          | 2            | 8             | 4         |     |              | 12               | 1           | 1       | 2        | 1           | 17    |



|   |   |   |   |  |  |    |   |   |    |   |     |
|---|---|---|---|--|--|----|---|---|----|---|-----|
| a) Method of undetermined coefficients,<br>high order differential equations<br>b) Shift rule and its application | 2 | 8 | 4 |  |  | 12 | 1 | 1 | 1  | 1 | 16  |
| Review  |   |   |   |  |  |    |   |   | 2  | 2 | 4   |
| Final Exam  |   | 2 |   |  |  | 2  |   |   |    |   | 2   |
| Total   |   |   |   |  |  | 96 | 6 | 6 | 13 | 9 | 130 |
| <b>Note: one credit hour is equal 25 – 30 load work hour</b>  |   |   |   |  |  |    |   |   |    |   |     |



| 2. Course components (total contact hours and credits per semester): |               |          |            |           |            |       |       |
|--|---------------|----------|------------|-----------|------------|-------|-------|
| Credit   | Contact Hours |          |            |           | Self-Study | Other | Total |
|  | Lecture       | Tutorial | Laboratory | Practical |            |       |       |
| 3  | 60            | 30       |            |           | 40         |       | 130   |

|  |         |
|--|---------|
| 2. Additional private study/learning hours expected for students per week. | 3 Hours |
|--|---------|

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|--|
| 3. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy |
|--|

Course Learning Outcomes, Assessment Methods, and Teaching Strategy work together and are aligned. They are joined together as one, coherent, unity that collectively articulate a consistent agreement between student learning, assessment, and teaching.

The *National Qualification Framework* provides five learning domains. Course learning outcomes are required. Normally a course has should not exceed eight learning outcomes which align with one or more of the five learning domains. Some courses have one or more program learning outcomes integrated into the course learning outcomes to demonstrate program learning outcome alignment. The program learning outcome matrix map identifies which program learning outcomes are incorporated into specific courses.

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. **Fourth**, if any program learning outcomes are included in the course learning outcomes, place the @ symbol next to it.

Every course is not required to include learning outcomes from each domain.



|            | NQF Learning Domains<br>And Course Learning Outcomes   | Course Teaching<br>Strategies   | Course Assessment<br>Methods   |
|------------|--|---|--|
| <b>1.0</b> | <b>Knowledge</b>   |   |  |
| 1.1        | <ul style="list-style-type: none"> <li>a) Solving the system of linear equations using matrices</li> <li>b) Recognize the matrices and operation on them, To find the inverse of matrix</li> <li>c) Recognize the vectors and the scalar and vector products</li> <li>d) <b>Knowledge</b> The Eigen Value Problem , the Eigen Vectors</li> <li>e) Solving linear differential equations</li> </ul> | <p><b>Start</b> each chapter by general idea and the benefit of it.</p> <p><b>Demonstrate</b> the course information and principles through lectures.</p>     | <p>Exams</p> <p>Midterms</p> <p>Final examination.</p>                                       |
| 1.2        | <b>Outline</b> the logical thinking.   | <b>Provide</b> main ways to deal with the exercises.  | Home work.   |
|            | <b>State</b> the physical problems by mathematical method.   | <b>Solve</b> some examples during the lecture.  | Continuous discussions with the students during the lectures.                                |
| <b>2.0</b> | <b>Cognitive Skills</b>  |   |  |
| 2.1        | The students will <b>explain and interpret</b> a general knowledge of Linear Algebra.  | <b>Encourage</b> the student to look for some complicated problems in the different references.   | Midterm exams<br>Quizzes.  |
| 2.2        | Enable students to <b>analyses</b> the mathematical problems.  | <b>Ask</b> the student to attend lectures for practice solving problem.   | Doing homework.<br>Check the problems solution.  |
|            | Student's ability to <b>write</b> physical equations in a correct mathematical way.  | Homework assignments.   | Discussion of how to simplify or analyses some problems.                                     |
| <b>3.0</b> | <b>Interpersonal Skills &amp; Responsibility</b>   |   |  |
| 3.1        | The student should <b>illustrate</b> how take up responsibility.   | <p>Ask the students to search the internet and use the library.</p> <p>Encourage them how to attend lectures regularly by assigning marks for attendance.</p> | <p>Quizzes of some previous lectures.</p> <p>Ask the absent students about last lecture.</p> |



|            |  |   |   |
|------------|--|---|---|
| 3.2        | Must be <b>shown</b> the ability of working independently and with groups.   | Teach them how to cover missed lectures.<br>Give students tasks of duties   | Discussion during the lecture.  |
| <b>4.0</b> | <b>Communication, Information Technology, Numerical</b>  |   |   |
| 4.1        | The student should <b>illustrate</b> how to communicating with: Peers, Lecturers and Community.                    | Creating working groups with peers to collectively prepare: solving problems and search the internet for some topics. | Discussing a group work sheets.   |
| 4.2        | The student should <b>interpret</b> how to Know the basic mathematical principles using the internet.              | Give the students tasks to measure their: mathematical skills, computational analysis and problem solving.            | Discusses with them the results of computations analysis and problem solutions. |
|            | The student should <b>appraise</b> how to Use the computer skills and library.                                     | Encourage the student to ask for help if needed.  | Give homework's to know how the student understands the numerical skills.       |
|            | The student should <b>illustrate</b> how to Search the internet and using software programs to deal with problems. | Encourage the student to ask good question to help solve the problem.   | Give them comments on some resulting numbers.                                   |
| <b>5.0</b> | <b>Psychomotor</b>   |   |   |
| 5.1        | Not applicable   | Not applicable  | Not applicable  |
| 5.2        | Not applicable   | Not applicable  | Not applicable  |

#### Suggested Guidelines for Learning Outcome Verb, Assessment, and Teaching

| NQF Learning Domains                                    | Suggested Verbs  |
|---|--|
| <b>Knowledge</b>  | list, name, record, define, label, outline, state, describe, recall, memorize, reproduce, recognize, record, tell, write   |
| <b>Cognitive Skills</b>                                 | estimate, explain, summarize, write, compare, contrast, diagram, subdivide, differentiate, criticize, calculate, analyze, compose, develop, create, prepare, reconstruct, reorganize, summarize, explain, predict, justify, rate, evaluate, plan, design, measure, judge, justify, interpret, appraise |
| <b>Interpersonal Skills &amp; Responsibility</b>        | demonstrate, judge, choose, illustrate, modify, show, use, appraise, evaluate, justify, analyze, question, and write   |
| <b>Communication, Information Technology, Numerical</b> | demonstrate, calculate, illustrate, interpret, research, question, operate, appraise, evaluate, assess, and criticize  |





|                    |  |
|--------------------|--|
| <b>Psychomotor</b> | demonstrate, show, illustrate, perform, dramatize, employ, manipulate, operate, prepare, produce, draw, diagram, examine, construct, assemble, experiment, and reconstruct |
|--------------------|--|

Suggested **verbs not to use** when writing measurable and assessable learning outcomes are as follows:

Consider      Maximize      Continue      Review      Ensure      Enlarge      Understand  
Maintain      Reflect      Examine      Strengthen      Explore      Encourage      Deepen

Some of these verbs can be used if tied to specific actions or quantification.

**Suggested assessment methods and teaching strategies are:**

According to research and best practices, multiple and continuous assessment methods are required to verify student learning. Current trends incorporate a wide range of rubric assessment tools; including web-based student performance systems that apply rubrics, benchmarks, KPIs, and analysis. Rubrics are especially helpful for qualitative evaluation. Differentiated assessment strategies include: exams, portfolios, long and short essays, log books, analytical reports, individual and group presentations, posters, journals, case studies, lab manuals, video analysis, group reports, lab reports, debates, speeches, learning logs, peer evaluations, self-evaluations, videos, graphs, dramatic performances, tables, demonstrations, graphic organizers, discussion forums, interviews, learning contracts, antidotal notes, artwork, KWL charts, and concept mapping.

Differentiated teaching strategies should be selected to align with the curriculum taught, the needs of students, and the intended learning outcomes. Teaching methods include: lecture, debate, small group work, whole group and small group discussion, research activities, lab demonstrations, projects, debates, role playing, case studies, guest speakers, memorization, humor, individual presentation, brainstorming, and a wide variety of hands-on student learning activities.



| <b>5. Schedule of Assessment Tasks for Students During the Semester</b> |  |                       |                                |
|---|--|-----------------------|--------------------------------|
| Assessment  | Assessment task (eg. essay, test, group project, examination etc.) | Week due              | Proportion of Final Assessment |
| 1   | Midterm 1  | 5 <sup>th</sup> week  | 20 %                           |
| 2   | Midterm 1  | 10 <sup>th</sup> week | 20%                            |
| 3   | Homework + reports   | During the semester   | 20%                            |
| 4   | Final exam   | End of semester       | 40 %                           |

#### **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)

- 1- 6-office hours per week in the lecturer schedule.
- 2- The contact with students by e-mail , mobile, office telephone and website.

#### **E. Learning Resources**

##### **1. Required Text(s)**

1- Applied Linear Algebra by Peter J. Oliver , Prentice Hall , (2006)

##### **2. Essential References**

2- Differential Equations with Boundary Value Problems by James R. Brannan, John Wiley & Sons , (2010)

3- Mathematical Techniques: An Introduction for the Engineering, Physical, and mathematical Sciences , by D. W. Jordan , Oxford University Press , (2002)

##### **4- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List):**

Same as mention above.

##### **5-.Electronic Materials, Web Sites etc**

amazon web site



|   |             |
|---|-------------|
|   |             |
| <b>5- Other learning material such as computer-based programs/CD, professional standards/regulations:</b> | <b>None</b> |

## 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.) |               |
| <b>1. Accommodation (Lecture rooms, laboratories, etc.)</b>  |               |
| -Classroom with capacity of 30-students.<br>- Library.   |               |
| <b>2. Computing resources:</b>   | Not available |
| <b>3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list):</b>  | None          |

## G Course Evaluation and Improvement Processes

|   |   |
|---|---|
| <b>1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching:</b>  | Student evaluation electronically organized by the University.  |
| <b>2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department</b>   | The colleagues who teach the same course discuss together to evaluate their teaching.                         |
| <b>3 Processes for Improvement of Teaching</b>  | - Course report, Program report and Program self-study.<br>- A tutorial lecture must be added to this course. |
| <b>4. Processes for Verifying Standards of Student Achievement (eg. 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)</b> | The instructors of the course are checking together and put a unique process of evaluation.                   |
| <b>5 Describe the planning arrangements for periodically reviewing course</b>   |   |



**effectiveness and planning for improvement.**

1-The following points may help to get the course effectiveness:

- \* Student evaluation.
- \* Course report.
- \* Program report.
- \* Program self-study.

2- According to point 1 the plan of improvement should be given

Faculty or

Teaching Staff: **KAMAL NAZMI**

Signature:

Date Report Completed: \_\_\_\_\_

Received by: \_\_\_\_\_

Dean/Department Head

Signature: \_\_\_\_\_

Date: \_\_\_\_\_