جامعة آل البيت
دائرة ضمان الجودة والتخطيط

Al al-Bayt University

College of Sciences

Department of Mathematics

Course Syllabus: Numerical analysis (2)

First semester 2020-2021

1. Instructor Information

Instructor Name	**Safwan Al-Shara'**
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2. Course Description

Numerical solution of first derivative using 2,3,5-points forwards and backwards methods. Numerical solution of definite integrals using Quadruture formulas, Romberg method and Gaussian method. Runge-Kutta methods, Taylor method and multi-step methods. Numerical solutions of higher-Order equations and systems of differential equations. Stability. Approximating Eigenvalues.

3. Course Information

Course Code 401421	**Course Title** Numerical analysis (2)	**Level** fourth year
Delivery Mode Lecture online	**Pre-requisite** 401321	**Day(s) and Time** Monday, Wednesday: 12:30-2:00
Academic year 2020-2021	**Semester** First semester	**Credit Hours** 3

4. Course Objectives

1. Approximate a first derivative of function using forward and backward methods.
2. Approximate definite integrals using Quadruture formulas (Trapezoidal, Simpsion's and Mid-point rules), Romberg method and Gaussian method.
3. Finding the numerical Solutions of initial value problems of first order using Euler's method, Higher-Order Taylor methods, Runge-Kutta methods and Multistep methods.
4. Finding the numerical Solutions of higher-Order equations and systems of differential equations.
5. Understanding the stability of Multistep methods.
6. Approximating the eigenvalues of the matrices.

5. Intended Student Learning Outcomes

Successful completion of the course should lead to the following outcomes:

1) Knowledge:

* Understand the Taylor theorem.
* Finding approximate value for first derivative of function and its bound error.
* Finding approximate value for definite integrals and its bound error.
* Finding the numerical Solutions of initial value problems of first order and its bound error.
* Finding the numerical Solutions of higher-Order equations and systems of differential equations.
* Demonstrate knowledge and understanding the strongly and weakly stable of the multistep methods.
* Approximating the eigenvalues of the matrices.

2) Cognitive Skills

*Use the numerical techniques to evaluate some mathematical problems.
*Use mathematics to analyze data and translate data into visual representations.

3) General Competences

* Develop cooperative work habits and communication skills.
* Develop and practice disciplined habits of successful learning such as
* Attending class regularly, making sure to arrive on time, and ready to focus and staying to the end of each class
* Preparing for each class by prior textbook reading, practice with problems, and making a list of questions, etc.
* Taking responsibility for one's own learning—staying up to date in everything that concerns the course.
* Encourage the development of Estimation skills and Logical thinking.

6. Course Content

Teaching Week	Topics/Activities to be Covered
1	Numerical Differentiation
2	Richardson's Extrapolation , Elements of Numerical Integration
3	Composite Numerical Integration
4	Romberg Integration
5	Adaptive Quadrature Methods , Gaussian Quadrature
6	Improper Integrations
7	The Elementary Theory of Initial-Value Problems
8	Euler's Mathod , Higher-Order Taylor Methods
9	Runge-Kutta Methods
10	Mid-term exam
11	Multistep Methods , Higher-Order Equations and Systems Of DEs
12	Stability
13	Linear Algebra and Eigenvalues
14	The Power Method
15	Review
16	Final Exam

7. Teaching and learning Strategies and Evaluation Methods

Learning Outcomes	Teaching Strategies	learning Strategies	Evaluation Methods
-Approximate a first derivative of function using forward and backward methods. -Approximate definite integrals using Quadruture formulas (Trapezoidal, Simpsion's and Mid-point rules), Romberg method and Gaussian method.	- Pdf files and video record - Ask students questions and discuss them - Solve various issues	Give homework assignments	- Classroom presentations - Discussion
-Finding the numerical Solutions of initial value problems of first order and its bound error. -Finding the numerical Solutions of higher-Order equations and systems of differential equations.			- Classroom presentations - Discussion - Mid-term exam
-Demonstrate knowledge and understanding the strongly and weakly stable of the multistep methods			- Classroom presentations -Discussion - Final exam

8. Assessment

Assessment	Grade Proportion	Week/Dates
Class Work (Quizzes, Homework and Attendance of the lecture)	**10 %**	
Mid-term exam	**40 %**	**10th Week**
Final exam	**50%**	**End of Semester**
Total	**100%**	

9. Text Book

The main reference	Numerical Analysis
Authors	Richard L. Burden & J. Douglas Faires
Publisher	Gary Ostedt
Year	2001
The edition	9th. edition
The reference website	https://epdf.pub/numerical-analysis-9th-edition.html

10. References and additional resources

1	Laurene V. Fausell , Applied Numerical Analysis using Mat Lab.
2	David Kincaid & Ward Cheney, Numerical Analysis.
3	Cuntis F. Gerald & Patrick O. Wheatley, Applied Numerical Analysis, 7th edition.