The University of Jordan

Accreditation & Quality Assurance Center

Course Syllabus

Course Name:
Numerical Methods

Course Syllabus

1	**Course title**	Numerical Methods
2	**Course number**	0301472
3	**Credit hours**	3	
	Contact hours (theory, practical)	3	
4	**Prerequisites/corequisites**	Linear Algebra (0301241)
5	**Program title**	B.Sc.
6	**Program code**	
7	**Awarding institution**	The University of Jordan
8	**School**	Science
9	**Department**	Mathematics
10	**Course level**	Obligatory Specialization requirement
11	**Year of study and semester (s)**	4th year, 1st and 2nd semesters
12	**Other department (s) involved in teaching the course**	None
13	**Main teaching language**	English
14	**Delivery method**	√ Face to face learning ☐Blended ☐Fully online
15	**Online platforms(s)**	√Moodle √Microsoft Teams ☐Skype ☐Zoom ☐Others…………
16	**Issuing/Revision Date**	05/11/2022

17 Course Coordinator:

Name: Prof. Baha Alzalg Contact hours : Sun Tue Thr 10:30-11:30 AM

Office number: 204 Math Bldg Phone number : +962 6-535-5000 Ext. 22086

Email : b.alzalg@ju.edu.jo

18 Other instructors:

Name:

Office number:

Phone number:

Email:

Contact hours:

Name:

Office number:

Phone number:

Email:

Contact hours:

19 Course Description:

As statedin the approvedstudy plan.

Numerical analysis; numerical methods in linear algebra; numerical methods for ordinary and partial differential equations.

20 Course aims and outcomes:

A- Aims:

1.   Use several methods of solving algebraic and *transcendental* equations of one variable.

2.   Approximate functions by polynomials.

3.   Approximate differentiation & integration.

4.   Solve IVP numerically.

5.   Solve linear systems of equation.

6.   Use Iterative Techniques to solve linear systems.

B- Students Learning Outcomes (SLOs):

Upon successful completion of this course, students will be able to:

SLOs \ SLOs of the course	SLO (1)	SLO (2)	SLO (3)	SLO (4)	SLO (5)	SLO (6)	SLO (7)	SLO (8)
1 Apply appropriate theories, principles and concepts relevant to the numerical analysis.	●							
2 Formulate a reasoned argument from a variety of sources relevant to Numerical Analysis.		●						
3 Analyze and interpret information from a variety of sources relevant to Numerical Analysis.					●			
4 Select a reasoned argument to the solution of familiar and unfamiliar problems relevant to Numerical Analysis.							●	
5 Plan practical activities using techniques and procedures appropriate to Numerical Analysis.								●

21. Topic Outline and Schedule:

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
1	1.1	Review of Calculus (Taylor's Theorem)	1	Face to Face	Moodle		Quiz	Textbook
	1.2	Round-Off Errors	1	Face to Face	Moodle		Quiz	Textbook
	1.3	Asymptotic Notations	1	Face to Face	Moodle		Quiz	Textbook
2	2.1	The Bisection Method	2	Face to Face	Moodle		Quiz	Textbook
	2.2	Fixed Point Iteration	1	Face to Face	Moodle		Quiz	Textbook
	2.3	Fixed Point Iteration	2	Face to Face	Moodle		Quiz	Textbook
3	3.1	The Newton-Raphson Method	2	Face to Face	Moodle		Quiz	Textbook
	3.2	The Newton-Raphson Method	7	Face to Face	Moodle		Quiz	Textbook
	3.3	Error Analysis for Iterative Methods.	1	Face to Face	Moodle		Quiz	Textbook
4	4.1	Accelerating convergence.	1	Face to Face	Moodle		Quiz	Textbook
	4.2	Zeros of Polynomials and Muller's Methods.	2	Face to Face	Moodle		Midterm	Textbook
	4.3	Interpolation and the Lagrange Polynomials	2	Face to Face	Moodle		Midterm	Textbook
5	5.1	Interpolation and the Lagrange Polynomials	2	Face to Face	Moodle		Midterm	Textbook
	5.2	Divided Differences	2	Face to Face	Moodle		Midterm	Textbook
	5.3	Divided Differences	8	Face to Face	Moodle		Midterm	Textbook
6	6.1	Numerical Differentiation	2	Face to Face	Moodle		Midterm	Textbook
	6.2	Numerical Differentiation	5	Face to Face	Moodle		Midterm	Textbook
	6.3	Richardson Extrapolation	2	Face to Face	Moodle		Midterm	Textbook
7	7.1	Richardson Extrapolation	8	Face to Face	Moodle		Midterm	Textbook
	7.2	Elements of Numerical Integration	1	Face to Face	Moodle		Midterm	Textbook
	7.3	Elements of Numerical Integration	2	Face to Face	Moodle		Midterm	Textbook

	8.1	Composite Numerical Integration	2	Face to Face	Moodle		Midterm	Textbook
8	8.2	Composite Numerical Integration	5	Face to Face	Moodle		Midterm	Textbook
	8.3	Romberg Integration	2	Face to Face	Moodle		Midterm	Textbook
	9.1	Adaptive Quadiature methods	2	Face to Face	Moodle		Midterm	Textbook
9	9.2	Elementary Theory of IVP	1	Face to Face	Moodle		Midterm	Textbook
	9.3	Euler's Method	2	Face to Face	Moodle		Midterm	Textbook
	10.1	Euler's Method	8	Face to Face	Moodle		Midterm	Textbook
10	10.2	Higher Order Taylor's Method	7	Face to Face	Moodle		Midterm	Textbook
	10.3	Runge-Kutta Methods	2	Face to Face	Moodle		Midterm	Textbook
	11.1	Runge-Kutta Methods	7	Face to Face	Moodle		Midterm	Textbook
11	11.2	Linear Systems of Equations	1	Face to Face	Moodle		Quiz	Textbook
	11.3	Pivoting Strategies	1	Face to Face	Moodle		Quiz	Textbook
	12.1	Linear Algebra and Matrix Inversion	1	Face to Face	Moodle		Quiz	Textbook
12	12.2	Linear Algebra and Matrix Inversion	5	Face to Face	Moodle		Quiz	Textbook
	12.3	The Determinant of a Matrix	5	Face to Face	Moodle		Quiz	Textbook
	13.1	Matrix Factorization	2	Face to Face	Moodle		Quiz	Textbook
13	13.2	Matrix Factorization	8	Face to Face	Moodle		Quiz	Textbook
	13.3	Special Types of Matrices	1	Face to Face	Moodle		Quiz	Textbook
	14.1	Norms of Vectors and Matrices	1	Face to Face	Moodle		Exam	Text Book
14	14.2	Norms of Vectors and Matrices	1	Face to Face	Moodle		Exam	Textbook
	14.3	Iterative Techniques for Solving linear Systems	2	Face to Face	Moodle		Exam	Textbook
	15.1	Iterative Techniques for Solving linear Systems	8	Face to Face	Moodle		Exam	Textbook
15	15.2	Error Estimates and Iterative Refinement	1	Face to Face	Moodle		Exam	Textbook
	15.3	Error Estimates and Iterative Refinement	1	Face to Face	Moodle		Exam	Textbook

22 Evaluation Methods:

Opportunities to demonstrate achievement of the SLOs are provided through the following assessment methods and requirements:					
Evaluation Activity	**Mark**	**Topic(s)**	**SLOs**	**Period (Week)**	**Platform**
Midterm	30		1, 2, 5, 7		On Campus
Quiz(s)	20		1, 2, 7, 8		On Campus
Final Exam	50		1, 2, 5, 7		On Campus

23 Course Requirements

Each student must have:
- Account on Microsoft Teams

24 Course Policies:

1. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled time. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.
2. If a student is absent for more than 10% of lectures without an excuse of sickness or due to other insurmountable difficulty, then he/she shall be barred from the final examination also he/she will get a failing grade in this course.
3. Medical certificates shall be given to the University Physician to be authorized by him. They should be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.
4. Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.
5. Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on home works.

25 References:

A- Required book (s), assigned reading and audio-visuals:

Numerical Analysis by Burden and Fairs, the latest edition, Brooks/Cole Pub. Co.

B- Recommended books, materials, and media:

Numerical Mathematics and Computing by W. Cheney and D. Kincaid, 3rd.

26 Additional information:

Name of Course Coordinator: Prof. Baha Alzalg Signature: ----------------------- Date: 5/11/2022

Head of Curriculum Committee/Department: Prof. Ahmad Al Zghoul-- Signature: ------------------------------------

Head of Department: -Prof. Manal Ghanem - Signature: -M. Ghanem

Head of Curriculum Committee/Faculty: --------------------------------------- Signature: ------------

Dean: Mahmoud Jaghoub Signature: ---