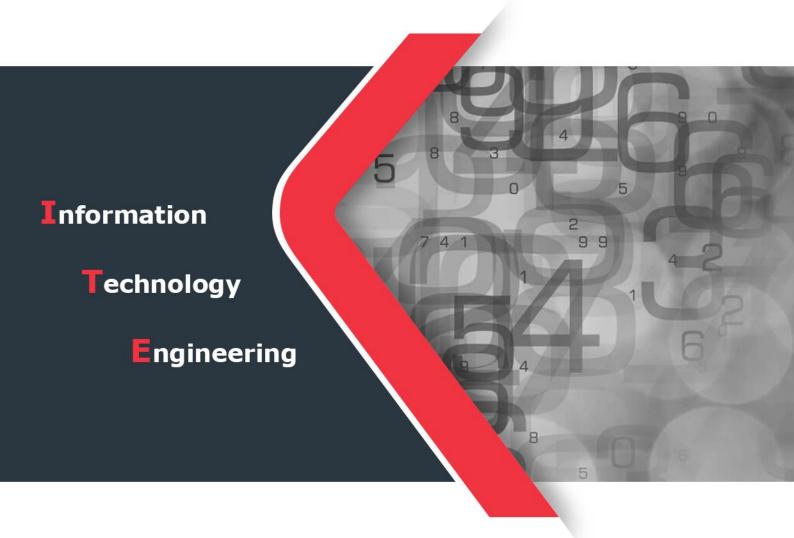


Numerical Analysis

Course description





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1. Basic Information:

Course Name	Numerical Analysis
Course Code	BNA401
Number of Presentational Sessions*	2x6
Number of Synchronous Sessions**	12
Number of Shorter Tests***	2
Number of Exams***	1
Theoretical Sessions Work Load (hrs.)	36
Practical Sessions Work Load (hrs.)	36
Credit Hours	5

^{*}Each presentational session comprises both recorded lecture (1.5 hrs.) and interactive learning content (1.5 hrs.).

N.B.

Generally, each chapter requires two presentational sessions: one for the recorded content and one for the interactive content (unless the chapter is too long, in which case it may require more sessions). This note applies to synchronous sessions as well, where each chapter requires one synchronous session generally.

2. Prerequisites Courses:

Course	code
Linear Algebra	BLA401
Mathematical Analysis II	BMA402

3. Course Objectives:

^{**}Each synchronous session comprises the interactive lecture carried out in real time in a virtual class (1.5 hrs.).

^{***}Each shorter test is 0.5 hr. long. The final exam is 2 hrs. long.

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This course is an introduction to Mathematical Analysis. The objective of this course is to introduce students to the extent to which numerical methods are needed for solving various scientific problems, and to train them to use these methods to find approximate solutions to the issues raised in various fields of research.

Topics include: Solving nonlinear equations, Numerical integration, Solving the systems of linear equations by direct methods (Gauss, LU) and Solving the systems of linear equations by iterative methods (Jacobi and the Gauss–Seidel).

4. Learning Objectives:

After successfully completing the course, students should be able to:

- Understand and apply he most important numerical methods used in solving nonlinear algebraic and transcendental equations with error calculation in each method, such as Bisection method, Secant method and Newton's method. Introducing the algorithms for developing computer programs that help in finding the solution.
- Apply the most famous methods in calculating definite integrals and estimate the committed errors, such as the rectangle rule, Trapezoidal rule and the Simpson's rule.
- Understand and apply the direct methods used for solving the systems of linear equations, including Gauss method and LU method.
- Understand and apply the iterative methods for solving the systems of linear equations, including Jacobi method the Gauss-Seidel method, and studying the convergence of these methods.

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5. Results Assessment:

Intended Learning	Assessment Way				
Objectives					
	Interactive	Applied	Final	Presentations	Reports
	Content &	Activities	Exam/	And	
	Recorded	(Synch.	Shorter	Interviews	
	Sessions	Sessions)	Tests		
Understanding	✓	✓	✓	✓	✓
Logical reasoning	✓	√	✓	✓	✓
Applying	✓	✓	✓	✓	✓

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6. Course content:

Chapter	Subject	Content	Number of Learning Objects	Number of synchronous Learning Objects
CH 1	Solving Non Linear Equations	 Introduction Bisection method Convergence speed Secant method Newton's method Exercises 	6	3
CH 2	Numerical integrals	 Introduction Rectangle rule Trapezoidal rule Simpson's rule Exercises 	5	2
CH 3	Matrices, Review and Complements	 Basic definitions Eigenvalues Norms Exercises 	4	2
CH 4	Direct methods for solving Systems of linear equations	 Introduction Gauss Method LU Method Exercises 	4	2

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CH 5	iterative methods for solving Systems of linear equations	 Introduction Jacobi Method Gauss-Seidel Method Test of convergence Exercises 	5	2
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7. Practical Activities:

• Tools and Labs:

Tool Name	Descriptions
MS- Excel	Using software can help students in solving numerical
Mathematica	scientific problems in their future work.

• Distribution of Practical Activities by chapters:

Chapter	Activities Type	Remarks
CH1	☑ Exercises	
	□ Seminars	
	□ Projects	Homework
	☐ Experiments	
	✓ Homework	
	□ Others	
CH2	☑ Exercises	
	□ Seminars	
	□ Projects	Homework
	☐ Experiments	
	✓ Homework	
	□ Others	
CH3	☑ Exercises	
	□ Seminars	
	□ Projects	Homework
	☐ Experiments	
	✓ Homework	

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	□ Others	
CH4	☑ Exercises	
	□ Seminars	
	□ Projects	Homework and seminars
	□ Experiments	
	✓ Homework	
	□ Others	
CH5	☑ Exercises	Homework
	□ Seminars	
	□ Projects	
	□ Experiments	
	✓ Homework	
	□ Others	

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- 2. د. فوزي دنان، " الرياضيات للمهندسين (10) الرياضيات العددية"، منشورات جامعة دمشق 1991–1990.
 - 3. د. برلنت مطيط، "التحليل العددي"، منشورات جامعة دمشق 2013–2014.
 - 4. Gautschi. W, "Numerical Analysis", Second Edition, Springer Science, 2012.