



Arab Academy for Science, Technology & Maritime Transport
College of Engineering & Technology
Department of Computer Engineering

University/Academy: Arab Academy for Science, Technology & Maritime Transport
Faculty/Institute: College of Engineering & Technology
Program: B.Sc. Mechanical Engineering

Form no. (12)
Course Specification

1- Course Data

Course Code: CC 413	Course Title: Numerical Analysis	Academic Year/Level: 3th year / 5th semester
Specialization: Computer Engineering	No. of Instructional Units 3 Credits	Lecture 2 Hrs.
		Practical 2 Hrs.

2- Course Aim

Solving Equations, error analysis, solving system of linear algebraic equations, numerical differentiation & integration, Interpolation and regression.

3- Intended Learning Outcomes

q- Knowledge and Understanding	<p>Through knowledge and understanding, students will be able to:</p> <ul style="list-style-type: none"> • Learn the theories of solving equations (K1) • Learn the methodologies of finding roots off equations (Bisection, False Position & Secant) (K5) • Learn the methodologies of finding roots off equations (Successive & Modified Successive Approximation) (K5) • Learn the methodologies of finding roots off equations (Newton Raphson) (K5) • Learn the methodologies of finding roots off equations (Berge Vieta) (K5) • Differentiate between different types of errors (K5) • Concepts of linear equations (K1) • Learn the methodologies of solving linear equations (Gauss elimination and Gauss Jordan) (K5) • Learn the methodologies of solving linear equations (Gauss Jordan method for Integral matrices) (K5) • Learn the methodologies of solving linear equations (Jacobi, Gauss Siedel) (K5) • Learn the meaning & usage of matrix inversion (K1) • Learn the concepts of interpolation (K1) • Learn the different methodologies of numerical interpolation (Linear, Quadratic, and Lagrange polynomials) (K5) • Learn how to calculate differentiation using mathematical methods (2 & 3 points forward & backward - midpoint) (K5) • Learn how to calculate integration using mathematical methods (Mid-point) (K5) • Learn how to calculate integration using mathematical methods (Trapezoidal, Composite Trapezoidal, Simpson, Composite Simpson & Gaussian) (K5) • Learn the concepts of regression (K1) • Learn the different methodologies of regression (Linear & Quadratic) (K5) • Learn the different methodologies of regression (Lagrange) (K5)
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r- Intellectual Skills	<ul style="list-style-type: none"> • Select appropriate method to solve one variable equations problems (I1) • Select appropriate method to solve one variable equations problems (I1) • Select appropriate method to solve one variable equations problems (I1) • Select appropriate method to solve one variable equations problems (I1) • Differentiate between the results of the various-one-variable-equations methods (I11) • Design a computer application to simulate the solution to one of the methods (I12,I17) • Select appropriate mathematical solutions to minimize errors (I2) • Select appropriate method to solve linear equations problems (I1) • Select appropriate method to solve linear equations problems (I1) • Select appropriate method to solve linear equations problems (I1) • Select appropriate method to solve linear equations problems (I1) • Select appropriate method to solve interpolation problems (I1) • Select appropriate method to solve integration & differentiation problems (I1) • Select appropriate method to solve integration problems (I1) • Differentiate between the results of the integration methods (I11) • Select appropriate method to solve regression problems (I1) • Differentiate between the results of the various regression methods (I11)
s- Professional Skills	<p>Through professional and practical skills, students will be able to:</p> <ul style="list-style-type: none"> • Apply knowledge of mathematical methods to solve one variable equations problems (P1) • Apply knowledge of mathematical methods to solve one variable equations problems (P1) • Apply knowledge of mathematical methods to solve one variable equations problems (P1) • Students have to present one of the methods in the form of pseudo code (P12) • Analyze the errors on graphs using computer programs (P7) • Apply knowledge of mathematical methods to solve linear equations problems (P1) • Apply knowledge of mathematical methods to solve differentiation problems (P1) • Apply knowledge of mathematical methods to solve integration problems (P1) • Apply knowledge of mathematical methods to solve regression problems (P1)
t- General Skills	<p>Through general and transferable skills, students will be able to:</p> <ul style="list-style-type: none"> • none

4- Course Content

Week No.1	Solution of equations of one variable: Bisection method, False Position method, and secant method.
Week No.2	Solution of equations of one variable: Successive Approximation method, and modified Successive Approximation method.
Week No.3	Solution of equations of one variable: Newton Raphson method and nearly equal roots.
Week No.4	Solution of equations of one variable: Berge Vieta method (of roots of polynomials).
Week No.5	Error Analysis and Propagation: Types and sources of errors and ill-conditioning and instability.
Week No.6	Error Analysis and Propagation: Process graphs, error propagation with examples.
Week No.7	Solutions of linear equations: (Direct Methods) Gauss elimination and Gauss Jordan methods.

Week No.8	Solutions of linear equations: (Direct Methods) Gauss Jordan method for Integral matrices.
Week No.9	Solutions of linear equations: (Indirect Methods) Jacobi, Gauss Siedel, and conditions of convergence.
Week No.10	Matrix Inversion using direct methods for solution of linear equations. Eigen values.
Week No.11	Numerical Interpolation (Linear, Quadratic, and Lagrange polynomials).
Week No.12	Numerical Differentiation and Integration (Mid-point integration).
Week No.13	Numerical Integration (Trapezoidal, Simpson, and Gaussian integration).
Week No.14	Linear and Quadratic regression.
Week No.15	Lagrange regression and revision.
Week No.16	Presentation of projects and Final Exam.

5- Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

6-Teaching and Learning Methods for Students with Special Needs

- Personalized teaching is available for special needs students and an academic advisor is appointed to follow up with these students and to monitor progress.

7- Student Assessment

a-Procedures used	1-Written Examinations to assess The Intended Learning Outcomes. 2-Class Activities (Reports, Discussions, -----) to assess The Intellectual Skills.	
b- Schedule:	Assessment 1	7 th Week Written Exam
	Assessment 2	12 th Week Written Exam
	Assessment 3	Continuous
	Assessment 4	16 th Week Final Written Exam
c- Weighing of Assessment	7 th Week Examination	30 %
	12 th Week Examination	20 %
	Final-term Examination	40 %
	Oral Examination	00 %
	Practical Examination	00 %
	Semester Work	10 %
	Total	100%

8- List of References:

a- Course Notes	
b- Required Books (Textbooks)	<ul style="list-style-type: none"> • Steven C. Chapra and Raymond P. Canale, “Numerical Methods for Engineers with Software and Programming Applications”, McGraw Hill, latest edition. •
c- Recommended Books	<ul style="list-style-type: none"> • Faire Burden, “Numerical Analysis”, PWS, latest edition. • Earl .E. Swartzlander, “Computer Arithmetic”, IEEE Computer Society Press. • Robert .F. Churchhouse, “Numerical methods hand book of applicable mathematics, John Wiley & Sons, latest edition.
d- Periodicals, Web Sites, etc.	

Course coordinator:

Program Manager: