



Future Academy
Higher Future Institute for Specialized Technological Studies

Course Specification

1- Course information:

Course Code:	BSC 305
Course Title:	Numerical Computing
Year/level	3 rd level
Academic Programs	Computer Science Program (B.Sc.)
Contact hours/ week	(theoretical 2 hrs, practical 2 hrs, total 3 hrs)

2- Course aims:

This course aims to provide students with elements of error analysis and the sources of error, real roots of an equation, polynomial approximation by different method of numerical methods, numerical solutions of systems of ordinary differential equations, numerical integration. The student expects to program a computer in addition to use a graphing calculator.

3- Intended learning outcomes of the course (ILOs):

a- Knowledge and understanding:

On successful completion of this course, the student should be able to:

- a1- **Define** the numerical methods: Introduction & Scope.
- a2- **Recognize** the errors in numerical calculation.
- a3- **Determine** the numerical solution of algebraic & transcendental equation.
- a4- **Determine** the numerical solution of ordinary differential equations and partial differential equations.
- a5- **Determine** the numerical solution of integral equations.

b- Intellectual skills:

On completing this course, the student should be able to:

- b1- **Explain** numbers, significant digit, and different types of errors.
- b2- **Compare the different methods (Algorithms)** of solving nonlinear equations.
- b3- **Solve** the numerical differentiation & numerical integration.

c- Professional and practical skills:

At the end of this course, the student will be able to:

- c1- **Apply** the different algorithms to solve algebraic & transcendental equations.
- c2- **Analyze** the total error resulting from approximation.

d- General and transferable skills:

On successful completion of this course, the student should be able to:

d1- **Compute** different types of numerical solution of algebraic & transcendental equation.

d2- **Managements** how to do Brainstorming discussions for solve numerical solution of algebraic & transcendental equation.

d3- **Working in groups** to find the numerical solution of ordinary differential equations and think creatively about new exercises.

d4- **life-long learning** the ability to gain numerical skills.

4- Course contents

Week No.	Topics/units	Number of hours		ILO's
		Lecture hours	Practical/ Tutorial hours	
1	Numerical Methods: Introduction & Scope. Errors in Numerical Calculation.	2	2	a1, a2, b1, d4
2	Solution of Algebraic & Transcendental Equations (evaluation of polynomials by Horner's method)	2	2	a2, a3, b1, b2, c1, c2, d1, d2, d4
3	Method of solving non-linear equations (Bisection Method- False Position Method- Newton Raphson Method)	2	2	a2, a3, b1, b2, c1, c2, d1, d2, d4
4	Revision 1 on solution of algebraic & transcendental equations + Quiz 1	2	2	a2, a3, a4, b1, b2, c1, c2, d1, d2, d3, d4
5	Method of solving non-linear equations (Secant Method)- Horner's Method for finding roots	2	2	a2, a3, b1, b2, c1, c2, d1, d2, d4
6	Differentiating Continuous Function (forward difference & backward difference quotient - central difference quotient)	2	2	a2, a4, b1, b3, d3, d4
7	Midterm Exam			
8	Error Analysis resulting from numerical differentiate - Differentiating Tabulated Functions	2	2	a2, a4, b1, b3, d3, d4
9	High Order Derivatives	2	2	a2, a4, b1, b3, d3, d4
10	High Order Derivatives	2	2	a2, a4, b1, b3, d3, d4
11	Revision 2 on high order derivatives + Quiz 2	2	2	a2, a3, a4, b1, b2, c1, c2, d1, d2, d3, d4
12	Numerical Integration (Newton Cotes General Formula)	2	2	a2, a5, b1, b3, d4
13	Simpson's & Composite Simpson's Rule - Gaussian Integration & Changing the limit of integration	2	2	a2, a5, b1, b3, d4
14	Revision 3 on numerical integration	2	2	a2, a3, a4, b1, b2, b3, b4, c1, c2, d1, d2, d3, d4

5- Teaching and learning methods

Methods	ILO's																			
	a1	a2	a3	a4	a5	b1	b2	b3	b4	b5	c1	c2	c3	c4	c5	d1	d2	d3	d4	d5
Lectures	√			√		√					√	√				√		√		
Practical sections		√	√				√	√									√		√	
Self-learning							√	√				√						√	√	
Discussion groups		√	√				√	√									√		√	

6- Teaching and learning methods for Low-achieving students

- Extra teaching hours for those who need help.
- More quizzes to assess their ability for understanding the course.
- Encourage the teamwork for those students with other advanced ones to increase their participation and understanding.

7- Student assessment

Assessment method	Time	Grade weight (%)	week	ILOs
Course Work (Tutorial Exercise and Assignments)		10	Every week	a1, a2, a3, b1, b2, b3, c1, c2, d1, d2, d4
Quiz 1		5	Week#4	a1, a2, a3, b1, b2, b3, c1, c2, d1, d2, d4
Mid-Term exam		15	Week#7	a2, a3, a4, a5, b1, b2, b3, c1, c2, d1, d2
Quiz 2		5	Week#11	a1, a2, a3, b1, b2, b3, c1, c2, d1, d2, d4
Final written exam		60		a1, a2, a3, a4, a5, b1, b2, b3, c1, c2, d1, d2, d3, d4

8-List of references

8.1. Student notebooks:

Lecture PowerPoint uploaded on classroom.

8.2. Essential textbooks:

- Elden, L., Wittmeyer-Koch, L. and Nielsen, H.B., 2004. Introduction to Numerical Computation-analysis and MATLAB illustrations.
- Shampine, L.F., 1997. Fundamentals of numerical computing.

8.3. Recommended textbooks:

- Moler, C.B., 2004. Numerical computing with MATLAB. Society for Industrial and Applied Mathematics.
- Thisted, R.A., 2017. Elements of statistical computing: Numerical computation. Routledge.

8.4. Journals, Periodical and Reportsetc.

<https://www.bing.com/ck/a?!&&p=eb9b0c598c6f734d4e5fc19210bd32a44889a5203ef9652fcd952b38798d7d4eJmltdHM9MTczMTgwMTYwMA&ptn=3&ver=2&hsh=4&fclid=23bc4517-0a77-6b22-063b-50120b2c6a4e&psq=journal+of+numerical+computing&u=a1aHR0cHM6Ly9saW5rLnNwcmluZ2VyLmNvbS9qb3VybmFsLzExMDc1&ntb=1>

8.5. Websites

<https://www.bing.com/ck/a?!&&p=954cfb43c0cbbb1e1cbf3f73a082825e6eb4de3b85680d3543b8991db214d78cJmltdHM9MTczMTgwMTYwMA&ptn=3&ver=2&hsh=4&fclid=23bc4517-0a77-6b22-063b-50120b2c6a4e&psq=website+for+numerical+comuting&u=a1aHR0cHM6Ly9udW1weS5vcmcv&ntb=1>

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