Syrian Arab Republic		الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالـــي
Syrian Virtual University		الجامعة الافتراضية السورية

Course Description: Numerical Analysis

1- Basic Information:

Course Name	Numerical Analysis
Course ID	ISE_NA
Contact Hours (Registered Sessions)	16
Contact Hours (Synchronized Sessions)	16
Mid Term Exam	-
Exam	75 min
Registered Sessions Work Load	16
Synchronized Session Work Load	16
Credit Hours	3

2- Pre-Requisites:

Course	ID
None	

3- Course General Objectives:

The objective of numerical analysis course is to introduce the 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. The numerical analysis course includes six chapters, respectively:

- Estimating errors
- Solving nonlinear equations
- interpolation
- Numerical integration
- Solving the systems of linear equations
- Introduction to the solution of ordinary differential equations

4- Intended Learning Outcomes (ILO):

Code	Intended Learning Outcomes
Error Estimation	Provide students with the knowledge of the sources and types of errors. Estimating errors in basic arithmetic operations as well as in functions (of single and multiple parameters). The accumulation of errors and calculating higher limits to reduce their inflation in recursive processes.
Solving nonlinear equations	Presenting the 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.
Interpolation	Implement the techniques of interpolation. Development and use of the most important forms of interpolation such as Newton formula and Lagrange formula in addition to the Least squares method. Reverse interpolation.
Numerical integration	The use of the most famous numerical rules in calculating the definite integrals and estimating the committed errors. The undertaken rules are: the method of rectangle rule, Trapezoidal rule and the Simpson's rule.
Solving systems of linear equation	Identify the most immediate and iterative methods used for solving the systems of linear equations, including the LU method, Jacobi method and the Gauss-Seidel method, and studying the convergence of the iterative methods.
Introduction for solving ordinary differential equations	Identify the simplest numerical methods to solve the ordinary differential equations of the first and second order, including the Euler method and the Runge-Kutta method. Introducing a method of solving differential equations of higher order and another method of solving systems of ordinary differential equations, namely the successive derivation method and the successive approximation method.

5- Course Syllabus (18 hours of total synchronized sessions;18 hours of total Recorded Sessions)

- **RS:** Recorded Sessions**; SS:** Synchronized Sessions**;**

ILO	Course Syllabus	RS	SS	Type	Additional Notes
Error Estimation	• Sources and types of errors. • Estimating errors in basic arithmetic operations. • Estimating errors in functions (of single and multiple parameters). • Accumulation of errors and calculating higher limits to reduce their inflation in recursive processes.		3	☒ Exercises ☒ Assignments ☐ Seminars ☐ Projects ☐ Practices ☐ Others	
Solving nonlinear equations	• Numerical methods used in solving nonlinear algebraic and transcendental equations with error calculation in each method. • Bisection method • Secant method • Newton's method		3	☒ Exercises ☒ Assignments ☐ Seminars ☐ Projects ☐ Practices ☐ Others	
Interpolation	• Using the most important forms of interpolation such as: • Newton formula Lagrange formula • Least squares method • Reverse interpolation		3	☒ Exercises ☒ Assignments ☐ Seminars ☐ Projects ☐ Practices ☐ Others	

Numerical integration	• The use of the most famous numerical rules in calculating the definite integrals and estimating the committed errors. • Rectangle rule • Trapezoidal rule • Simpson's rule		3	☒ Exercises ☐ Assignments ☐ Seminars ☐ Projects ☐ Practices ☐ Others	
Solving systems of linear equation	• Identify the most immediate and iterative methods used for solving the systems of linear equations. • LU method • Jacobi method • Gauss-Seidel method • The convergence test		3	☒ Exercises ☐ Assignments ☐ Seminars ☐ Projects ☐ Practices ☐ Others	
Introduction for solving ordinary differential equations	• Presenting some of simplest numerical methods to solve the ordinary differential equations of the first and second order, such as: • Euler method • Runge-Kutta method. Successive derivation method • Successive approxi-mation method		3	☒ Exercises ☐ Assignments ☐ Seminars ☐ Projects ☐ Practices ☐ Others	

6- Assessment Criteria (Related to ILOs)

ISC	Interactive Synchronized Collaboration		Ex	Exams		Rpt	Reports
PF2F	Presentations and Face-to-Face Assessments		PW	Practice Work			

ILO Code	ILO	Intended Results	Assessment Type				
			ISC	PW	Ex	PF2F	Rpt
Error Estimation	Estimating errors in basic arithmetic operations as well as in functions (of single and multiple parameters). Accumulation of errors and calculating higher limits to reduce their inflation in recursive processes.		☒	☒	☒		
Solving nonlinear equations	Using the most important numerical methods for solving nonlinear algebraic and transcendental equations with error calculation in each method. The undertaken methods are: Bisection method, Secant method and Newton's method.		☒	☒	☒		
Interpolation	Using the most famous forms of interpolation such as Newton formula and Lagrange formula in addition to the Least squares method. Reverse interpolation.		☒	☒	☒		

Numerical integration	The use of the most important numerical rules in calculating the definite integrals and estimating the committed errors. • Rectangle rule • Trapezoidal rule • Simpson's rule.		☒		☒		
Solving systems of linear equation	Introducint the most immediate and iterative methods used for solving the systems of linear equations, • LU method • Jacobi method • Gauss-Seidel method. • Convergence test.		☒		☒		
Introduction for solving ordinary differential equations	Introduction to the simplest numerical methods for solving ordinary differential equations from the first and second order. • Euler method • Modified Euler method • Runge-Kutta method. • Successive derivation method • Successive approxim-ation method.		☒		☒		

7-Practice Tools:

Tool Name	Description
1. MS-Excel 2. Mathematica Software	Using some software can help students in solving numerical scientific problems in the future work.

8-Main References

1. الأسس العامة للتحليل العددي. د. دعد الحسيني، د. محمد صبح. منشورات جامعة دمشق 1991-1992
2. ا لرياضيات للمهندسين (10) الرياضيات العددية. د. فوزي دنان. 1990-1991
3. التحليل العددي. د. هاشم عبد اللي، منشورات جامعة حلب 1983-1984
4. التحليل الحديث. د. أحمد الدرويش، منشورات جامعة حلب 1977-1978
5. التحليل العددي. د. برلنت صبري مطيط، منشورات جامعة دمشق – كلية العلوم 2013-2014

9-Additional References