



الجامعة الافتراضية السورية  
SYRIAN VIRTUAL UNIVERSITY

# Numerical Analysis

Course description

**I**nformation

**T**echnology

**E**ngineering



Syrian Arab Republic	 الجامعة الافتراضية السورية SYRIAN VIRTUAL UNIVERSITY	الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالي
Syrian Virtual University		الجامعة الافتراضية السورية

## 1. Basic Information:

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

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

\*\*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.

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:

Syrian Arab Republic	 الجامعة الافتراضية السورية SYRIAN VIRTUAL UNIVERSITY	الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالي
Syrian Virtual University		الجامعة الافتراضية السورية

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 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.
- 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.

Syrian Arab Republic	 الجامعة الافتراضية السورية SYRIAN VIRTUAL UNIVERSITY	الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالي
Syrian Virtual University		الجامعة الافتراضية السورية

## 5. Results Assessment:

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

Syrian Arab Republic	 SVU الجامعة الافتراضية السورية SYRIAN VIRTUAL UNIVERSITY	الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالي
Syrian Virtual University		الجامعة الافتراضية السورية

## 6. Course content:

Chapter	Subject	Content	Number of Learning Objects	Number of synchronous Learning Objects
CH 1	Solving Non Linear Equations	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Bisection method</li> <li>3. Convergence speed</li> <li>4. Secant method</li> <li>5. Newton's method</li> <li>6. Exercises</li> </ol>	6	3
CH 2	Numerical integrals	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Rectangle rule</li> <li>3. Trapezoidal rule</li> <li>4. Simpson's rule</li> <li>5. Exercises</li> </ol>	5	2
CH 3	Matrices, Review and Complements	<ol style="list-style-type: none"> <li>1. Basic definitions</li> <li>2. Eigenvalues</li> <li>3. Norms</li> <li>4. Exercises</li> </ol>	4	2
CH 4	Direct methods for solving Systems of linear equations	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Gauss Method</li> <li>3. LU Method</li> <li>4. Exercises</li> </ol>	4	2

Syrian Arab Republic	 SVU الجامعة الافتراضية السورية SYRIAN VIRTUAL UNIVERSITY	الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالي
Syrian Virtual University		الجامعة الافتراضية السورية

<b>CH 5</b>	iterative methods for solving Systems of linear equations	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Jacobi Method</li> <li>3. Gauss–Seidel Method</li> <li>4. Test of convergence</li> <li>5. Exercises</li> </ol>	5	2
-------------	---	---	---	---

Syrian Arab Republic	 SVU الجامعة الافتراضية السورية SYRIAN VIRTUAL UNIVERSITY	الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالي
Syrian Virtual University		الجامعة الافتراضية السورية

## 7. Practical Activities:

- **Tools and Labs:**

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

- **Distribution of Practical Activities by chapters:**

Chapter	Activities Type	Remarks
CH1	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Experiments <input checked="" type="checkbox"/> Homework <input type="checkbox"/> Others	Homework
CH2	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Experiments <input checked="" type="checkbox"/> Homework <input type="checkbox"/> Others	Homework
CH3	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Experiments <input checked="" type="checkbox"/> Homework	Homework

Syrian Arab Republic	 SVU الجامعة الافتراضية السورية SYRIAN VIRTUAL UNIVERSITY	الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالي
Syrian Virtual University		الجامعة الافتراضية السورية

	<input type="checkbox"/> Others	
<b>CH4</b>	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Experiments <input checked="" type="checkbox"/> Homework <input type="checkbox"/> Others	Homework and seminars
<b>CH5</b>	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Experiments <input checked="" type="checkbox"/> Homework <input type="checkbox"/> Others	Homework



Syrian Arab Republic	 الجامعة الافتراضية السورية SYRIAN VIRTUAL UNIVERSITY	الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالي
Syrian Virtual University		الجامعة الافتراضية السورية

## 8. References:

1. د. دعد الحسيني، د. محمد صبح، "الأسس العامة للتحليل العددي"، منشورات جامعة دمشق 1991-1992.
2. د. فوزي دنان، " الرياضيات للمهندسين (10) الرياضيات العددية"، منشورات جامعة دمشق 1990-1991.
3. د. برانت مطيط، "التحليل العددي"، منشورات جامعة دمشق 2013-2014.
4. Gautschi. W, "Numerical Analysis", Second Edition, Springer Science, 2012.