جامعة الإسراء
ISRA UNIVERSITY

Course Syllabus

According to JORDAN National Qualification Framework (JNQF)

Course Name: Numerical Analysis

Course Number: 06052253

General Course Information:

Course title	**Numerical Analysis**
Course number	**06052253**
Credit hours	**3**
Education type	**Face-to-Face**
Prerequisites/corequisites	**Calculus I (01102181)**
Academic Program	**Computer Science**
Program code	**605**
Faculty	**Information Technology**
Department	**Computer Science**
Level of course	**3rd year**
Academic year /semester	**2021/2022, First Semester**
Awarded qualification	**Bachelor (Bsc)**
Other department(s) involved in teaching the course	**None**
Language of instruction	**English**
Date of production/revision	**2021/2022**

Course Coordinator:

Coordinator's name	**Dr. Faiz Al_Shrouf**
Office No	**HoD**
Office Phone extension number	**2464**
Office Hours	**[1-2],[3-4] (Sun - Tues)** **[9:30-11:00] (Monday and Wednesday)**
Email	**Fayez.shrouf@iu,edu,jo**

Other Instructors:

Instructor name	
Office No	
Office Phone extension number	
Office Hours	
Email	

Course Description *(English/Arabic)*:

English	This course aims to: introduction to matrix algebra, solving linear system of equations errors of calculations, roots of nonlinear equation, use of numerical methods to solve systems of non-linear equations, approximation Functions, Find derivatives, find the values of numerical integrals by numerical methods, the use of numerical methods to solve differential equations.
Arabic	يهدف المساق الى تعريف الطرائق العدديه لحل المسائل الرياضيه ومنها خصائص المصفوفات ودورها في حل انظمة المعادلات الخطيه مثل طريقة كريمر جاوس جوردان طريقة المعكوس للمصفوفه كما يهدف ايضا عرض طرق عدديه في حل انظمة المعادلات الغير خطيه وايجاد جذور المعادلات غير الخطيه وحساب الاخطاء طرق حل التكاملات العدديه والتفاضل العددي والمعادلات التفاضليه

Textbook: *Author(s), Title, Publisher, Edition, Year, Book website.*

Richard Khoury, Douglas W. Harder, Numerical Methods and Modelling for Engineering, Springer, 10th edition ,2018

References: *Author(s), Title, Publisher, Edition, Year, Book website.*

Required book (s), assigned reading and audio-visuals:

1. Steven C. Chapra, Applied Numerical Methods, McGraw-Hill, 3rd edition, 2017.
2. Jaan Kiusalaas, Numerical Methods in Engineering with MATLAB, Cambridge University Press, 2nd edition, 2009.

Course Educational Objectives (CEOs):

1.	**Track sources of errors when using numerical approximations on a digital system**
2.	**Find the roots of nonlinear equations using bracketing and open methods**
3.	**Solve a system of linear algebraic equations using direct and iterative methods**
4.	**Construct function approximation using interpolation formulas**
5.	**Apply high accuracy differentiation and integration numerical formulas**
6.	**Solve ordinary differential equations using numerical methods**

Intended Learning Outcomes (ILO's):

	Subject Intended learning outcomes (ILOs) describe what students are expected to know and be able to do at the end of the course. These outcomes are related to the knowledge, skill and competence that students acquire:	**Relationship to CEOs**	**Contribution to PLOs**	**Bloom Taxonomy Levels***	**Descriptors****

A	**Knowledge and Understanding:**				
A1	**Appreciate the limitation of exact mathematical methods and the need for numerical methods to solve most applied problems in engineering and science.**	**1,2,3,4,5,6**	**A,B**	**1**	**K**
A2	**Pick the appropriate numerical method to solve the problem at hand given criteria like efficiency, stability and accuracy.**	**1,2,3,4,5,6**	**A,B**	**1**	**k**
A3	**Analyze the truncation error in the various numerical methods using methods like Taylor series expansion.**	**1,2**	**A,B**	**1**	**k**
A4	**Construct correct numerical codes that adhere to best coding practices**	**3,4,5,6**	**A,B**	**2**	**c**
B	**Intellectual skills:**				
B1					
B3					
C	**Subject specific skills:**				
C1	**Numerical calculation and approximation**	**1,2,3,4,5,6**	**A,B**	**3,4**	**s**
C2					
C3					
D	**Transferable skills:**				
D1					
D2					
D3					

***Bloom Taxonomy Levels**

Level #	1	2	3	4	5	6
Level Name	Knowledge	Comprehension	Application	Analysis	Evaluation	Synthesis

** Descriptor (National Qualification Framework Descriptors): K : Knowledge, S: Skill, C: Competency.

Program Learning Outcome (PLOs):

Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviours that students acquire as they progress through the program. A graduate of the (_____) program will demonstrate:	Descriptors**		
	K	S	C

a.	**Analyse a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.**	√		
b.	**Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.**		√	
c.	Communicate effectively in a variety of professional contexts.			√
d.	Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.			√
e.	Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.			√
f.	Apply computer science theory and software development fundamentals to produce computing-based solutions [CS}		√	

**** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)**

Weekly Schedule *(please choose the type of teaching)*

■ **Face to Face**

Week	First Hour	Second Hour	Third Hour	Ach. ILOs	Ach. PLOs	Descriptors**
1	**Introduction** Matrices Operations on Matrices	Examples on Matrices	Examples	A1,A2	a	K
2	**Matrix Properties Matrix inversion**	Examples	Examples	A1,A2	a	K
3	**Solving system of Linear Equations Cramer's Method**	Examples	Examples	A3,A4	b	S
4	**Solving system of Linear equations Gauss-Jordan**	Examples	Examples	A3,A4	b	S
5	**Solving system of linear equations Matrix inversion**	Examples	Examples	A3,A4	b	S
6	**Solving non-linear equations Bi-section method**	Examples	Examples	A3,A4	B	S
7	**Solving non-linear equations Newton's method/ secant method**	Examples	Examples	A3,A4	B	S
8	**Solving system of-non-linear system of equations**	Examples	Examples	A3,A4	B	S
9	**Polynomial approximation Taylor approximation/Newton Method**	Examples	Examples	A3,A4	B	S
10	**Polynomial approximations**	Examples	Examples	A3,A4	B	S

	Lagrange's approximation					
11	**Sources of errors**	Examples	Examples	A3,A4	B	S
12	**Numerical differentiations**	Examples	Examples	A3,A4	B	S
13	**Numerical Integrations**	Examples	Examples	A3,A4	B	S
14	**Case studies**	Examples	Examples	A1,A2,A3,A4,C1	A,B	C
15	**Case studies**	Examples	Examples	A1,A2,A3,A4,C1	A,B	C

* **K: Knowledge, S: Skills, C: Competency**

Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

- **Interactive videos**
- **Practice Labs**
- **Discussion Forums**
- **Quizzes**
- **Other Interactive online activities**
- **Reports**

Course Policies:

A- Attendance policies:

The maximum allowed absences is 15% of the lectures.

B- Absences from exams and handing in assignments on time:

Midterm exam can be retaken based on approval of excuse by the instructor's discretion.

Not handing assignment on time will incur penalties.

C- Academic Health and safety procedures

D- Honesty policy regarding cheating, plagiarism, and misbehaviour:

Cheating, plagiarism, misbehaviour will result in zero grade and further disciplinary actions may be taken.

E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.
- Activities (Course Videos, homework , Discussion Forums, Quizzes) **20%**
- Midterm **30%**
- Final Exam **50%**

F- Available university services that support achievement in the course: **E-Learning Platform, Labs, Library.**

Required equipment:

- **PC / Laptop with webcam and mic**
- **Internet Connection**
- **Access to the IU E-Learning Platform at: https://elearn.iu.edu.jo/**

- **E-learning plan**
- Satisfaction questionnaires for online and face-to-face learning
- Software for e-learning
- Training

Assessment Tools implemented in the course:

- Final Exam
- Midterm Exam
- Quizzes
- Homework
- Practice Labs
- Discussion Forums
- Periodic reports for learning assessment
- Improvement plans for online or face-to-face teaching
- Others:…….

Responsible Persons and their Signatures:

Course Coordinator	**Dr. Faiz Al-Shrouf**	**Completed Date**	15 / 10 / 2021
		Signature	

Received by (Department Head)	**Dr. Faiz Al Shrouf**	**Received Date**	15 / 10 / 2021
		Signature	