COURSE Syllabus

Course Name: Numerical analysis

Course Number: 04082211

General Course Information:

Course title	Numerical analysis methods
Course number	04082211
Credit hours (theory, practical)	3Hrs Theory
Contact hours (theory, practical)	10:00-11:00 su, tu,th
Prerequisites/corequisites	Linear Algebra
Academic Program	Renewable energy engineering
Program code	03
Awarding institution	Isra University
Faculty	Engineering
Department	Renewable energy engineering
Level of course	Third Year
Academic year /semester	1st Semester 2022-2023
Awarded qualification	B.Sc
Other department(s) involved in teaching the course	-
Language of instruction	English
Date of production/revision	22-06-2022

Course Coordinator:

Coordinator's Name: Eng. Faten Alsarayrah
Office No.: third floor
Office Phone: 2502
Office Hours: Sun: [9:00-10:00], Mon: [11:00-12:00], Tue: [9:00-10:00], Wed: [11:00-12:00], Thu: [12:00-1:00]
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Other Instructors:

Instructor's Name:
Office No.:
Office Phone:
Office Hours:
Email:

Course Description:

Approximations and numerical errors, roots of equations, methods of solving linear and non linear equations, numerical integration, numerical differentiation, theory of curve fitting, the use of numerical techniques and

computer to solve civil engineering (structural, hydraulics, environmental, transportation and geotechnical problems.

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

1. Advanced Engineering Mathematics, by H.C. Taneja, 0th Edition, Kindle Edition, 2013, https://www.amazon.com/Advanced-Engineering-Mathematics-H-C-Taneja-ebook/dp/B01FQWJISQ

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

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

1. Numerical Methods, by Babu Ram, 2010.
2. Numerical methods in civil engineering, lecture notes by Janusz ORKISZ, 2007.

Course Educational Objectives (CEOs):

1.	Understand the basic concepts of numerical analysis methods.
2.	Develop the basic understanding of numerical algorithms and skills used in solving equation of one variable.
3.	Solve a system of linear and non-linear equations using numerical methods.
4.	Approximate differentiation & integration.
5.	Solve initial value problems (IVP) numerically

Intended Learning Outcomes (ILO's):

	Intended Learning Outcomes (ILO's)	**Relationship to CEOs**	**Contribution to PLOs**
A	**Knowledge and Understanding:**		
A1	Understand the basic concepts of numerical methods and the importance of these methods in solving mathematical problems in real life	1	a,g
B	**Intellectual skills:**		

B1			
C	**Subject specific skills:**		
C1	Use several methods of solving algebraic and transcendental equations of one variable	2,3	a
C2	Solve linear and non-linear system of equations	2,3	a
C3	Use finite differences and interpolation to solve mathematical problems.	3	a
C4	Use numerical integration and derivatives to find approximate solutions for some problems.	4	a
C5	Use numerical methods to solve initial value problems.	5	a
D	**Transferable skills:**		
D1	Using numerical methods in solving mathematical problems in real life.	1	a

Topic Outline and Schedule:

Topic	Weeks	Achieved ILOs
Introduction to numerical methods: Difference between algebraic and numerical methods**,** Importance of numerical methods in solving mathematical complex real-life problem. Types of errors	1	a1,d1
Solution of non-linear equation (bracketing methods): Bisection method False position method	2	c1
Solution of non-linear equation (non-bracketing methods): Secant method Newton Raphson method	3	c1
Solution of linear system of equations: Lowe upper decomposition method.	4	c2
Solution of linear system of equations: Gauss-Seidel method	5	C2
Interpolation: Introduction to interpolation Direct method of interpolation (linear interpolation, quadratic interpolation and cubic interpolation)	6	c3
Interpolation:	7	c3

Lagrangian interpolation (linear interpolation, quadratic interpolation and cubic interpolation)		
Interpolation: Newton's Divided Difference Polynomial Method of Interpolation (linear interpolation, quadratic interpolation and cubic interpolation)	8	C3
Numerical integration: Trapezoidal method (Single application and multiple segment application of Trapezoidal rule)	9	C4
Numerical integration: h/3 Simpson's rule (Single application and multiple segment application of h/3 Simpson's rule)	10	C4
Numerical integration: 3h/8 Simpson's rule (Single application and multiple segment application of 3h/8 Simpson's rule).	11	C4
Numerical integration: Gauss Quadrature rules of numerical integrations.	12	C4
Differential equation (Solving initial value problem) Introduction to differential equations.	13	C5
Differential equation (Solving initial value problem) Simple Euller's method. Modfied Euller's method	14	C5
Differential equation (Solving initial value problem) Runge Kutta's method**.**	15	C5
Final exam	16	

Teaching Methods and Assignments:

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

- Lectures.
- Lab hands on
- Online material

Course Policies:

A- Attendance policies:

The maximum allowed absences is 15% of the lectures.

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

First Exam and second 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.

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

Required equipment:

Assessment Tools implemented in the course:

- ☐ Mid Exam 35%.
- ☐ Final Written Exam 50%.
- ☐ Quizzes.
- ☐ Homework 10%.
- ☐ Integrative Projects.
- ☐ Case Study.
- ☐ Written Reports.
- ☐ Participation in Lecture 5%.
- ☐ Practice in the Lab.
- ☐ Illustrative Presentations.
- ☐ Oral Exams.
- ☐ Others (identify):

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	
a.	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
b.	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
c.	An ability to communicate effectively with a range of audiences.
d.	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
e.	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
f.	An ability to develop and conduct appropriate experimentation, analyse, and interpret data, and use engineering judgment to draw conclusions.
g.	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Responsible Persons and their Signatures:

Course Coordinator	**Eng. Faten alsarayrah**	**Completed Date**	
		Signature	

Received by (Department Head)		**Received Date**	/ /
		Signature	