Course Description Template

Course Description

This course description provides a brief summary of the most important course features and learning outcomes expected of the student to achieve, demonstrating whether they have made the most of the available learning opportunities. These should be linked to the program description.

1. Educational Institution	Warith Al-Anbiya University
2. Scientific Department / Center	Department of Biomedical Engineering
3. Course Name/Code	Numerical Analysis / WBM -32-02
4. Available Forms of Attendance	Weekly
5. Semester/Year	Chapter Two/2023
6. Number of Hours (Total)	120 Hours
7. Date of this description	12/3/2023

8. Course Objectives

- To provide the numerical methods of solving the non-linear equations, interpolation, differentiation, and integration.
- To improve the student's skills in numerical methods by using numerical analysis software and computer facilities.

9. Course Outputs and Methods of Teaching, Learning and Assessment

A. Cognitive Objectives

A1- The student will be able to use numerical methods in solving equations and employ them appropriately.

A2- Gain experience and knowledge in the types of differential equations and methods of solving them numerically.

A3. Gain experience and knowledge in solving types of integrals numerically.

A4- Making the student able to show the real knowledge of mathematical concepts during the study ladder and their applications in the engineering field.

A5- Develop an understanding of the basic ideas and concepts of numerical methods.

B. Skills objectives of the course

B1 - How to write programs using MATLAB to solve mathematical problems and find numerical solutions.

B2 - Solving mathematical models that represent numerically different physical and engineering models and finding the best one that suits the experimental data .

B3 – Skills of calculating the types of integrals by various numerical methods.

B4 – Skills of calculating differential equations using a set of numerical methods.

B5- Exercises solving skills from the textbook and from the auxiliary resources that have application in the practical aspect.

Teaching and learning methods

- ✓ The lecturer is to give theoretical lectures.
- ✓ Explanation and clarification using modern electronic means.
- ✓ The method of the lecture is based on brainstorming and feedback.
- ✓ The method of self-learning through extra-curricular assignments that require exerting skills and self-explanations in experiential methods.
- ✓ The teacher requests periodic reports for the basic topics of the subject.
- ✓ The instructor conducts practical experiments related to the theoretical aspect.

Evaluation methods

- ✓ Daily exams with practical and scientific questions.
- ✓ Participation scores for competition questions among students.

✓ Scoring homework and reports assigned to them. ✓ Scoring for practical experience reports. ✓ Semester exams for the curriculum in addition to the mid-year exam and the final exam.

C. Emotional and Value Goals
    A1- Observation and perception.
    A2- Analysis and Interpretation
    A3. Conclusion and evaluation
    C4- Preparation and Evaluation

d. General and qualifying skills transferred (other skills related to employability and personal development).
  D1- Skills necessary to work within the local labor market to maintain all medical devices related to fluid issues.
  D2- Enabling the student to use the special and general equations of the study subjects and how to benefit from them in analyzing the problems and extracting the results accurately.
  D3- Holding special workshops for students for the purpose of self-development for them.
  D4- Developing the student's ability to analyze information and interpret the data obtained through conducting practical experiments, using manual skills, or using computers such as simulation of systems.

10. Course Structure					
Evaluation Method	Method of education	Unit Name/Topic	Required Learning Outcomes	Hours	The week
Daily exams + homework	Lectures presented in pdf format	Linear Interpolation: Newton-Gregory	Learning the calculation using technique of estimating the value of a function for any intermediate value of the independent variable.	2	The first
Daily exams + homework	Lectures presented in pdf format	Linear Interpolation: Lagrange interpolating polynomial	Learning the calculation of the Lagrange interpolating polynomial of lowest degree that interpolates a given set of data.	2	Second
Daily exams + homework	Lectures presented in pdf format	Interpolation: General Equation	Learning the calculation using technique of General Equation	2	Third
Daily exams + homework	Lectures presented in pdf format	Numerical integration: Equal segments Trapezoidal method	To calculate the area under the curve of a function plotted on a graph. The trapezoidal rule that computes a function f(x) with a set of linear functions.	2	Fourth
Daily exams + homework	Lectures presented in pdf format	Numerical integration: Unequal segments	To calculate the area under the curve of a function plotted	2	V

		Trapezoidal method	on a graph. The trapezoidal rule that computes a function f(x) with a set of linear functions.		
Daily exams + homework	Lectures presented in pdf format	Numerical integration: Simpson's rules	Learning the calculation using technique of Simpson's rules which solves several approximations for definite integrals	2	Sixth
Daily exams + homework	Lectures presented in pdf format	Numerical Integration: Gaussian Quadrature Method	Learning the calculation of the definite integral of a function, usually stated as a weighted sum of function values at specified points within the domain of integration.	2	Seventh
Daily exams + homework	Lectures presented in pdf format	Solution of non-linear equations: Bisection method	Learning the numerical calculation of the bisection method which is one of the first numerical methods developed to find the root of a nonlinear equation.	2	Eighth
Daily exams +	Lectures presented	Solution of non-linear equations:	Learning the numerical calculation of	2	Ninth

homework	in pdf format	Newton Raphson method	the Newton-Raphson method which is the method of choice for solving nonlinear systems of equations.		
Daily exams + homework	Lectures presented in pdf format	Solution of non-linear equations: Secant method	Learning the numerical calculation of the Secant method which is a very effective numerical procedure used for solving nonlinear equations of the form f(x) = 0	2	X
Daily exams + homework	Lectures presented in pdf format	Numerical solution of ODE: Taylor series	Learning the numerical calculation of the Taylor series that provides a means to predict a function value at one point in terms of the function value and its derivatives at another point.	2	Eleventh
Daily exams + homework	Lectures presented in pdf format	Euler method and modified Euler method	Learning the numerical calculation of the Euler's method which is the first order numerical methods for solving ordinary differential	2	Twelfth

			equations with given initial value.		
Daily exams + homework	Lectures presented in pdf format	Runge - Kutta method	To calculate using the technique of Runge - Kutta method for solving the initial-value problems of differential equations.	2	Thirteen th
Daily exams + homework	Lectures presented in pdf format	Finite differences method	Learning the numerical calculation of the finite differences method for solving partial differential equations.	2	Fourtee nth
Daily exams + homework	Lectures presented in pdf format	Matrix method	Learning the numerical calculation of Matrix method to find the solution to the system of equations such as Gaussian elimination method.	2	Fifteent h

11. Infrastructure	
1. Numerical Methods of Engineers, Chapra &Canale, 6th Edition.	1- Required Textbooks
2. Applied Numerical Analysis, Gerald & Wheatley, 7th Edition.	2- Key Reference(s)

All solid scientific journals that have to do with the broad concept of mathematical theories and their results.	A) Recommended Books and References (Scientific Journals, Reports, …..)
1. books-world.net 2. www.pdfdrive.com	B) Electronic References, Websites, …..

12. Course Development Plan
1-   Keeping pace with the scientific development in the field of specialization and providing students with all the Publication of the Scientific Subject.   2-   Updating and revising lectures annually.   3-   use Modern Means of Education.