	Ministry of Higher Education and Scientific Research - Iraq University of Warith Al_Anbiyaa.... College of Engineering Oil and Gas Department	

MODULE DESCRIPTOR FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Numerical analysis		**Module Delivery**
Module Type	**Basic learning activities**		☒ **Theory**
Module Code	ENG316		☐ **Lecture**
ECTS Credits	**5**		☐ **Lab**
SWL (hr/sem)	**125**		☐ **Tutorial** ☐ **Practical** ☒ **Seminar**

Module Level	UGIIII	**Semester of Delivery**	5
Administering Department	OGE	**College**	ENG
Module Leader	Malik Mustafa	**e-mail**	malik.mustafa@uowa.edu.iq
Module Leader's Acad. Title	Asst.Prof.	**Module Leader's Qualification**	PhD
Module Tutor		**e-mail**	E-mail
Peer Reviewer Name	Name	**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	ENG212	**Semester**	3
Co-requisites module	1- It provides abroad foundation in the basic of science and engineering.	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1- Use of numerical methods in a variety of engineering problems. 2- Basic methods of numerical analysis and the numerical approximation 3- Use mathematical techniques which are required to approximate the solution of single nonlinear equations and integrals. 4- Numerical solution of differential equations. 5- Introduction to the principle of numerical simulation methods
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Understand key mathematical techniques in numerical analysis 2- Identify and apply appropriate mathematical techniques to approximate functions 3- Perform error analysis to select an appropriate numerical model and to estimate errors in numerical solution of a given problem. 4- Derive a variety of numerical algorithms/methods 5- Compare the viability of different approaches to the numerical solutions of various mathematical problems arising in roots of linear and non-linear equations, interpolation and approximation, numerical differentiation and integration, and differential equations. 6- Analyze and evaluate the accuracy of common numerical methods.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Use of numerical methods in a variety of petroleum engineering problems, The Purpose of Numerical methods in Petroleum Engineering, Noncomputer Methods Numerical Methods and Engineering Practice, A simple mathematical model, Ordinary Differential Equations: Order, linearity, and conditions, Classify the solution methods, Numerical Methods for Solving ODE: Taylor Series Method, Euler Method, Types of Errors, Heun's Method, Midpoint Method, Solution of a system of first order

	ODEs, Conversion of a high order ODE to a system of first order ODEs, Conversion of a system of high order ODEs to a system of first order ODEs, Use different methods to solve systems of first order ODEs, Runge-Kutta Methods To understand the motivation for using Runge Kutta method and the basic idea used in deriving them. Use Runge Kutta of order to solve ODEs, Boundary Value Problem, Vectors, Matrices, Systems of Linear Equations, Cramer's Rule, Naive Gaussian Elimination Problems with Naive Gaussian Elimination, Gauss Jordan Method, Gauss-Jordan Method, Boundary Value Problem, Shooting Method, Finite Difference Methods Introduction to Least Squares, Linear Regression, Nonlinear Least Squares Nonlinear Least Squares Problems, Interpolation Problem, Lagrange Interpolation, Linear and Quadratic Interpolation, Newton's Divided Difference Method First order derivatives, High order derivatives Introduction to Numerical Integration, Trapezoid Method, Romberg Method, Gauss Quadrature

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem)	47	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4

الحمل الدراسي غير المنتظم للطالب خلال الفصل			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Numerical Analysis
Week 2	Analytical and Numerical methods
Week 3	Ordinary Differential Equations
Week 4	Numerical solution of differential equations
Week 5	Conversion of a high order ODE to a system of first order ODEs.
Week 6	Conversion of a system of high order ODEs to a system of first order ODEs.
Week 7	Runge-Kutta Methods
Week 8	Solution of Systems of Linear Equation and Numerical Methods

	Methods
Week 9	**Numerical Methods for Matrix and Solution Boundary Value Problems**
Week 10	**Least Squares Curve Fitting**
Week 11	**Interpolation**
Week 12	**Inverse Interpolation**
Week 13	**Numerical Differentiation**
Week 14	**Extrapolation**
Week 15	**Numerical Integration**
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	1. Numerical Methods for Engineers", Steven C. Chapra and Raymond P. Canale. 2. W. Cheney and Kincaid, Numerical Mathematics and Computing, 2002	Yes
Recommended Texts		No
Websites		

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.