Course Specification

(Bachelor)

Course Title: Ordinary differential equations	
Course Code: MTH1201	
Program: BSc. in Mathematics	
Department: Mathematics	
College: Al-Qunfudah University College	
Institution: Umm Al-Qura University	
Version: 2	
Last Revision Date: 17/07/2024	

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (4)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	

3. Level/year at which this course is offered: (1/1)

4. Course general Description:

Differential equations are an important branch of mathematics. They have a rich mathematical Formalization, as well as a very successful history of being applied to important problems in physics, chemistry, engineering, and biology. This course will introduce primarily linear, first and second order differential equations. Solution techniques for such equations will be presented. The application of Laplace transforms to differential equations will be introduced.

5. Pre-requirements for this course (if any):

6. Pre-requirements for this course (if any):

7. Course Main Objective(s):

The course objective is to achieve an elementary knowledge of ordinary differential equations and to become more familiar with rigorous proofs in analysis. The objectives are summarized mainly in the competence in solving linear differential equations, employing different techniques namely integrating factors, substitution, and variation of parameters and reduction of order.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4	100 %
2	E-learning	0	0
3	Hybrid • Traditional classroom • E-learning	0	0

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning	0	0

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	36
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (**_Exam, Quizzes, Activities…_**)**	4
Total		**40**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Identify linear and nonlinear equations**	*K1, K5*	**Lecture and Tutorials**	**Exams, quizzes**
1.2	**Examine higher order differential equations**	*K3, K5*	**Lecture and Tutorials**	**Exams, quizzes**
1.3	**Present an account of basic concepts and definitions for differential equations**	*K1, K3, K5*	**Lecture and Tutorials**	**Exams, quizzes**
1.4	**Describe exact equations and its solutions**	*K1, K3*	**Lecture and Tutorials**	**Exams, quizzes**
2.0	**Skills**			
2.1	**Compare the methods of solution developed in higher order and solution in second/first order equations**	*S1, S5*	**Lecture and Tutorials**	**Exams, quizzes**
2.2	**Use methods for obtaining exact solutions of linear homogeneous and nonhomogeneous differential equations**	*S3, S5, S9*	**Lecture and Tutorials**	**Exams, quizzes**
2.3	**Apply elementary Laplace transform techniques**	*S3, S5*	**Lecture and Tutorials**	**Exams, quizzes**
3.0	**Values, autonomy, and responsibility**			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.1	Prepare for success in disciplines which rely on differential equations, and in more advanced mathematics which incorporate these topics, such as Partial Differential Equations	V2	Lecture/ Individual or group work	Exams, quizzes
3.2	Interpret graphical and qualitative representations of solutions to problems	V4	Lecture/ Individual or group work	Exams, quizzes
3.3	Evaluate fundamental concepts of differential equations, and the interrelationship between differential equations and linear algebra	V2, V4	Lecture/ Individual or group work	Exams, quizzes
3.4	Generalize mathematical concepts in problem-solving through integration of new material and modeling	V4	Lecture/ Individual or group work	Exams, quizzes

C. Course Content

No	List of Topics	Contact Hours
1.	*Definition of a differential equation: degree and order. Elimination of arbitrary constants*	2
2.	*First Order Differential Equations: Existence theorem, separation of variables, homogeneous equations, exact equations, linear equations, method of integrating factors, non-exact equations and Bernoulli equation.*	12
3.	*Homogeneous higher order linear Equations with constant coefficients*	8
4.	*Non-homogeneous linear Equations: undetermined coefficients, variation of parameters, Inverse differential operator*	10
5.	*The Laplace Transform*	8
Total		40

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exam	6th	30 %
2.	Quizzes and homework's	During semester	20 %
3.	Final exam	End of semester	50 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• *Elementary Differential Equations, 8th edition, 1997, Earl D.Rainville, Phillip E. Bedient* • *William E. Boyce and Richard C. DiPrima: Elementary Differential Equations and Boundary Value Problems, 10th edition.*
Supportive References	*Polking, Boggess and Arnold, Differential Equations with BoundaryValue Problems, second edition, Pearson Prentice-Hall*
Electronic Materials	*None*
Other Learning Materials	*None*

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classrooms**
Technology equipment (projector, smart board, software)	**Data Show, Smart Board**
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Courses Assessment survey**
Effectiveness of Students assessment		**Courses Assessment survey**
Quality of learning resources	**Students**	**Courses Assessment survey**
The extent to which CLOs have been achieved	**Faculty Member**	**Post-Rubric and Course report**
Periodically reviewing course effectiveness and planning for improvement	**Course committee**	**Annual report**

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Curriculum Committees
REFERENCE NO.	**1**
DATE	17/07/2024