Course Specifications

Course Title:	**Ordinary Differential Equations**
Course Code:	**30112502-4**
Program:	**BSc. Mathematics 301100**
Department:	**Mathematics**
College:	**Al Leith University College**
Institution:	**Umm Al-Qura University**

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A. Course Identification

1. Credit hours:	4 hours
2. Course type	
a.	University ☐ College ☐ Department ☒ Others ☐
b.	Required ☒ Elective ☐
3. Level/year at which this course is offered:	Fourth Level / Second Year
4. Pre-requisites for this course (if any)**:**	Calculus (2) 30112501-4
5. Co-requisites for this course (if any)**:**	Does not exist

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	4 Hours / Week	100%
2	**Blended**	0	0%
3	**E-learning**	0	0%
4	**Correspondence**	0	0%
5	**Other**	0	0%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	(4 hours) x (15 weeks)
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify)	10 hours (quiz, exam)
	Total	70 hours
Other Learning Hours*		
1	**Study**	(3 hours) x (15 weeks)
2	**Assignments**	(3 hours) x (15 weeks)
3	**Library**	(3 hours) x (15 weeks)
4	**Projects/Research Essays/Theses**	(1 hour) x (15 weeks)
5	**Others** (specify)	5 hours workgroup
	Total	155 hours

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course 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 separable equations, homogeneous and inhomogeneous equations, as well as an intuition for modeling-based applications will be presented. The application of Laplace transforms to differential equations, Systems of linear differential equations, linearization of nonlinear systems, and phase plane methods will be introduced.

2. Course Main Objective

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. In addition the competence in finding the Laplace Transform of specified functions and solving linear ordinary differential equations using the Laplace Transform.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Identify linear and nonlinear equations	K1
1.2	Examine higher order differential equations	K4
1.3	Present an account of basic concepts and definitions for differential equations	K3
1.4	Name qualitative representations of solutions to problems	K5
1.5	Describe exact equations and its solutions	K4
2	**Skills :**	
2.1	Compare the methods of solution developed in higher order and solution in second/first order equations	S1
2.2	Use methods for obtaining exact solutions of linear homogeneous and nonhomogeneous differential equations	S4
2.3	Apply elementary Laplace transform techniques	S5
3	**Competence:**	
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	C2
3.2	Interpret graphical and qualitative representations of solutions to problems	C3
3.3	Evaluate fundamental concepts of differential equations, and the interrelationship between differential equations and linear algebra	C5
3.4	Generalize mathematical concepts in problem-solving through integration of new material and modeling	C4

C. Course Content

No	List of Topics	Contact Hours
1	First Order Differential Equations: linear equations, method of integrating factors, difference between linear and nonlinear equations	8
2	Exact equations and integrator factors	4
3	Second Order linear Equations, homogeneous equations	8
4	Second Order linear Equations, nonhomogeneous equations	12
5	Higher order linear Equations, homogeneous equations	8
6	Higher order linear Equations, the method of variation of parameters	8
7	The Laplace Transform, solution of initial value problems, Step functions, Differential equations with discontinuous forcing functions, impulse functions	12
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Identify linear and nonlinear equations	Lecture Tutorials	Exams (Quizzes, Midterm and Final). Written and possibly oral exam at the end of the course. In addition, compulsory work may be given during the course
1.2	Examine higher order differential equations	Lecture Tutorials	
1.3	Present an account of basic concepts and definitions for differential equations	Lecture Tutorials	
1.4	Name qualitative representations of solutions to problems	Lecture Tutorials	
1.5	Describe exact equations and its solutions	Lecture Tutorials	
2.0	**Skills**		
2.1	Compare the methods of solution developed in higher order and solution in second/first order equations	Lecture Individual or group work	Exams (Quizzes, Midterm and Final). Homework
2.2	Use methods for obtaining exact solutions of linear homogeneous and nonhomogeneous differential equations	Lecture Individual or group work	
2.3	Apply elementary Laplace transform techniques	Lecture Individual or group work	
3.0	**Competence**		
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	Lecture Individual or group work	Exams (Quizzes, Midterm and Final). Research Essays

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.2	Interpret graphical and qualitative representations of solutions to problems	Lecture Individual or group work	
3.3	Evaluate fundamental concepts of differential equations, and the interrelationship between differential equations and linear algebra	Lecture Individual or group work	
3.4	Generalize mathematical concepts in problem-solving through integration of new material and modeling	Lecture Individual or group work	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Pentage of Total Assessment Score
1	Midterm 1	6th week	20%
2	Midterm 2	12th week	20%
3	Homework + reports + Quizzes	During semester	10%
4	Final exam	End of semester	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

All faculty members are required to be in their offices outside teaching hours. Each member allocates at least 4 hours per week to give academic advice to students and to better explain the concepts seen during the lectures.

Students are required to complete the homework problems. Students are welcome to work together on homework. However, each student must turn in his or her own assignments, and no copying from another student's work is permitted. Deadline extensions for homework will not be given. Students are encouraged to discuss with professor about homework problems.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	William E. Boyce and Richard C. DiPrima: Elementary Differential Equations and Boundary Value Problems, 10th edition
Essential References Materials	Polking, Boggess and Arnold, *Differential Equations with Boundary Value Problems*, second edition, Pearson Prentice-Hall
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Large classrooms that can accommodate more than 30 students
Technology Resources (AV, data show, Smart Board, software, etc.)	Data Show, Smart Board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Direct
Quality of learning resources	Students	Direct
Extent of achievement of course learning outcomes	Faculty Member	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Council of the Mathematics Department**	**The mathematical sciences (college of applied sciences) and the mathematics (Al Leith university college) department's first meeting of the coordinative committee**
Reference No.	**4101050782**	**First meeting**
Date	**Sunday, 17 November 2019**	**Thursday, 17 October 2019**

Department Head

Dr. Ali Hassani