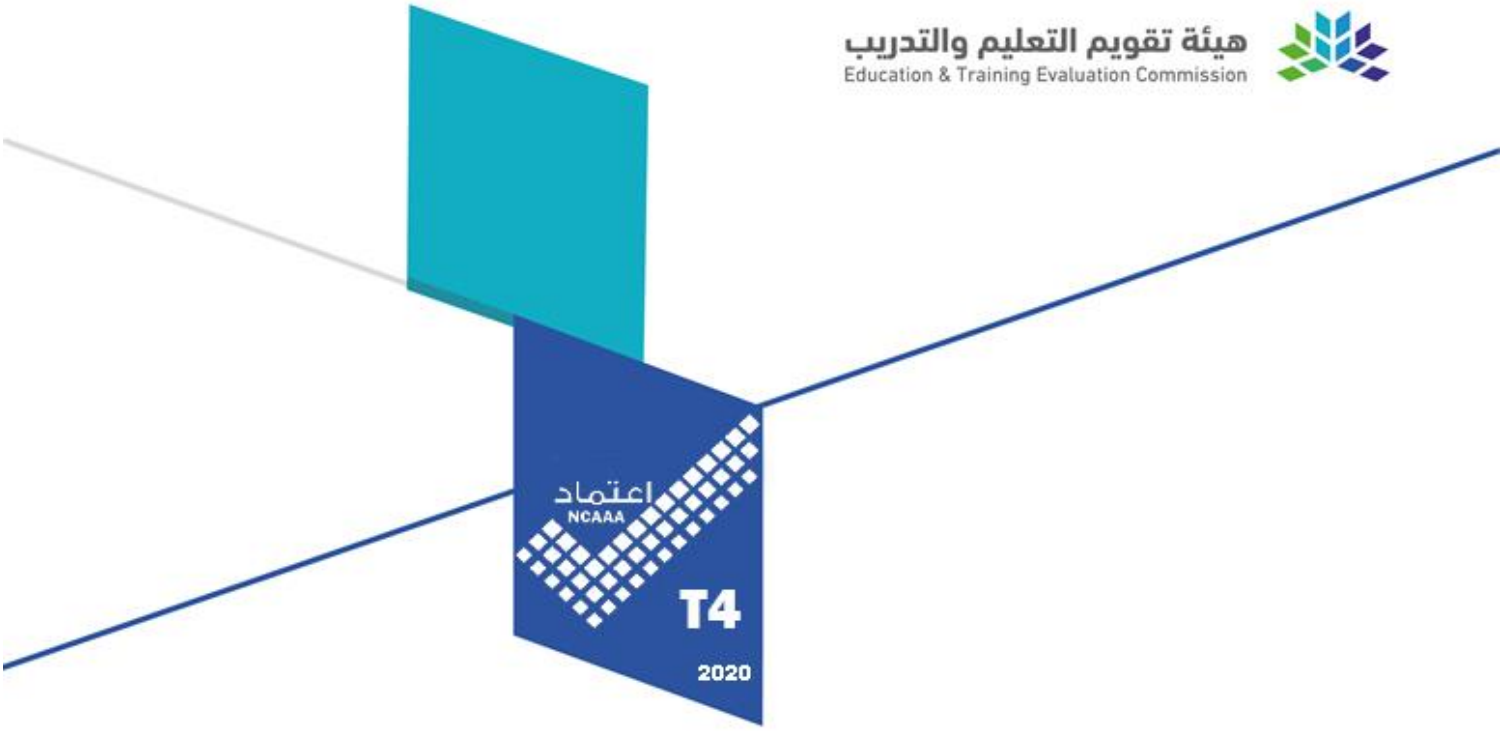
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	**Differential Equations For Physics**
Course Code:	**2032203-3**
Program:	**Bachelor in Physics**
Department:	**Department of Physics**
College:	**College of Science**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 6th Level/ 2nd Year
4. Pre-requisites for this course (if any)**:** Differentiation and Integration(2022111-4)
5. Co-requisites for this course (if any)**:None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	50
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	50

B. Course Objectives and Learning Outcomes

1. Course Description

Basic concepts of differential equations (order, degree, linearity, homogenous, non-homogeneous and linearity – initial-value and boundary-value problems)–First-order degree differential equations (standard and differential form – separable, exact, linear, homogenous equations and non-homogeneous equations can be converted into homogeneous) –nonlinear equations that can be converted into linear differential equations (Bernoulli and Riccati equations…) -First-order and higher-degree differential equations(Clairautand Lagrange equations….) -Application offirst-orderdifferential equations in physics - Higher order homogeneous, non-homogeneous and linear differential equationswith constant coefficients, cases of different roots of the characteristic equation,) - Methods of finding the homogeneous and particular solutions - Some physics applications.

2. Course Main Objective

Recognize the types of differential equations and apply knowledge of mathematics to the solution of problems. Designing and implementing solutions to practical problems in physics and transform practical problems in physics into differential equations.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	• State the basic concepts and classify the various differential equations	K1
1.2	• Recognize the theory of solution of various differential equations describing natural phenomena	K3
2	**Skills :**	
2.1	• Solve 1st and 2nd order linear ordinary differential equations using appropriate theoretical methods	S2
2.2	• Formulate a physical phenomenon into a differential equation by using physics laws and evaluate its adequate solution related to the boundary (subsidiary) conditions of the problem	S3
3	**Values:**	
3.1	• Show responsibility for working independently and for continuous improvement of personal capacities.	V1

C. Course Content

No	List of Topics	Contact Hours
1	**Basic concepts of differential equations:** ▪ Ordinary and partial differential equations ▪ Order and degree of a differential equation ▪ Linear, nonlinear, homogeneous and non-homogeneous differential equations ▪ General and particular solution of differential equations ▪ Initial –Value and Boundary –Value problems ▪ Some examples	5
2	**First-Order and First-degree differential equation:** ▪ Standard form and differential form ▪ Separable equation ▪ Homogeneous equation and reduction to homogeneous equation ▪ Exact equation and reduction to exact equation by multiplying by integrating factor ▪ Linear equation ▪ Nonlinear equations that can be converted into linear differential equations (Bernoulli equation, Riccati equations…) ▪ Higher-degree differential equation can be converted to First-degree differential equation. The equation can be solved relative to x or relative to y ▪ Clairaut equation ▪ Lagrange equation	15
3	**Applications of First-order differential equation:** ▪ Growth and Decay problems ▪ Temperature problems ▪ Falling Body problems ▪ Dilution problems ▪ Electrical Circuits ▪ Orthogonal Trajectories	7

4	**Higher-order linear differential equation with constant coefficients:** ▪ Linearly independent and linear dependant functions ▪ The Wronskian ▪ The differential operator and the Characteristic equation ▪ Solution of homogeneous equation according the nature of roots of its characteristic equation ▪ Particular solution of a non-homogeneous equationby using the inverse differential operatorfor different cases of the second term of equality ▪ Particular solution of a non-homogeneous equation by using the method of variation of parameters ▪ Particular solution of a non-homogeneous equation by using the method of undetermined coefficients ▪ Homogenous differential equation with variable coefficients: Cauchy-Euler equation, Legendrelinear equation ▪ Method of factorisation ▪ Reduction of order and its cases	18
5	**Application of Second-order differential equation with constant coefficients:** ▪ Spring problems ▪ Electrical Circuits problems ▪ Buoyancy problems	5
Total		50

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 and Understanding**		
1.1	• State the basic concepts and classify the various differential equations	Lecture	Written exam and Homework reports
1.2	• Recognize the theory of solution of various differential equations describing natural phenomena	Lecture Discussion	Written exam
2.0	**Skills**		
2.1	• Solve 1st and 2nd order linear ordinary differential equations using appropriate theoretical methods	Lectures	Written exam and Homework reports
2.2	• Formulate a physical phenomenon into a differential equation by using physics laws and evaluate its adequate solution related to the boundary (subsidiary) conditions of the problem	Lecture and Groups discussion	Written exam
3.0	**Values**		
3.1	• Show responsibility for working independently and for continuous improvement of personal capacities.	Groups discussion	Homework

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Activities	Periodically	10%
2	Midterm exam	6th	30%
3	Short exam	9th	10%
4	Final exam	12th	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 :

- 6 Hours per week during office hours, in the instructor's office, or by appointment.
- Teaching staff are available for individual student consultations during office hours.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	- Introduction to Ordinary Differential Equations and Some Application by Edward Burkard - Elementary Differential Equations by William F. Trench
Essential References Materials	- Differential Equations with Boundary-Value Problems a Zill Cullen (1) - Differential Equations by Richard Bronson and Gabriel B. Costa, third edition
Electronic Materials	http://faculty.uml.edu/dimitris_christodoulou/Teaching/documents/DEs__R_Bronson.pdf
Other Learning Materials	- Mathematica, Mathlab

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture room with max 60 seats Labs
Technology Resources (AV, data show, Smart Board, software, etc.)	data show, Smart Board, software
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
Student Feedback on Effectiveness of Teaching	Students	Indirect

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Evaluation of Teaching	Department	Indirect
Improvement of Teaching	Program leaders	Direct
Quality of learning resources	Faculty	Direct
Extent of achievement of course learning outcomes,	Program leaders	Direct

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

H. Specification Approval Data

Council / Committee	Department Council
Reference No.	
Date	October 2, 2022