هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Classical Mechanics (1)**
Course Code:	**2032202-3**
Program:	**Bachelor in Physics**
Department:	**Physics Department**
College:	**College of Science**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours: 4
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)**: : Calculus (1) / 2021204-4**
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 : This course covers important parts in classical mechanics. Students will study Vectors analysis and coordinate systems. Motion of a particle in three dimensions will be studied. Conservative forces and force fields will be covered. Constrained motion of a particle, central forces and planetary motion are also included. Finally, non inertial reference frames will be studied.

2. Course Main Objective

- To introduce students to vectors analysis and coordinate systems.
- To introduce students to equation of the motion in one dimensional and their applications.
- To introduce students to general motion of a particle in tow and three dimensions and their applications.
- To teach the students non-inertial reference systems.
- To teach the students the central forces and celestial mechanics.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Identify the basic concepts of a differential vector operations.	K1
1.2	Define Newton's laws and energetic theorems of classical mechanics	K2
2	**Skills :**	
2.1	Solve quantitative problems relating to the motion of a particle by using Newton's and energetic laws.	S2
2.2	Analyze the dynamics of particles in rotating non-inertial reference frames using appropriate fictitious forces.	S2
3	**Values:**	
3.1	Show responsibility for working independently and interacting with colleagues and staff to extract important information and identifying key issues to make progress.	V1

C. Course Content

No	List of Topics	Contact Hours
1	**Unit1**: Vector Analysis: • Definition • Scalar Product • Vector product • Triple Scalar Product, Triple Vector Product • Gradient, Divergence and Curl • Successive Application of operator e.g. 1-Vector Integration 2- Gauss's Theorem 3- Stocks' Theorem	**6**
2	**Unit2:** Coordinate Systems: • Curvilinear Coordinates • Differential Vector Operations • Cartesian Coordinates • Spherical Polar Coordinates • Circular Cylindrical Coordinates.	**7**
3	**Unit3:** Equation of the motion in one dimensional: • forces as a function in : time, distance, velocity • variable mass • escape velocity (gravitational).	**5**
4	**Unit4:** General Motion of A Particle in Tow and Three Dimensions: • Linear Momentum • Angular Momentum • The Work Principle •Conservative Forces and Force Fields • The Potential Energy Function in 3-D Motion • Condition For The Existence of a Potential Function • Motion of a projectile in a Uniform Gravitational Field • The Harmonic Oscillator in Two And Three dimensions. •Example: 1- Constrained Motion of a Particle, 2-The Simple Pendulum.	**10**
5	**Unit5:** Non-inertial Reference Systems: • Translation of the coordinate system • Inertial Forces • General Motion of The Coordinate System • Dynamics of a Particle in a Rotating Coordinate System(Coriolis Force) • Examples: 1-Effects of The Earth's 2-The Foucault Pendulum .	**10**
6	**Unit6:** Central Forces and Celestial Mechanics: • The Law of Gravity • Gravitational Force Between a sphere and a Particle • Potential Energy in a Gravitational Energy • Potential Energy in a General Central Field • Angular Momentum in a Central Field • The Law of Areas, Kepler's Laws of Planetary Motion • Orbit of a Particle in a	**12**

	Central Field • Energy Equation of the Orbit • Orbits in an Inverse-Square Field • Periodic Time of Orbital Motion • Motion in an Inverse-Square Repulsive Field •	
Total		**45**

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	Identify the basic concepts of a differential vector operation	Lecture Discussion	Written exam
1.2	Define Newton's laws and energetic theorems of classical mechanics.	Lecture Discussion	Written exam
2.0	**Skills**		
2.1	Solve quantitative problems relating to the motion of a particle by using Newton's and energetic laws.	Problem solving	Written exam Activities
2.2	Analyze the dynamics of particles in rotating non-inertial reference frames using appropriate fictitious forces.	Problem solving	Written exam Activities
3.0	**Values**		
3.1	Show responsibility for working independently and interacting with colleagues and staff to extract important information and identifying key issues to make progress.	Groups discussion	Project

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Activities	Periodically	10%
2	Midterm exam	6^{th}	30%
3	Short exam	9^{th}	10%
4	Final exam	12^{th}	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 : • Each faculty member is assigned a group of students for continuous academic advice during six office hours weekly (6 hrs./week). • Also teaching staff are available for individual student consultations during office hours.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Analytical Mechanics by: G. R. Fowles and G. Cassiday, 7thed., Brooks Cole Publishing (2004). • H. Goldstein, Classical Mechanics, Adison Weley Pub. Company (1981)
Essential References Materials	Introduction to Classical Mechanics: With Problems and Solutions by David Morin. Cambridge University Press; 1st edition (2008).
Electronic Materials	http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
Other Learning Materials	MATHEMATICA, MATHLAB

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Classrooms.
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 of Teaching	Pear reviewer Program coordinator Departmental council Faculty council	Indirect
Improvement of Teaching	Program coordinator Relevant committee	Direct
Quality of learning resources	Students Instructor Faculty	Indirect
Extent of achievement of course learning outcomes,	Program coordinator Instructor	Direct
Course effectiveness and planning for improvement	Program coordinator Instructor	Indirect

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