هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Classical Mechanics 3**
Course Code:	**PHY2503**
Program:	**Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura 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: Level 6th / 2nd year
4. Pre-requisites for this course (if any): Classical Mechanics 2
5. Co-requisites for this course (if any):

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	40	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	40
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	
	Total	40

B. Course Objectives and Learning Outcomes

1. Course Description

This course covers the study of the mechanics of rigid bodies in plane motion, in three dimensions, and their applications. Moreover, the course covers the Lagrangian mechanics as well as a discussion of Hamilton's equations and their applications in solving some mechanical problems.

2. Course Main Objective

The student will be able to

- Calculate the center of mass of a rigid body.
- Calculate the moment of inertia of a rigid body that rotated about a fixed axis.
- Describe the theorems of static equilibrium of rigid body.
- Describe Euler's equation of motion of a rigid body.
- Solve mechanical problems using Lagrangian and Hamiltonian formalisms.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Define the physical quantities related to the rotation of a rigid body about a fixed axis.	K1
1.2	Describe the motion of a rigid body using mathematics.	K1
2	**Skills :**	
2.1	Solve problems related to the rotation of a rigid body about a fixed axis using mathematical methods.	S1
2.2	Explain the formulas related to Lagrange's equations.	S2
3	**Values:**	
3.1	Work effectively and responsibly in teamwork.	V2

C. Course Content

No	List of Topics	Contact Hours
1	**Mechanics of Rigid Bodies, Planar Motion** • Center of mass of a rigid body. • Some theorems of static equilibrium of rigid body. • Rotation of a rigid body about a fixed axis (moment of inertia). • Calculation of the moment of inertia • The physical pendulum. • General theorem concerning angular momentum. • Laminar motion of rigid body. • Body rolling down in inclined plane.	14
2	**Motion of Rigid Bodies in Three Dimensions** • Angular momentum of a rigid body, Products of inertia. • Use of matrices in rigid body dynamics (the inertia tensor). • Determination of principle axes. • Rotational kinetic energy of a rigid body. • Moment of inertia of a rigid body about an arbitrary axis, the momental ellipsoid. • Euler's equation of motion of a rigid body. • Free rotation of a rigid body under no forces. Geometric description of the motion. • Free rotation of a rigid body with an axis of symmetry. Analytical treatment.	14
3	**Lagrangian Mechanics** • Generalized coordinates. • Generalized forces. • Lagrange's equations. • Some Applications of Lagrange's equations. • Generalized moments ignorable coordinate. • Lagrange's equations for impulsive forces. • Hamilton's variational principle. • The Hamiltonian function (Hamiltonian equation). • Lagrange's equations of motion with constraints.	12
	Total	40

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	Define the physical quantities related to the rotation of a rigid body about a fixed axis.	1. Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams. 3. Lecturing method: Board, Power point. 4. Discussions 5. Brain storming Start each chapter by general idea and the benefit of it.	- Solve some examples - Discussions during the lectures Exams: a) Quizzes. b) Midterm exams. c) Final exam.
1.2	Describe the motion of a rigid body using mathematics.		
2.0	**Skills**		
2.1	Solve problems related to the rotation of a rigid body about a fixed axis using mathematical methods.	1. Preparing main outlines for teaching. 2. Following some proofs. 3. Define duties for each chapter	1. Exams: a) Quizzes. b) Midterm exams. c) Final exam 2. Homework's.
2.2	Explain the formulas related to Lagrange's equations.		
3.0	**Values**		
3.1	Work effectively and responsibly in teamwork.	● Organize the students in a small groups (teamwork). ● Give students tasks of duties as a small project.	● Evaluate the scientific reports. ● Discussing the reports with each teamwork. ● Evaluate the efforts of each student in preparing the report.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Exam	8th	30%
2	Homework's & Quizzes & Reports	All weeks	20 %
3	Final Exam	End of the 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: Each student will be supervised by academic adviser in physics department and timetable for academic advice were given to the student each semester. (4hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Analytical Mechanics by G. R. Fowles and G. L. Cassiday (2005), 7th edition.
Essential References Materials	
Electronic Materials	
Other Learning Materials	• Classical Mechanics by John R. Taylor (2005). • Classical Dynamics of Particles and Systems by S. Thornton, and J. Marion (2004), 5th edition.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- Classroom
Technology Resources (AV, data show, Smart Board, software, etc.)	- Black Board - Data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching Strategies	Students	Questionnaire
Effectiveness of student assessment	Instructor	Exams
Extent of achievement of course learning outcomes	Instructor	Course report
Quality of learning resources	Instructor	Course report

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	
Reference No.	
Date	