هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Classical Mechanics 2**
Course Code:	**PHY2502**
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 5th /2nd year
4. Pre-requisites for this course (if any)**: Classical Mechanics 1**
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

The course covers the study of noninertial reference systems, as well as the central forces and celestial mechanics. The motion of a system of many particles is also covered in the course.

2. Course Main Objective

The student will be able to

- Calculate the center of mass, angular momentum, and kinetic energy of a system of particles.
- Describe the Kepler's laws of planetary motion using mathematics.
- Describe the motion of two interacting bodies using mathematics.
- Calculate the energy equation of the orbit and the periodic time of orbital motion.
- Derive the formulas related to the motion of particle in rotating coordinate systems.

- Derive the formulas related to the motion of particle in a central field.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Define the physical quantities related to the motion of the particle in a rotating system.	K1
1.2	Describe the Kepler's laws of planetary motion using mathematics.	K1
2	**Skills :**	
2.1	Solve the problems related to the motion of particle in a central field using mathematics.	S1
2.2	Explain the laws and formulas related to the system of particles.	S2
3	**Values:**	
3.1	Work effectively and responsibly in teamwork.	V2

C. Course Content

No	List of Topics	Contact Hours
1	**Noninertial Reference Systems** • Accelerated coordinate systems and inertial forces. • Rotating coordinate systems. • Dynamics of a particle in a rotating coordinate system. • Effects of earth's rotation. • The Foucault pendulum.	12
2	**Gravitation and Central Forces** • Introduction. • Gravitational force between a uniform sphere and a particle. • Kepler's laws of planetary motion. • Kepler's second law: equal areas. • Kepler's first law: The law of ellipses. • Kepler's third law: The harmonic law. • Potential energy in a gravitational field: gravitational potential. • Potential energy in a general central field. • Energy equation of an orbit in a central field. • Orbital energies in an inverse-square field.	16
3	**Dynamics of Systems of Particles** • Introduction. • Center of mass and linear momentum of a system. • Angular momentum and kinetic energy of a system. • Motion of two interacting bodies: the reduced mass. • Collisions. • Oblique collisions and scattering: comparison of laboratory and center of mass coordinates. • Motion of a body with variable mass: rocket motion.	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 motion of the particle in rotating system.	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 Kepler's laws of planetary motion using mathematics.		
2.0	**Skills**		
2.1	Solve the problems related to the motion of particle in a central field using mathematics.	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.
2.2	Explain the laws and formulas related to the system of particles.		
3.0	**Values**		
3.1	Work effectively and responsibly in teamwork.	● Organize the students in small groups (teamwork). ● Give students tasks 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 an academic adviser in physics Department and the time table for academic advice were given to the student each semester. (4 hours 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	