هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	Classical Mechanics 2
Course Code:	PHYS 312
Program:	B.Sc. in Physics
Department:	Department of Physics and astronomy
College:	College of Science
Institution:	King Saud University
Version:	2.0.0
Last Revision Date:	Sep 2023

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	**3(3+0+0)**				
2. Course type					
a.	University ☐	College ☐	Department☒	Track☐	Others☐
b.	Required ☒	Elective☐			
3. Level/year at which this course is offered:	Fifth level / third year.				
4. Course general Description The course aims to introduce students to advanced classical mechanics.					
5. Pre-requirements for this course (if any): 212 Phys					
6. Co- requirements for this course (if any):					
7. Course Main Objective(s) 1. To familiarize the student with the concept of Action and the principle of least action 2. The student should understand the concept of the Lagrangian and the Euler-Lagrange equations of motion. 3. The student should learn the concept of the Hamiltonian and Hamiltonian equations of motion. 4. The student should understand motion in noninertial reference frames and inertial forces. 5. The student should understand the concept of central forces, and that gravity is an example of such a force.					

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	100%
2.	E-learning	0	0
3.	Hybrid • Traditional classroom • E-learning	0	0
4.	Distance learning	0	0

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	0

3.	Field	0
4.	Tutorial	0
5.	Others (specify)	0
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	describe the lagrangian for a system	K1	• Give extensive examples during lecture. • Give problem sheets to be discussed during lecture..	• Hold Class discussion, tutorial sessions. • Give quizzes, mid-term exam and final exam.
1.2	recognize the redused mass in central field problems	K2		
2.0	Skills			
2.1	Evaluate the effect of centripetal force and Coriolis forces on motion in non-inertial reference frames	S1	• Give extensive examples during lecture • Give problem sheets to be discussed during lecture and labs. • assignments. • Discussions in the classes	• Hold Class discussion, tutorial and lab sessions. • Give quizzes, mid-term exam and final exam.
2.2	Analyze the Hamilton's Equations of motion	S2		
2.3	illustration Planetary motion and Kepler's laws.	S3		
3.0	Values, autonomy, and responsibility			
3.1	Work in a team and acknowledge others' work.	V1	• assignments. • Homework • Project	Hold Class discussion

C. Course Content

No	List of Topics	Contact Hours
1.	**Energy and angular momentum:** Energy; conservative forces, Projectiles, Moments; angular momentum, Central forces; conservation of angular momentum, Polar co-ordinates, The calculus of variations, Hamilton's principle; Langrage's equations.	6
2.	**Central Conservative forces**: the isotropic harmonic oscillator, the conservation laws, the inverse square law, Orbits, scattering cross sections, mean free path, Rutherford scattering.	6
3.	**The Two-body problem:** center-of-mass and relative co-ordinates, the center-of-mass frame, Elastic collisions, Cm. and Lab cross-section.	9
4.	**Many-body systems:** Momentum; center-of-mass, Angular momentum; central internal forces, the earth- moon system, Energy; conservative forces, Langrage's equations.	6
5.	**Rigid Bodies**: Basic principle, Rotation about a fixed axis, Perpendicular components of angular momentum, Principle axes of inertia, Effect of a small force on the axis, Instantaneous angular velocity, Stability of rotation about a principle axis, Euler's angles.	9
6.	**Lagrangian Mechanics:** Generalzied co-ordinates, holomomic system, Lagrange's equations, Precession of a symmetric top, Pendulum constrained to rotate about an axis, Charged particle in an electromagnetic fired, The stretched string.	6
7	**Hamiltonian Mechanics:**Hamilton's equations, Conservation of energy. Ignorable co-ordinates, The symmetric top, Stability of a vertical top, Lioville's theorem, Symmetries and conservation laws, Galilean transformations.	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	First Midterm examination	Approx. 6	20%
2.	Second Midterm examination	Approx. 12	20%
3.	Quizzes and homework	Weekly	20%
4.	Final examination	From 16 to 18	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Classical Dynamics of Particles and Systems by S. Thornton and J. Marion, 5th edition, Brooks/Cole, 2004.
Supportive References	Classical Mechanics, John R. Taylor, 3rd edition, University Science books, 2005.
Electronic Materials	None
Other Learning Materials	Internet sites relevant to the course

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	A classroom which accommodates 25 students.
Technology equipment (projector, smart board, software)	Whiteboard and Smart board
Other equipment (depending on the nature of the specialty)	Not applicable

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students\ Peer Reviewer	Indirect \ direct
Effectiveness of students assessment	Students- Faculty	Direct
Quality of learning resources	students	Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
The extent to which CLOs have been achieved	Faculty	Indirect
Other	None	None

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	Physics Department's council
REFERENCE NO.	7th (2nd term /1445)
DATE	16/10/1445 H