KINGDOOM OF SAUDI ARABIA
Ministry of Education
Al Imam Mohammad Ibn Saud Islamic University
College of Science
Department of Physics

المملكة العربية السعودية
وزارة التعلـيـم
جامعة الإمام محمد بن سعود الإسلامية
كلية العلوم
قسم الفيزياء

SYLLABUS

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Language
PHY	**303**	**Classical Mechanics (2)**	**3**	**2**	**0**	**2**	**5**	**PHY 105, MAT 203**	**5**	**English**

A. Course Description

This course deals with fundamental concepts and principles in classical mechanics, applied to particles, systems of particles and rigid bodies. Vector calculus is used extensively to explore topics. The Lagrangian formulation of mechanics is introduced to show its powerful problem solving ability. Modern notation and terminology are used throughout in support of the course objectives: to facilitate students' transition to advanced physics and the mathematical formalism needed for the quantum theory of physics.

B. Course Outcomes

At the end of this course the student will be able to**:**
1. Understand the notions of configuration space and generalized coordinates space in mechanics.
2. Explain various aspects of classical dynamics.
3. Obtain the Euler-Lagrange equations from a variational principle.
4. Understand the relation between Lagrange's equations and Newton's laws.
5. Use Lagrange's equations to solve complex mechanical problems.
6. Obtain the Hamiltonian formulation of a mechanical system.
7. Develop problem solving and critical thinking skills.

C. References

Required Textbook
Thornton S.T. and Marion J.B., **Classical Dynamics of Particles and Systems,** 5th Edition, Thomas Learning Inc. (2004).

Other references
- Fowles G.R. and Cassiday G., **Analytical Mechanics,** 7th Edition**,** Brooks Cole Publishing (2004).
- Goldstein H., Poole C., and Safko J., **Classical Mechanics,** 3rd Edition, Addison-Wesley (2000).

Course Website: http://www.imamm.org/

D. Topics Outline

1. **Coordinate Systems and Transformation:** *Coordinate Systems and Transformation: Cartesian coordinates; circular cylindrical coordinates; spherical coordinates (*Contact hours*: 6).*
2. **Some Methods in the Calculus of Variations:** *Euler's equation, functions with several dependent variables, Euler's equation when auxiliary conditions are imposed (*Contact hours*: 8).*
3. **Lagrangian and Hamiltonian Mechanics:** *Hamiltonian's principle, generalized coordinates, Lagrange's equations of motion in generalized coordinates, Lagrange's equations with undetermined multipliers, equivalence of Lagrange's and Newton's equations, a theorem*

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concerning the kinetic energy, conservation theorems, canonical equations of motion–Hamiltonian mechanics (Contact hours: 16).

4. ***Central Force Motion:*** *Reduced mass, conservation theorems-first integrals of the motion, planetary motion-Kepler's problem (Contact hours: 10).*

5. ***Motion in a Noninertial Reference Frame:*** *Rotating coordinate systems, centrifugal and Coriolis forces, motion relative to the earth (Contact hours: 10).*

6. ***Mechanics of Rigid Bodies:*** *Inertia tensor, angular momentum, principal axes of inertia, moments of inertia for different body coordinate systems, Eulerian angles, Euler's equations for a rigid body (Contact hours: 10).*

E. Office Hours

Office hours give students the opportinuity to ask in-depth questions and to explore points of confusion or interest that cannot be fully addressed in class.

F. Exams & Grading System

The semi-official dates of the exams for this course are:

- **Midterm 1:** 6th or 7th week.
- **Midterm 2:** 11th or 12th week.
- **Quizzes & Homeworks:** During the semester.
- **Final Exam:** 16th week.

Your course grade will be based on your semester work as follows:

Midterm 1: 20 %	**Midterm 2:** 20 %	**Final Exam:** 40 %
Quizzes, Homework, Attendance & Participation: 20 %		

The grading distribution:

A⁺	**A**	**B⁺**	**B**	**C⁺**	**C**	**D⁺**	**D**	**F**
[95, 100]	[90, 95)	[85, 90)	[80, 85)	[75, 80)	[70, 75)	[65, 70)	[60, 65)	[0, 60)

G. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

Executive Rules for Study Regulations and Exams
goo.gl/ykm7t3