COURSE PORTFOLIO

FACULTY OF SCIENCE

PHYSICS DEPARTMENT

COURSE NAME: *Analytical Mechanics*

COURSE NUMBER: *Phys 252*

SEMESTER/YEAR: *2nd / 1438 H*

DATE: *Jumada 1 -1439 H*

Instructor Information

- **Name of the instructor:** Dr. Hala A Al-Jawhari
- **Office location:** Faculty of Science, 3rd floor, Room No. (108).
- **Office hours:**

Sunday	Monday	Tuesday	Wednesday	Thursdays
11-1	-	-	-	10-12

- **E-mail address:** haljawhari@kau.edu.sa

Course Information

- **Course name and number:** Analytical Mechanics - Phys (252)
- **Course meeting times & places:**

	Time	Room
Lectures	9:30 -11 **Mon & Wed**	1135
	1 - 2:30 **Mon & Wed**	1135

- **Course prerequisites and requirements:** Phys (101) + Math (202)
- **Description of the course :**

The material covered in this course is concerned with Newton's laws of motion and their applications to linear motion, harmonic oscillator, and inertial forces.

Course Objectives

By the end of this course student must be able to:

1. Define mechanics, vector and scalar quantities, velocity, acceleration, work, potential energy, kinetic energy, power, and momentum.
2. Calculate any of these quantities when given sufficient data.
3. State *Newton's* three laws of motion and recognize their applications.
4. List and describe the properties of oscillations.
5. Identify the difference between *the inertial* and *non-inertial* systems.
6. State *Kepler's* three laws and recognize their applications.

Learning Resources

- The primary textbook for the course is

Analytical Mechanics by G.R. Fowles & G.R. Cassiday. 7th ed.

- Additional references that may be helpful to students in this course:

- http://www.sciencejoywagon.com/physicszone/lesson/default.htm
- http://www.dctech.com/physics/tutorials.html
- http://www.phys-astro.sonoma.edu/people/faculty/tenn/ResourcesIntroPhysics.html

Course Requirements and Grading

✍ **Student assessment:**

H.W	**10%**	**On each tutorial session**
Quiz	**10%**	**After each tutorial session**
1st EXAM	**20%**	**5/7/1439**
2nd EXAM	**20%**	**3/8/1439**
FINAL EXAM	**40%**	**End of the semester**

✍ **Expectations from students:**

- Students are expected to attend lectures on time.
- Students may discuss a homework assignment to clarify what is required. However, students may NOT share or copy each other work.
- Students are expected to prepare them self for each exam or quiz, and bring their own pens and calculator.

✍ **Student responsibilities to the course:**

The student responsibilities are to:

- Attend all lectures, since the absence of 25% of the total lectures will prevent the student from attending the final exam.
- Submit each problem set on its defined date. .
- Work hard on each given exam or quiz. **Four** quizzes will be given each with 10 marks, then; the average of them will be encountered.

✍ **Expectations for each assignment:** To be done individually and honestly.

Detailed Course Schedule

PROVISIONAL COURSE OUTLINE

week	*Topic*	*Readings*
1	Units & Dimensions.	Ch 1, Sec 1-2
	Vectors	Ch 1, Sec 3
2	The scalar product, The Vector product & Triple product	Ch 1, Sec 4-6
	Derivative of a Vector & Velocity and Acceleration in *Rectangular* Coordinates.	Ch 1, Sec 9-10
3	*Velocity and Acceleration in Plane Polar* Coordinates.	Ch 1, Sec 11
	Velocity and Acceleration in *Cylindrical & Spherical* Coordinates.	Ch 1, Sec 12
4	***Tutorial Session 1***	
	Historical introduction to Newton's Laws of Motion & the 1st law.	Ch 2, Sec 1
5	The 2nd , 3rd laws & Acceleration Under a Constant Force.	Ch 2, Sec 1- 2
	Forces that depend on Position: Concepts of Kinetic & Potential energy	Ch 2, Sec 3
6	The Concepts of Kinetic & Potential energy (Examples).	Ch 2, Sec 3
	Forces that depend on Velocity: Fluid Resistance & Terminal Velocity.	Ch 2, Sec 4
7	***Tutorial Session 2***	
	General motion in 3D (principles of work & conservative forces).	Ch 4, Sec 1
***** 1st EXAM *****		
8	Potential energy & The Del Operator.	Ch 4, Sec 2
	Examples of Potential energy & The Del Operator	Ch 4, Sec 2
9	Projectile Motion.	Ch 4, Sec 3
	Tutorial Session 3	
10	Linear Restoring Force (Harmonic Motion).	Ch 3, Sec 1-2
	Simple Harmonic Motion.	Ch 3, Sec 2
11	Energy Considerations in Harmonic Motion.	Ch 3, Sec 3
	Damped Harmonic Motion.	Ch 3, Sec 4
12	Quality factor & DHM Examples.	Ch 3, Sec 4
	Forced Harmonic Motion (Resonance).	Ch 3, Sec 6
13	The Harmonic Oscillator in 2D & 3D.	Ch 4, Sec 4
	Motion of Charged Particles in Electric and Magnetic Fields.	Ch 4, Sec 5
14	Constrained Motion of a Particle.	Ch 4, Sec 6
	Tutorial Session 4	
***** 2nd EXAM *****		
15	Newton's Law of Gravity,	Ch 6, Sec 1-2
	Kepler's Laws.	Ch 6, Sec 3-5
	Tutorial Session 5	
****** FINAL EXAM ******		