TISHK INTERNATIONAL UNIVERSITY
FACULTY OF EDUCATION
Department of PHYSICS EDUCATION,
2022-2023 Spring
Course Information for PHYS 306 ADVANCED MECHANICS

Course Name:	ADVANCED MECHANICS

Code	Regular Semester	Theoretical	Practical	Credits	ECTS
PHYS 306	6	3	-	3	4

Name of Lecturer(s):	Mudhaffer Mustafa Emeen
Teaching Assistant:	NA
Course Language:	-
Course Type:	Main
Office Hours	9:00-11:00
Contact Email:	mudhaffer.mustafa@tiu.edu.iq Tel:07504514638
Teacher's academic profile:	-
Course Objectives:	After our students completed the F=ma approach to mechanics. Whereas this is all very nice, it assumes that they can actually write down the forces. This is usually not the case, especially when we are dealing with constrained motion or non-trivial systems. (Just try writing down the equations of motion for a double pendulum using the F=ma approach.) Once we have finished off a few loose ends, we will develop the techniques that are really used for solving complex problems, i.e. LaGrange and Hamiltonian mechanics. Both of these are based on energy principles and it is usually much easier to find your equations of motion from them.
Course Description (Course overview):	This course introduces students how to use the basic principles of mechanics to design more robust mechanical structures and systems. Simple techniques are presented to analyze deformation/strains as well as forces/stresses in linear elastic structures under mechanical loading. Whenever feasible, simplifying assumptions are made to enable convenient closed form solutions. Such methods are very useful for quick design and assessment of simple structures. For more complex structures, computational methods such as finite element methods are required. A simple overview of the finite element method is also presented.

COURSE CONTENT

Week	Hour	Date	Topic
1	3	29/1-2/2/2023	Introduction: Newtonian mechanics
2	3	5-9/2/2023	Reference frames
3	3	12-16/2/2023	Alternative coordinate systems
4	3	19-23/2/2023	Mechanics of a single body
5	3	26/2-2/3/2023	Mechanics of a system of bodies
6	3	5-9/3/2023	Kepler’s problem
7	3	12-16/3/2023	Kepler\
8	3	19-23/3/2023	Kepler’s Examples
9	3	26-30/3/2023	Calculus of variations
10	3	2-6/4/2023	Midterm Exam
11	3	9-13/4/2023	Generalized momenta and conservation statements
12	3	16-20/4/2023	Motion in a rotating reference frame
13	3	23-27/4/2023	Hamiltonian mechanics, From Lagrange to Hamilton
14	3	30/4-4/5/2023	Applications of Hamiltonian mechanics, Liouville’s theorem, Canonical transformation
15	3	7-11/5/2023	Lagrange Mechanics
16	3	14-18/5/2023	Hamiltonian Mechanics
17	3	21-25/5/2023	Examples on LaGrange and Hamiltonian Mechanics
18	3	28/5-1/6/2023	Final Exam
19	3	4-8/6/2023	Final Exam

COURSE/STUDENT LEARNING OUTCOMES

1	Solve problems with symbolic (rather than numeric) parameters.
2	Evaluate and articulate whether an answer is reasonable using limiting case analysis, dimensional analysis or multiple solutions paths
3	Coordinate multiple representations (e.g. verbal/text descriptions, diagrams, algebraic equations, free-body diagrams, matrix equations, space-time diagrams, etc) to solve
4	Use Newtonian, Lagrangian and Hamiltonian methods for solving mechanics problems

5	Use Lorentz transformations to describe physical situations in inertial reference frames

COURSE'S CONTRIBUTION TO PROGRAM OUTCOMES

(Blank : no contribution, I: Introduction, P: Profecient, A: Advanced)

	Program Learning Outcomes	**Cont.**
1	Discuss concepts and principles of physics.	I
2	Conduct proper experiments safely and interpret the data in physics teaching physics.	P
3	Use the results of recent education and subject-specific developmental research when designing, implementing and justifying their own practice as a teacher.	P
4	Apply analytical and theoretical skills to model and solve physics problems.	P
5	Identify students' misconceptions and deal with them in classroom.	P
6	Prepare physics lessons with appropriate learning materials and teaching methods.	P
7	Effectively assess, plan, teach, organize, and manage physics classrooms.	P
8	Use appropriate methods and techniques to improve students' critical thinking, creative thinking and problem-solving skills in physics.	P
9	Use required modern methods and techniques for student-centered teaching by considering individual and cultural differences of students.	P
10	Effectively use a variety of teaching technologies and techniques and classroom strategies to foster student learning.	P
11	Communicate effectively and work collaboratively within the context of a global society.	P
12	Exhibit character and decision-making skills embodying professionalism and ethical behavior.	P

Prerequisites (Course Reading List and References):	Key references: FRANKLIN, . 2010. Advanced Mechanics and General Relativity, Cambridge University Press. *Useful references: 2. 2009. Advanced Mechanics Of Solids, Tata McGraw-Hill Publishing Company Limited.
Student's obligation (Special Requirements):	1- Students must turn off all cell phones and pagers when entering any classroom. 2-There will be a homework which is important for developing an understanding of the course material due (almost) every week. All homework has equal weight. You must hand in your own work and put the explanation in your own words. 3- Questions in lecture are always good, and are strongly encouraged. 4- I strongly encourage collaboration, an essential skill in science, by making a presentation writing a report and so on. 5- After each assignment handling there will be a very short quiz covering the material in class.
Course Book/Textbook:	Key references: FRANKLIN,. 2010. Advanced Mechanics and General Relativity, Cambridge University Press. *Useful references: 2. 2009. Advanced Mechanics Of Solids, Tata McGraw-Hill Publishing Company Limited.
Other Course Materials/References:	http://www.ilectureonline.com/lectures/subject/PHYSICS/34
Teaching Methods (Forms of Teaching):	Lectures, Presentation, Project, Report, ,

COURSE EVALUATION CRITERIA

Method	**Quantity**	**Percentage (%)**
Quiz	1	10
Homework	1	10
Project	1	10
Presentation	1	10
Midterm Exam(s)	1	20
Final Exam	1	40
Total		**100**

Examinations: Essay Questions, Multiple Choices, Short Answers, , ,

Extra Notes:

ECTS (ALLOCATED BASED ON STUDENT) WORKLOAD

Activities	**Quantity**	**Workload Hours for 1 quantity***	**Total Workload**
Theoretical Hours	19	3	57
Practical Hours	19	0	0
Final Exam	1	20	20
Quiz	1		0
Homework	1		0
Project	1		0
Presentation	1		0
Midterm Exam(s)	1		0
Total Workload			**77**
ECTS Credit (Total workload/25)			**3**

Peer review

Signature:	Signature:	Signature:
Name:	Name:	Name:
Lecturer	Head of Department	Dean