Philadelphia University

Faculty of Engineering & Technology

Department of Mechanical Engineering

First Semester 2023/2024

Course Information

Course Title:	**Theory of machines** (620333)
Prerequisite:	Dynamics (620212)
Credit Hours:	3 credit hours (16 weeks per semester, approximately 44 contact hours)
Textbook:	Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002
References:	1. Theory of machines and mechanics, by J. Uicker, G. Pennock, and J.E. Shigley, 3rd edition, 2011. 2. Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines by R. L. Norton, 3rd edition,1999
Website:	http://www.philadelphia.edu.jo/academics/nmusa
Course Description:	Simple mechanisms, velocity and acceleration analyses in mechanisms, force analysis in simple mechanisms, theory of gearing, gear trains, balancing of rotating masses, belt drive, and cams.
Instructors:	Dr. Nabil Musa **Email**: nmusa@philadelphia.edu.jo **Office**: Engineering Building, room E61206, ext.:2343 Office hours: Sat, Sun, Mon Tues, 12:00-13:00 Mon
Course Coordinator:	Dr. Nabil Musa **Email**: nmusa@philadelphia.edu.jo **Office**: Engineering Building, room E61206, ext.:2343 Office hours: Sat, Sun, Mon Tues, 12:00-13:00 Mon
Technology Requirements:	• Personal computer, laptop, or mobile phone. • Internet Connection. • Access to Philadelphia University E-Learning Portal (MS Teams and Moodle)
Learning Style:	F2F
Communication:	• Announcement: the announcements will be posted in MS Teams or Moodle on a regular basis. • Email. • MS Teams or Moodle chats.
Course Objectives	• Classify and understand the functions of different types of mechanisms, and understand the concepts of link, joint, pair, chain, and mobility. • Perform position, velocity, and acceleration analysis of mechanisms algebraically, analytically, and graphically. • Calculate the different forces acting on a simple mechanism. • Design a cam profile according to a given follower motion • Understands the theory of gearing, analysis, and design of different types of gear trains. • Perform balancing of rotating masses and design a belt drive

Course Learning Outcomes (CLO) and Relation to ABET Student Outcomes		
CLOs	**Outcomes**	**ABET PLOs**
K1, K2	Classify and understand the functions of different types of mechanisms, and understand the concepts of link, joint, pair, chain, and mobility.	1
K1, K2	Perform position, velocity, and acceleration analysis of mechanisms algebraically, analytically, and graphically.	1
S3	Calculate the different forces acting on a simple mechanism.	1
K2	Design a cam profile according to a given follower motion	2
K1	Understand the theory of gearing, analyze, and design different types of gear trains.	1
K1	Perform balancing of rotating masses, and Analyze and design a belt drive	1

Grading Policy and Assessment Instruments					
Graded Item	**Marks**	**Topic (s)**	**CLO(s)**	**Learning Portal** (Teams/ Moodle/ F2F/ Others)	**Week**
Assignment 1	5	Simple mechanisms	K2	F2F	5
Assignment 2	5		K1-K2	F2F	13
Quiz 1	5	velocity and acceleration analyses in mechanisms	K2	F2F	4
Quiz 2	5	force analysis in simple mechanisms	K2	F2F	7
Quiz 3	5	theory of gearing, gear trains	K2, S3	F2F	12
Quiz 4	5	balancing of rotating masses	K2	F2F	14
Mid Exam	30%	Weeks 1-8	K1-K2	F2F	8
Final Exam	40%	Week 1-15	1-5	F2F	16
Total Marks	**100%**				
Notes:	• Two written exams will be given. • Copying homework is forbidden, any student caught copying the homework or any part of the homework will receive zero marks for that homework. • Quizzes: 10-minute quizzes will be given to the students during the semester. These quizzes will cover material discussed during the previous lecture(s). • Homework: Problem sets will be given to students. Homework should be solved individually and submitted before the due date. • The final exam will cover all the class material.				

Course Content: Learning Resources/ References/ Activities/ Assessment Methods						
Week	**Lecture**	**Topic**	**CLOs**	**Learning Resources/ References/ Activities/ Assessment Method**	**Learning Style** (F2F, Synchronous, Asynchronous)	**Assessment Method**
1	**L1**	Introduction of simple mechanisms.	-	Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	Types of links, and kinematic pairs.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
2	**L1**	• Types of joints and Kinematics pairs. • Number of degrees of freedom.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	Solving problems.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
3	**L1**	Grashof criteria.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	Solving problems (mobility, and Grashof criteria).		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
4	**L1**	● Solving problems (mobility, and Grashof criteria). ● Quiz 1(kinematic pairs, mobility, and Grashof Criteria).		Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines by R. L. Norton, 3rd edition,1999	F2F	
	L2	• Position Analysis • Translation and rotation • Complex Motion		Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines by R. L. Norton, 3rd edition,1999	F2F	Quiz-1
5	**L1**	• Graphical position analysis of linkage. • Velocity analysis.		Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines by R. L. Norton, 3rd edition,1999	F2F	Assignment 1
	L2	• Definition of velocity • Graphical velocity analysis. • Assignment 1.		Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines by R. L. Norton, 3rd edition,1999	F2F	
6	**L1**	• Instant Center of velocity. • Angular velocity.		Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines by R. L. Norton, 3rd edition,1999	F2F	
	L2	• Angular velocity ratio. • Problem-solving		Theory of Machine. By: R.S.	F2F	

		(displacement and velocity)		Khurmi and J. K. Gupta., 2002		
7	**L1**	• Analytical solution for velocity. • Quiz 2 (displacements and velocity).		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	Quiz 2
	L2	• Acceleration analysis • Acceleration of any point on linkage.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
8	**L1**	• Analytical solution for acceleration • Problem solving.		-	F2F	
	L2	• Estimated Midterm exam		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
9	**L1**	• Solving Example 10.4 • Classwork		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	• Cam design • Type of follower motion.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
10	**L1**	• Types of joint closure. • Problem solving.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	• Types of followers • Types of Cams.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
11	**L1**	• Problem-solving (Cams). • Type of motion constrains.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	• Types of motion programs. • SVAJ diagram.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
12	**L1**	• Double dwell Cam design. • Simple harmonic motion (SHM). • Quiz 3		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	• Cycloidal displacement. • Single Dwell cam design.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	Quiz 3
13	**L1**	• Single dwell cam design choosing SVAJ function. • Assignment 2.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	• Sizing the cam • Pressure angle • Radius of curvature		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	Assignment 2
14	L1	• Problem solving (can). • The fundamental law of gearing. • Quiz 4		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	• Introduction to Gear and gear train. • Gear teeth, and contact ratio. • Simple gear train.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	Quiz 4

15	**L1**	• Design of gear train. • Design of reverted compound trains. • Balancing of rotating mass, static balance. • Dynamic balance.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
	L2	• Linkage balance • Problem solving.		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	
16		• Final exam		Theory of Machine. By: R.S. Khurmi and J. K. Gupta., 2002	F2F	

Notes:
For Blended and F2F Courses: L1 & L2 each 1 hour.
For Online Course: L1 and L2 each 1.5 hours.

Credit Hours Distribution Report	
Learning Style	**Credit Hours**
F2F	32
Synchronous	0
Asynchronous	16
Total	48

Academic Honesty/ Student Conduct	○ As a student at Philadelphia University, you are expected to follow the university regulations and guidelines for academic honesty/student conduct found in the student handbook. ○ This means that you should not cheat, plagiarize, and let another student use your account in LMS learning portals.
Attendance Policy	Absence from classes and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse, acceptable to and approved by the Dean of the relevant college/faculty, shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.

October 2023