Identification	**Subject**	ME 420 Theory of Machines, 6 ECTS	
	Department	Mechanical Engineering	
	Program	Undergraduate	
	Term	Fall 2022	
	Instructor	Faraj Khalikov	
	E-mail:	faraj.khalikoff@gmail.com	
	Phone:		
	Classroom/hours		
	Office hours		
Prerequisites	Dynamics		
Language	English		
Compulsory/Elective	Compulsory		
Required textbooks and course materials	**Textbook:** Theory of Machines: Sadhu Singh, Pearson Education, 2nd edition, 2007. **Suggested Course Materials:** 1- F.P. Beer, E.R. Johnston Jr., and W.E. Clausen. Vector Mechanics for Engineers - Dynamics, 7th edition, McGraw-Hill Inc. 2- H.H. Mabie and C.F. Reinholz. Mechanisms and Dynamics of Machinery, 4th edition, Wiley. 3- G.H. Martin. Kinematics and Dynamics of Machines, 2nd edition, McGraw-Hill. 4- Theory of Machines, R. S. Khurmi, J. K. Gupta, S. Chand Publications, New Delhi 2015.		
Course outline	Knowledge of various mechanisms and machines is a prerequisite for enabling a mechanical engineer to work an industry. Theory of Machines is a fundamental course for Mechanical engineers to understand the working principles of any machine. Kinematic and dynamic analysis are crucial to the design of mechanism and machines. Kinematics of machines is the study of the relative motion of machine parts and is one of the first considerations of the designer in the design of the machine. Dynamic of machines treats with the forces acting on the parts of a machine and the motions resulting from these forces. A dynamic analysis is necessary to ensure that balance is provided for rotating and reciprocating parts and that all members are adequate from the standpoint of strength. Machines are characterized by the fact that they have mobility and must move to perform their function and this course is necessary for mechanical engineering students to understand the motion, transmission of the motion and the forces responsible for the motion.		
Course Objective	The general objective of this course is to learn how to analyze the motions of mechanisms, design mechanisms to have given motions, and analyze forces in machines. This includes relative motion analysis and design of gears, gear trains, cams, and linkages, simultaneous graphical and analytical analysis of position, velocity, and acceleration, considering static and inertial forces. This course aims to equip the mechanical engineering students with the fundamentals of kinematics and dynamics of machines and give them necessary skills to analyze the motion of machines and their components.		
Learning outcomes	Upon successful completion of this course, the student will be able to: 1. Distinguish kinematic and kinetic motion. 2. Identify the basic relations between distance, time, velocity, and acceleration. 3. Apply vector mechanics as a tool for solving kinematic problems. 4. Create a schematic drawing of a real-world mechanism. 5. Determine the degrees-of-freedom (mobility) of a mechanism. 6. Use graphical and analytic methods to study the motion of a planar mechanism. 7. Design basic gear trains. 8. Design basic cam systems.		
Teaching methods	**Lecture**		x

	Experiential exercise		x
	Assisted work		-
	Assisted lab work		-
	Others		-
Evaluation	**Methods**	**Date/deadlines**	**Percentage (%)**
	Midterm Exam		30
	Projects		20
	Quiz		10
	Final Exam		40
	Total		100

Policy

- **Ethics**
  Copy of other students' work is highly discouraged. All assignments must be handled by the student himself. This is a university policy and violators will be reprimanded accordingly.
- **Preparation for class**
  The structure of this course demands your individual effort outside the classroom for extra practice of many problems within the textbook. After each session, every student needs to put sufficient time to practice and finish the assignments by the predetermined date.
- **Withdrawal (pass/fail)**
  This course strictly follows grading policy of the School of Science and Engineering. Thus, a student is normally expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year.
- **Cheating/plagiarism**
  Cheating or other plagiarism in handling the assignments, Mid-term and Final Examinations will lead to course failure. In this case, the student will automatically get zero (0), without any considerations.
- **Professional behavior guidelines**
  The students shall behave in the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly discouraged.
- **Quiz**
  There will be quizzes during the semester. The questions will be relevant to the previous weeks' topics. If you read your assignments weekly, if you actively listen to the lectures and participate to the discussions you will be successful in answering the quiz questions.
- **Project**
  The aim of the class project (that uses most of the concepts that have been learnt) is to create something that is tangible and useful. Students will work to complete four projects. Projects and report guidelines will be provided at the appropriate time.
  The project is evaluated over a nominal range of 40 points total (this means projects may not all have the same relative weight in the calculation of a grade), consisting of:
  Style and Clarity. Up to 10 points.
  One measure of a student's commitment to learning is the care which is used in the preparation of homework assignments.
  · State the assignment name and number; due date; brief description; student name.
  Correctness and clarity. Up to 30 points.
  · Solution correctness.
  · Clarity, conciseness.
  · Completeness.
  Lateness. (Subtractions from point total.) Up to 15 points.
  The project is due at the prescribed time. Exceptions will be considered only when arranged beforehand with me, or in documented emergencies.

	10% of total possible points will be subtracted for each day a project is late: 10% for one day late; 20% for two days late; 30% for three days late; 40% for four days late; 50% for five days late. A project more than 5 days late will not be scored, but it should be handed in and may be used as an aid in determining a student's overall grade.

Tentative Schedule

Week	Topics	Textbook/Assignments
1	Fundamental concepts, Definitions; geometrical categorization of mechanisms; mobility; kinematic inversion; Grashof's law.	Chapter 1
2	Intro. Graphical solution of vector equations.	Chapter 2
3	Definitions; velocity polygons; apparent linear velocity of a point; apparent angular velocity; instant centers of velocity.	Chapter 3
4	Linear acceleration; angular acceleration; acceleration difference vector;	Chapter 4
5	Acceleration polygons; apparent acceleration; instant centers. **Quiz 1/ Delivery of assignments**	Chapter 4
6	Preliminaries; forces acting on links; graphical analysis and superposition; analytical force balance and matrix solution.	Chapter 5
7	Introduction; balancing of machinery; balancing of rotating shafts. analysis of rotor balancing.	Chapter 6
8	Review **Midterm Exams**	
9	Kinematics of cams, definition and classification	Chapter 7
10	Displacement diagrams, cam profile design	Chapter 7
11	**Quiz 2/ Delivery of assignments**	Chapter 8
12	Dynamics of cams, rigid cam systems	Chapter 9
13	Fundamental law of gearing. Automotive transmission, Planetary Gears	Chapter 9
14	Automotive transmission, Planetary Gears	Chapter 9
15	Conclusion – Solve problems	
16	**Final Exam**	

This syllabus is a guide for the course and any modifications to it will be announced in advance.