OSTIM TECHNICAL UNIVERSITY
FACULTY OF ENGINEERING

COURSE SYLLABUS FORM
2020-2021

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MEC 204 Dynamics							
Course Name	**Course Code**	**Period**	**Hours**	**Application**	**Laboratory**	**Credit**	**ECTS**
DYNAMICS	MEC 204	1	3	0	0	3	4

Language of Instruction	English
Course Status	Compulsory
Course Level	Bachelor
Learning and Teaching Techniques of the Course	Lecture, Discussion, Question Answer, Practice

Course Objective

At the end of this course, the student will
• be able to conduct the kinematical analysis for the plane motion of particles,
• comprehend the basic principles underlying the kinetics of particles,
• be able to apply the concepts of work-energy and impulse-momentum to particle motion problems,
• be able to conduct a kinematical analysis for the plane motion of rigid bodies,
• identify, formulate and solve engineering problems in rigid body dynamics,
• be able to apply the concepts of work-energy and impulse-momentum to rigid body systems.

Learning Outcomes

1. Ability to analyze plane particle motion (position, velocity and acceleration) in rectangular, normal-tangential (path) and polar coordinates, and identify the most suitable coordinate system for a problem.
2. Ability to interrelate the three planar representations of the particle motion in different coordinate systems.
3. Ability to analyze three-dimensional particle motion (position velocity and acceleration) in rectangular, cylindrical and spherical coordinates.
4. Understanding of relative motion of a particle with respect to a translating coordinate system.
5. Ability to write down geometric constraint equation(s) for a system consisting of particles, and together with the time derivatives, use them for the analysis of motion.
6. Ability to apply Newton's second law of motion to analyze instantaneous relations between forces and acceleration characteristics of a particle, by using a free-body-diagram.
7. Understanding of work-energy principles for particles, ability to evaluate the kinetic energy of particles as well as the potential energy associated with gravity and spring forces, and work done by forces and ability to identify the type of particle kinetic problems for which the work-energy equation is most suitable.

8. Understanding of impulse-momentum principles for particles, ability to evaluate the linear and angular momentum of particles and systems of particles, as well as linear and angular impulse of forces and, ability to identify the type of particle kinetic problems for which the impulse-momentum equations are most suitable. 9. Understanding of conservation laws for energy and momentum, and ability to apply them to a given kinetic problem as appropriate. 10. Ability to utilize coefficient of restitution concept in the solution of particle impact problems. 11. Ability to extend Newton's second law of motion, work-energy and impulse momentum principles to a system of particles. 12. Ability to describe and analyze the angular motion of a rigid body in two-dimensional (planar) space, and identify the three modes of rigid body motion: pure translation, fixed axis rotation and general plane motion. 13. Ability to analyze the velocity and acceleration characteristics of a system consisting of rigid bodies, by using the concept of relative motion between two points on the same rigid body. 14. Understanding of instantaneous center of zero velocity, and apply this concept for the velocity analysis of systems consisting of rigid bodies. 15. Ability to apply the motion relative to rotating frame concept for the velocity and acceleration analysis of systems consisting of particles and rigid bodies. 16. Understanding of the concept of mass moment of inertia and radius of gyration of a rigid body about an axis, and ability to apply parallel-axis theorem for the determination of mass moment of inertia with respect to another axis or of composite bodies. 17. Ability to apply Newton's second law of motion.

Course Outline
Kinematics and kinetics of particles and system of particles. Plane kinematics and kinetics of rigid bodies. Newton`s second law of motion. Methods of work-energy and impulse-momentum.

Weekly Topics and Releated Preparation Studies		
Weeks	**Topics**	**Preparation Studies**
1	**INTRODUCTION to DYNAMICS** Basic concepts Newton`s laws Units Gravitation	Chapter 1

2	**DYNAMICS of PARTICLES** KINEMATICS of PARTICLES: Rectilinear motion Plane curvilinear motion	Chapter 2
3	KINEMATICS of PARTICLES: Normal and Tangential coordinates Polar coordinates	Chapter 2
4	KINEMATICS of PARTICLES: Relative motion Constrained motion of connected particles	Chapter 2
5	KINETICS of PARTICLES Force, mass and acceleration	Chapter 2
6	KINETICS of PARTICLES: Work and energy	Chapter 3
7	KINETICS of PARTICLES: Impulse and momentum	Chapter 3
8	Midterm exam	
9	KINETICS of PARTICLES: Impact	Chapter 3
10	**DYNAMICS of RIGID BODIES** PLANE KINEMATICS of RIGID BODIES: Rotation Absolute motion	Chapter 4
11	PLANE KINEMATICS of RIGID BODIES:	Chapter 4

	Relative velocity Instantaneous center of zero velocity	
12	PLANE KINEMATICS of RIGID BODIES: Relative acceleration	Chapter 4
13	PLANE KINETICS of RIGID BODIES: Mass moments of inertia General equations of motion	Chapter 5
14	PLANE KINETICS of RIGID BODIES: Translation Fixed axis rotation	Chapter 5
15	PLANE KINETICS of RIGID BODIES: General plane motion Work and energy relations	Chapter 5
16	**Final Exam**	

Textbook(s)/References/Materials:
Engineering Mechanics Dynamics, Meriam&Kraige

Assessment		
Studies	**Number**	**Contribution margin (%)**
Attendance	14	10
Lab		
Application		
Field Study		
Course-Specific Internship (if any)		
Quizzes / Studio / Critical	5	20
Homework		
Presentation		
Projects		
Report		
Seminar		
Midterm Exams / Midterm Jury	1	30

General Exam / Final Jury	1	40
	Total	**100**
Success Grade Contribution of Semester Studies		60
Success Grade Contribution of End of Term		40
	Total	**100**

Relationship Between Course Learning Outcomes and Program Competencies						
Nu	**Learning Outcomes**	**Contribution Level**				
		1	**2**	**3**	**4**	**5**
1	An ability to apply knowledge of science, mathematics, and engineering.					x
2	An ability to design static systems, components, or processes to meet industrial needs.					x
3	An ability to work with multi-disciplinary teams.					x
4	An ability to identify, formulate, and solve engineering problems.					x
5	Take responsibility to solve unpredictable and complex problems encountered in applications as an individual and as a member of a team			x		
6	Plan and manage activities in teamwork			x		
7	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.				x	
8	Can do research on interdisciplinary fields.			x		

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Course hours (Including the exam week: 16 x total course hours)	16	3	48
Laboratory			
Application			
Course-Specific Internship			
Field Study			
Study Time Out of Class	14	2	28
Presentation / Seminar Preparation			
Projects			
Reports			
Homeworks			
Quizzes / Studio Review	5	2	10
Preparation Time for Midterm Exams / Midterm Jury	1	15	15
Preparation Period for the Final Exam / General Jury	1	15	15
Total Workload			**116**