AERO 204 - DYNAMICS

Course Code	Course Name	Semester	
AERO 204	Dynamics	Fall ☐ Spring ☒ Summer ☐	
Hours		**Credit**	**ECTS**
Theory	**Practice** / **Lab**	3	5
3	0 / 0		

Course Details	
Department	Aerospace Engineering
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Course Objectives	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.
Course Content	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.
Course Method/ Techniques	Lecture ☒ Question & Answer ☐ Presentation ☐ Discussion ☐
Prerequisites/ Corequisites	
Work Placement(s)	

Textbook/References/Materials

- Engineering Mechanics Dynamics, Meriam&Kraige
- Engineering Mechanics: Dynamics, R.C. Hibbeler, Pearson, Prenti

Course Category				
Mathematics and Basic Sciences	☒		Education	☐
Engineering	☒		Science	☐
Engineering Design	☒		Health	☐
Social Sciences	☐		Profession	☐

Weekly Schedule

No	Topics	Materials/Notes
1	INTRODUCTION to DYNAMICS: Basic concepts Newton`s laws Units; Gravitation	Intro
2	DYNAMICS of PARTICLES KINEMATICS of PARTICLES: Rectilinear motion; Plane curvilinear motion Normal and Tangential coordinates, Polar Coordinates	Chapter 12
3	KINEMATICS of PARTICLES: Polar coordinates Relative motion: Constrained motion of connected particles	Chapter 12
4	KINETICS of PARTICLES: Force, mass and acceleration	Chapter 13
5	KINETICS of PARTICLES Force, mass and acceleration Work and energy	Chapter 13
6	KINETICS of PARTICLES: Work and energy Impulse and momentum	Chapter 14
7	KINETICS of PARTICLES: Impulse and momentum Impact	Chapter 15
8	Midterm Exam	
9	DYNAMICS of RIGID BODIES PLANE KINEMATICS of RIGID BODIES: Rotation; Absolute motion	Chapter 16
10	PLANE KINEMATICS of RIGID BODIES: Relative velocity Instantaneous center of zero velocity; Relative acceleration	Chapter 16
11	PLANE KINETICS of RIGID BODIES: Mass moments of inertia General equations of motion	Chapter 17
12	PLANE KINETICS of RIGID BODIES: Translation Fixed axis rotation	Chapter 17
13	PLANE KINETICS of RIGID BODIES: General plane motion	Chapter 18

	Work and energy relations	
14	PLANE KINETICS of RIGID BODIES: Impuls Momentum relations, , Introduction to 3D Motion	Chapter 19-20
15	Final Exam	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance	14	
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize	4	20%
Homework		
Presentation / Seminar		
Project		
Report		
Seminar		
Midterm Exam	1	30%
Final Exam	1	50%
	Total	**100%**
Contribution of Semester Studies and Midterm to Success Grade		50%
Contribution of End of Semester Studies to Success Grade		50%
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	3	42
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time			
Quiz/Studio/Criticize	4	5	20
Homework			
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm	1	25	25
Final Exam and Preparation for Final Exam	1	30	30
Total Workload			**117**
Total Workload / 25			**4,68**
ECTS Credit			**5**

Course Learning Outcomes	
No	**Outcome**
L1	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
L2	Ability to interrelate the three planar representations of the particle motion in different coordinate Systems.
L3	Ability to analyze three-dimensional particle motion (position velocity and acceleration) in rectangular, cylindrical and spherical coordinates.
L4	Understanding of relative motion of a particle with respect to a translating coordinate system.
L5	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.
L6	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.
L7	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.
L8	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.
L9	Understanding of conservation laws for energy and momentum, and ability to apply them to a given kinetic problem as appropriate.
L10	Ability to utilize coefficient of restitution concept in the solution of particle impact problems.
L11	Ability to extend Newton's second law of motion, work-energy and impulse momentum principles to a system of particles.
L12	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.
L13	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.
L14	Understanding of instantaneous center of zero velocity, and apply this concept for the velocity analysis of systems consisting of rigid bodies.
L15	Ability to apply the motion relative to rotating frame concept for the velocity and acceleration analysis of systems consisting of particles and rigid bodies.
L16	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.
L17	Ability to apply Newton's second law of motion.

Contribution of Course Learning Outcomes to Program Competencies/Outcomes												
Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant												
	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**Total**

L1	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L2	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L3	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L4	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L5	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L6	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L7	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L8	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L9	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L10	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L11	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L12	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L13	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L14	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L15	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L16	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
L17	5	5	5	5	2	4	2	2	2	2	3	37/55; 67.27%
											Total	629/935; 67,27%