Engineering mechanics

Course Unit Title	Mechanical engineering
Course Unit Code	VTSS-B10
Type of Course Unit	Compulsory
Level of Course Unit	3rd year
National Credits	3
Number of ECTS Credits Allocated	
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Aghalarova I.U.
Name of Lecturer (s)	Aghalarova I.U.
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Engineering Mechanics is a foundational course that introduces the fundamental principles and laws governing the behavior of physical systems under the influence of forces. This course is divided into two main branches:

1. **Statics:** The study of bodies in equilibrium, where the sum of forces and moments acting on a system equals zero. It covers topics such as force systems, free-body diagrams, equilibrium of particles and rigid bodies, and structural analysis, including trusses and frames.
2. **Dynamics:** The study of bodies in motion, focusing on the relationship between forces and the resulting motion. This section covers the kinematics and kinetics of particles and rigid bodies, using concepts such as work-energy, impulse-momentum, and Newton's laws of motion.

Objectives of the Course:

Analyze force systems in static equilibrium.

Apply kinematic equations to describe the motion of particles and rigid bodies.

Solve engineering problems involving work, energy, impulse, and momentum.

Interpret and construct free-body diagrams to visualize forces and moments.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Comprehend fundamental concepts such as force, moment, couple, and equilibrium as applied to particles and rigid bodies.	1
2	Draw accurate free-body diagrams for particles and rigid bodies, identifying all forces	1,2,3

	acting on the system.	
3	Solve for unknown forces and moments using the equilibrium equations in two and three dimensions.	1
4	Resolve forces into components and calculate resultants of force systems, including concurrent, coplanar, and non-coplanar forces.	1
5	Calculate the moment of a force about a point or axis, and analyze systems involving force couples.	1,2
6	Analyze and calculate reactions at supports and connections for statically determinate structures such as beams and frames.	1,3
7	Apply methods like the method of joints and method of sections to analyze internal forces in trusses and other structures.	
8	Determine centroids and centers of gravity for composite bodies and calculate the effects of distributed forces.	

Assessment Methods: 1. Final Exam, 2. Independent works, 3. Midterm exam

Course's Contribution to Program

		CL
1	Provides the fundamental principles needed for advanced engineering courses such as Dynamics, Strength of Materials, Structural Analysis, Fluid Mechanics, and Machine Design.	5
2	Develops the ability to analyze complex systems, use logical reasoning, and apply mathematical techniques to solve real-world engineering problems. Prepares students to tackle multidisciplinary problems by mastering the analysis of force systems, equilibrium, and structural integrity.	4
3	Encourages critical thinking and the ability to break down large systems into solvable parts using free-body diagrams, equilibrium equations, and vector algebra. Strengthens the students' ability to approach problems systematically and think in terms of physical laws and mechanical principles.	4
4	Applies the principles of statics to the analysis and design of structures and mechanical systems, providing students with practical skills for fields such as civil, mechanical, aerospace, and structural engineering.	4
5	Instills essential mechanical engineering skills, making students proficient in using tools and techniques required for static analysis in various engineering industries (e.g., construction, automotive, aerospace).	3
6	Contributes to the body of knowledge required for engineering licensure exams such as the Fundamentals of Engineering (FE) exam or Professional Engineer (PE) certification, especially in fields requiring expertise in mechanics and structural analysis.	4
7	Enhances communication skills by teaching students to present technical solutions and analyses clearly through diagrams, mathematical calculations, and structured problem-solving approaches. Promotes collaboration through group projects, where students must work together to solve statics problems, simulating real-world engineering teamwork.	1

8	Introduces concepts of stability, safety, and reliability in engineering designs, which are essential for creating sustainable, efficient, and safe engineering solutions in civil and mechanical applications.	3

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[1]: Chapter 1, s: 3-12	Mechanics. Fundamental Concepts.	
2	[1]: Chapter 2, s: 17-32	Force Vectors. Scalars and Vectors. Vector Operations. Vector Addition of Forces.	
3	[1]: Chapter 2, s:33-46	Addition of a System of Coplanar Forces. Cartesian Vectors. Addition of Cartesian Vectors.	
4	[1]: Chapter 2, s:56-70	Position Vectors. Force Vector Directed Along a Line. Dot Product.	
5	[1]: Chapter 3, s:87-90	Equilibrium of a Particle. Condition for the Equilibrium of a Particle. The Free-Body Diagram.	
6	[1]: Chapter 3, s:91-115	Coplanar Force Systems. Three-Dimensional Force Systems.	
7			Midterm
8	[1]: Chapter 4, s:121-130	Force System Resultants. Moment of a Force - Scalar Formulation. Cross Product. Moment of a Force-Vector Formulation.	
9	[1]: Chapter 4, s:132-165	Principle of Moments . Moment of a Force about a Specified Axis. Moment of a Couple.	
10	[1]: Chapter 4, s:166-205	Simplification of a Force and Couple System. Further Simplification of a Force and Couple System. Reduction of a Simple Distributed Loading.	
11	[2]: Chapter 5, s:207-251	Conditions for Rigid Body Equilibrium. Free-Body Diagrams. Two- and Three-Force Members. EQUILIBRIUM IN THREE DIMENSIONS. Constraints and Statical Determinacy.	
12	[1]: Chapter 6, s:273-300	Simple Trusses. The Method of Joints. Zero Force Members. The Method of Sections.	
13	[1]: Chapter 7, s:343-380	Internal Forces Developed in Structural Members. Shear and Moment Equations and Diagrams. Relations between Distributed Load, Shear, and Moment.	
14	[2]: Chapter 9, s:465-487	Center of Gravity, Center of Mass, and the Centroid of a Body.	
15	[1]: Chapter 9, s:488-501	Composite Bodies.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. "Mechanics for Engineers: Statics" *Authors:* J.L. Meriam, L.G. Kraige
2. "Engineering Mechanics: Statics" *Authors:* R.C. Hibbeler, M.A. Hibbeler
3. "Statics and Mechanics of Materials" *Author:* R.C. Hibbeler

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Independent work	20%	
Seminar	0%	
Midterm Exam	30%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Regular attendance is required. Students are expected to attend all lectures and laboratory sessions.
- If a student misses a class, it is their responsibility to catch up on any missed material and assignments.
- Excessive absences (typically defined as more than 15% of the course) may result in a reduction of the final grade.
- Active participation is encouraged during lectures and discussions. Students should come prepared to engage with the material and contribute to class discussions.
- Homework will be assigned regularly and is due at the beginning of the class on the specified due date.
- Late submissions will incur a penalty (e.g., 10% deduction per day late), and assignments may not be accepted after a certain period (e.g., one week).
- Collaboration is allowed on homework, but each student must submit their own work. Plagiarism or copying will result in disciplinary action.

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**15**	**3**	**45**
Presentation	1	10	10
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	28	28
Self-study	14	5	70
Total Workload			**180**
Total Workload/30(h)			**180/30**

ECTS Credit of the Course	**6**