Course title	Structural Mechanics (ECTS 6)
Course/module code	QM2306
Semester(s) in which the course is taught	Semester 3
Assigned instructor	A. Abduraxmonov, Assistant Lecturer
Language of instruction	Uzbek
Course type	Compulsory
Study hours (including independent study)	**Total hours – 180.** **Contact hours – 72.** Lecture hours – 24 Laboratory hours – 24 Practical class hours – 24 **Independent study – 108 hours**
ECTS	6
Course aim and objectives / learning outcomes	**Course aim** – To develop students' competence in formulating analytical models of pipes, pipe supports, underground and above-ground utility networks, elevated structures and supporting structures; determining the effects of loads; and assessing strength, stiffness and stability, on the basis of the integrated principles of theoretical mechanics, strength of materials and structural mechanics **Course objectives** – to replace force systems with equivalent systems, release constraints and determine support reactions; formulate justified analytical models for static and dynamic problems; determine internal forces and moments, stresses and deformations; check strength and stiffness under tension–compression, shear, torsion and bending; assess the stability of compression members and support elements; analyse statically determinate and statically indeterminate systems using classical methods; apply influence lines, displacements, the force method and the displacement method to practical problems; and verify and interpret the results of matrix and computer calculations from an engineering perspective. **Learning outcomes:** **Professional competence:** TN1. Can explain the concepts of force, moment, constraint, equilibrium, kinematics and dynamics TN2. Can explain the criteria for stress, strain, strength, stiffness and stability TN3. Can distinguish between analytical models of beams, trusses, frames, arches and support systems TN4. Can explain the limits of applicability of methods for statically determinate and statically indeterminate systems TN5. Can explain the main stages of matrix calculations and computer analysis **Skills:** TN6. Can construct a free-body diagram and an analytical model; TN7. Can determine support reactions and internal forces and moments; TN8. Can calculate normal and shear stresses, and linear and angular strains; TN9. Can calculate the geometric properties of a cross-section; TN10. Can apply strength, stiffness and stability conditions to practical problems; TN11. Can construct influence lines and analyse the effects of moving loads; TN12. Can apply Mohr's integral, Vereshchagin's rule, the force method and the displacement method; TN13. Can evaluate computer calculation results using a manual check calculation.
Course content (topics)	**I. Main theoretical component (Lectures)** **Semester 3** **Topic 1:** Introduction to theoretical mechanics. Force and the free-body diagram. **Topic 2:** Coplanar force systems and support reactions. **Topic 3:** Spatial equilibrium, center of gravity and friction**.** **Topic 4:** Fundamentals of kinematics and dynamics. **Topic 5:** Internal forces and moments, stress and strain.

Topic 6: Tension–compression and the mechanical properties of materials.
Topic 7: Cross-sectional properties, shear and torsion.
Topic 8: Bending, combined loading and stability.
Topic 9: Analytical models and kinematic analysis.
Topic 10: Statically determinate beams, frames, trusses and influence lines.
Topic 11: Displacements in structures.
Topic 12: Statically indeterminate systems and computer analysis.

II. Guidelines and recommendations for organizing laboratory classes.

Semester 3

Recommended laboratory topics:

L1. Verification of force equilibrium
L2. Determination of the motion parameters of a body
L3. Determination of the mechanical properties of a material in tension
L4. Determination of the longitudinal deformation of a bar
L5. Torsion testing of a bar with a circular cross-section
L6. Determination of stresses in a beam under pure bending
L7. Determination of beam deflection and angle of rotation
L8. Stability testing of a bar under compression
L9. Verification of the analytical model of a statically determinate beam
L10. Determination of forces in truss members
L11. Verification of displacements through experiments and calculations
L12. Verification of a computational model using a manual check calculation

III. Guidelines and recommendations for practical classes

An instructor's preparation for a practical class begins with studying the initial documents (the curriculum, thematic plan and others) and ends with preparing a lesson plan. The instructor should have a clear understanding of the aim and objectives of the practical class and the amount of work each student is required to complete.

Methodological guidelines are the instructor's main methodological document for preparing and conducting practical classes.

The aim of a practical class is to understand the theory and acquire skills. It is intended to develop the ability to apply these consciously in learning and professional activities and to formulate one's own position with confidence.

Recommended practical topics:

Semester 3

1. Resolving force vectors and constructing a free-body diagram
2. Determination of support reactions for a coplanar force system
3. Problems involving spatial forces, the centre of gravity and friction
4. Problems in kinematics and the work–energy theorem
5. Construction of internal force and moment diagrams
6. Strength and deformation calculations under tension–compression
7. Cross-sectional properties and torsion analysis of a pipe
8. Analysis of strength and stiffness in bending and member stability
9. Kinematic and static analysis of a system
10. Analysis of beams, frames and trusses
11. Construction of influence lines and determination of displacements
12. Analysis of a statically indeterminate frame and a matrix model

IV. Independent study and independent work.

Independent study competence helps students develop themselves independently and improves the effectiveness of their professional activities. Students complete independent assignments on their mobile devices under the instructor's guidance, in either a traditional or electronic format.

Recommended topics for independent study:

Semester 3

1. Construction of a free-body diagram of a pipe support joint
2. Calculation of the support reactions of a pipe rack beam
3. Moments and centre of gravity of a spatial support system
4. A work–energy problem for a dynamic load in a utility network
5. A professional case study in the theoretical mechanics component
6. A glossary of terms relating to static and dynamic loads
7. Internal forces and moments in a pipe support member
8. Tension–compression analysis of a stepped bar
9. Torsion analysis of thin-walled and thick-walled pipe cross-sections

	10. Internal force and moment diagrams of a statically determinate frame 11. Influence lines for a moving load 12. Displacement using Mohr's integral and Vereshchagin's rule **V. Guidelines and recommendations for calculation and graphical assignments** When completing a calculation and graphical assignment, the student analyses the assignment conditions, identifies the given quantities and constructs an analytical model appropriate to the problem. The calculation results are presented as a graph, diagram or drawing in accordance with the assignment requirements. The methodological guidelines describe the calculation sequence, preparation of graphical materials and procedures for checking the results obtained. The aim of calculation and graphical assignments is to develop the skills required to apply theoretical knowledge to practical problems, carry out calculations independently and present the results graphically. **Recommended topics for independent study:** **Semester 3 (NM)** 1. Determination of the support reactions of a rigid body. S-1 2. Strength analysis of statically determinate stepped bars. K-1 3. Strength analysis of statically determinate multi-span beams D-1
Student assessment	Students' knowledge is assessed during the semester and final assessment on the basis of their mastery of the teaching materials (the results of tests, assignments, written work and oral work). Students are assessed on a 100-point scale throughout the Structural Mechanics course. Of these, 50 points are allocated to continuous and midterm assessment results (of the 50 points, 60 % is for continuous assessment and independent study, and 40 % for midterm assessment), while 50 points are allocated to the final assessment result. Students whose combined continuous and midterm assessment score is below 30 points are not admitted to the final assessment examination. A student who scores 30 points or more in the final assessment is considered to have passed the course.
Examination requirements	The student must have fully mastered the theoretical and practical concepts of the topic and be able to present the analysis results correctly. The student must have completed the assignments set for independent work and for continuous and midterm assessment. At the same time, the student must have obtained the required scores in continuous, midterm, independent study and final assessments for the relevant course within the prescribed time. A student who has not submitted the continuous assessment, midterm assessment and independent study assignments, or who has scored less than 30 points for these assignments and assessment components, is not admitted to the final assessment. A student who misses 25 percent or more of the contact hours allocated to the course without a valid reason is excluded from the course, is not admitted to the final examination and is considered not to have earned the corresponding course credits. A student who fails the final examination or scores within the "0-29,9" range in this type of examination is considered to be in academic arrears.
Recommended literature	**Core literature** 1. Sh.A. Shoobidov. Theoretical Mechanics. Study guide Toshkent, 2008. 240 pp. 2. T. Bultakov, G'.G'. Egamnazarov, X.X. Igamberdiyev. Practical Course in Theoretical Mechanics: Statics. Study guide Jizzax: Jizzakh Polytechnic Institute, 2019. 266 pp. URL: https://unilibrary.uz/literature/880109 3. X.X. Igamberdiyev, A.T. Axmedov. Strength of Materials: study guide. Jizzax: Jizzakh Polytechnic Institute, 2023. 220 pp. URL: https://unilibrary.uz/literature/636427 4. S. Ubaydullayev, X.X. Igamberdiyev. Structural Mechanics: textbook. Jizzax: Jizzakh Polytechnic Institute, 2023. 292 pp. URL: https://unilibrary.uz/literature/499041 5. X.Sh. To'rayev, M.X. Ismatov, F.X. Yo'ldashev, B.K. Javliyev. Structural Mechanics: Theoretical Foundations and Practical Problems. Study guide Toshkent: Moliya, 2002. 460 pp. **Additional literature**

6. E.T. Achilov. Structural Mechanics. Textbook. Jizzax: Jizzakh Polytechnic Institute – 2023. 292 pp.
7. E.T. Achilov. Structural Mechanics. Part 1. Study guide. - Jizzax: Jizzakh Polytechnic Institute – 2022. 227 pp.
8. B.I. Ahmedov. Structural Mechanics: textbook. – Jizzax: Jizzakh Polytechnic Institute, 2022. – 318 pp.
9. R.D. Xamraqulov. Structural Mechanics and Structures: textbook. – Jizzax: Jizzakh Polytechnic Institute, 2022. – 208 pp.
10. N.N. Narbekov. Strength of Materials: textbook. – Toshkent: “Lesson Press” publishing house, 2023. – 251 pp.
11. K. Ismayilov, S.K. Toshev, O.I. Eshniyazov, S.S. Amanov. Strength of Materials: study guide. – Toshkent: “Mashhur-Press” publishing house, 2017. – 272 pp.
12. N.X. Mirzakabilov, S.D. Quralov. Strength of Materials: study guide. – Jizzax: Jizzakh Polytechnic Institute, 2022. 109 pp.
13. A.Q. Usmanqulov, K. Ismayilov, O.K. Adilov, A.B. Gadayev. Strength of Materials. Part 2: study guide. – Toshkent: “Mashhur-Press” publishing house, 2019. – 336 pp.
14. Z.S. Turdaliyev. Theoretical Mechanics. Study guide. – Jizzax: Jizzakh Polytechnic Institute, 2023. – 197 pp.
15. T. Bultakov, G‘.G‘. Egamnazarov, X.X. Igamberdiyev. Practical Course in Theoretical Mechanics: Statics: study guide. – Jizzax: Jizzakh Polytechnic Institute, 2020. – 219 pp.
16. T. Bultakov. Practical Course in Theoretical Mechanics: Kinematics: study guide. – Jizzax: Jizzakh Polytechnic Institute, 2022. – 153 pp.
17. N.N. Narbekov, B.U. Qabilov. Solving Exercises and Problems in Theoretical Mechanics: study guide. – Toshkent: “Lesson Press” publishing house, 2023. – 131 pp.

Information sources

18. University of California San Diego. Structural Engineering Course Catalogue (SE 101A–B, SE 103, SE 105, SE 110A–B, SE 130A–B). URL: https://catalog.ucsd.edu/courses/SE.html
19. The University of Queensland. Structural Mechanics (CIVL2330), Semester 1, 2026. URL: https://course-profiles.uq.edu.au/course-profiles/CIVL2330-21217-7620
20. The University of Queensland. Structural Analysis (CIVL3340), Semester 1, 2025. URL: https://course-profiles.uq.edu.au/course-profiles/CIVL3340-21312-7520
21. QS. The University of Queensland — QS World University Rankings 2027: #=40. URL: https://www.topuniversities.com/universities/university-queensland
22. QS. University of California, San Diego (UCSD) — QS World University Rankings 2027: #81. URL: https://www.topuniversities.com/universities/university-california-san-diego-ucsd
23. Times Higher Education. The University of Queensland — World University Rankings 2026: #=80. URL: https://www.timeshighereducation.com/world-university-rankings/university-queensland
24. Times Higher Education. University of California, San Diego — World University Rankings 2026: #47. URL: https://www.timeshighereducation.com/world-university-rankings/university-california-san-diego
25. UniLibrary — the unified electronic library information system of higher education institutions. URL: https://unilibrary.uz/
26. National Database of Legislation of the Republic of Uzbekistan. URL: https://lex.uz/uz/