Name of subject	Theoretical mechanics (ECTS 4)
Subject/module code	NMEX1404
Teaching Semesters	4th semester
Responsible teacher	Y. Kuvandikov, PhD., associate professor.
Course language	Uzbek
Connection to the curriculum	Compulsory
Teaching hours (this including independent study)	**Total hours-120.** **Audience Training hours – 48** Lecture training hours – 24 Laboratory training hours – 12 Practical training hours – 12 **Independent study -72 hours**
ECTS	4
The purpose and tasks of subject / learning outcomes	**I. The content of the subject -** The development of all branches of modern technology, technological processes and the requirements imposed on them, taking into account the need to solve new scientific problems, is extremely relevant. The creation of theoretical foundations of mechanical problems that can meet these requirements, in turn, can serve as a practical tool for justifying the purpose of teaching the subject "Theoretical Mechanics" to students. Since the lesson is the main form of education in mastering the subject, it should be scientific, systematic, understandable, conscious and active, with a solid assimilation of knowledge, and organized taking into account the personal characteristics of the student. The purpose of teaching the subject "Theoretical Mechanics" to bachelors is to ensure that they independently solve various problems and innovations that arise in the process of future scientific and technical development. At the same time, studying the subject "Theoretical Mechanics" should help the future bachelor develop his worldview, thinking skills, and the ability to apply theoretical knowledge to solve practical problems. The subject "Theoretical Mechanics" is studied as one of the universal fundamental sciences, like physics and mathematics, and is the basis of all technical sciences. The purpose of teaching the subject is to form in students the appropriate knowledge, skills, and qualifications in methods for determining stresses and deformations in machines and mechanisms and their elements and structures, as well as methods for calculating these structures for strength, stiffness, and stiffness. **The task of science is -** Students are expected to develop basic skills in design and construction calculations, which are one of the main issues in the design process of machines and mechanisms, to be able to apply the basic methods of analyzing the balance, motion, and interaction of mechanical systems for machine and structure structures in solving technical problems, to be able to build and study mechanical and mathematical models of technical systems, and to develop the skills to study the balance and motion of mechanical systems. **Learning outcomes:** 1. Conditions of equilibrium of a rigid body under the influence of various systems of forces located arbitrarily in a plane and in

	space, methods for finding the center of gravity of a rigid body; 2. Forms of motion of a rigid body in mechanical motion, laws of mechanical motion taking into account changes occurring in the environment; basic laws and principles of dynamics, differential equations of motion of mechanical systems, general theorems of rigid body dynamics; internal forces arising in structural elements, stresses and deformations arising in simple types of deformation, calculation scheme of buildings and structures and their kinematic analysis; theory of influence lines, displacements arising in elastic systems, methods for calculating static and uncertain systems; 3. Theoretical foundations of science and application of scientific calculation formulas in solving practical problems; correct selection of calculation models of machine and mechanism elements; determination of internal forces and deformations in machine and mechanism elements; selection of calculation schemes for buildings and structures and their kinematic analysis; 4. Theory of influence lines; have the skills to calculate statically definite and uncertain systems under the influence of fixed and moving loads; 5. Apply and implement the knowledge gained in theoretical mechanics in the process of passing engineering and special disciplines; select computational models of machine and mechanism elements, select machine and mechanism calculation schemes and perform their kinematic analysis; **6.** determine stresses and displacements in machines and mechanisms; must have the skills to calculate statically definite and uncertain systems.
Course content (topics)	**I. Main theoretical part (Lecture)** Module 1. Topic 1. Introduction to theoretical mechanics. Basic concepts and axioms of statics. Topic 2. Projection of a force on an axis. System of intersecting forces at a point. Determination of an equal acting force. Topic 3. Balance of intersecting forces at a point. Topic 4. Moment of a force about a point and an axis. Couple force. Couple moment. Topic 5. Friction force. Friction in sliding and rolling. Module 2. Topic 6. Introduction to kinematics. Methods of transmitting point motion. Point trajectory. Topic 7. Determination of velocity and acceleration when the motion is given by a vector, coordinates and natural method. Topic 8. Forward motion of a rigid body. Rotational motion of a rigid body around a fixed axis. Plane parallel motion of a rigid body. Equations of plane parallel motion. Topic 9. Complex motion of a material point. Module 3. Topic 10. Introduction to dynamics. Basic laws of dynamics. Two main problems of dynamics. Topic 11. Elementary work of force. Force. Oscillatory motion of a material point. Topic 12. The magnitude of the momentum of a material point. Theorem on the change in the magnitude of the momentum of a material point.

II. Instructions and recommendations for organizing laboratory exercises.

In laboratory exercises, students develop basic skills in design calculations, which are one of the main issues in the design of machines and mechanisms, as well as practical skills and qualifications in conducting experiments, calculating and drawing tables and graphs. The proposed topics are selected based on opportunities and conditions.

Recommended topics for laboratory work:

1. Experimentally determine the equivalent force of a system of forces on a plane intersecting at one point.
2. Experimentally determine the center of gravity of a homogeneous plate.
3. Experimentally determine the laws of friction force.
4. Determine the speed of an object using angular velocity
5. Study the laws of oscillatory motion.
6. Experimentally study the law of conservation of momentum.
7. Study the motion of an object thrown in a horizontal direction.

III. Instructions and recommendations for practical training

The teacher's preparation for a practical training begins with the study of preliminary documents (curriculum, thematic plan, etc.) and ends with the development of a lesson plan. The teacher should have an idea of the goals and objectives of the practical training, the amount of work that each student must perform.

Methodological instructions are the main methodological document of the teacher in preparing and conducting practical training.

The purpose of a practical training is to understand the theory, acquire skills. It is to consciously apply it in educational and professional activities, and to develop the ability to confidently form one's own point of view.

Recommended practical topics:

1. Projection of a force on an axis. Solving problems related to a system of intersecting forces. A system of forces located arbitrarily on a plane. Solving problems related to the equilibrium of intersecting forces at a point.
2. Solving problems related to the moment of a force about a point and an axis. Couple moment. Solving problems related to determining the support reaction forces.
3. Solving problems related to determining the support reaction forces of a rigid body.
4. Solving problems related to determining the friction force.
5. Determining the velocity and acceleration of a point according to the given equations of motion.
6. Problems related to the rotational motion of a rigid body around a fixed axis. Determining the velocity and acceleration of a point in complex motion.
7. Solving problems related to the direct and inverse problems of dynamics.
8. Integrating differential equations of motion of a material point under the influence of constant forces. Problems related to the work of a force and the determination of power. Application of the theorem on the change in the magnitude of momentum to determining the velocity of a material point.

Instructions for organizing computational and graphic

	work The main purpose of performing computational and graphic work: - To develop students' skills in applying the theoretical knowledge they have acquired in practice and to form their independent work. - Each student in the subject performs computational and graphic work on the basis of individual assignments. When performing them, it is recommended to use the methodological instructions developed by the department for performing these computational and graphic works and the questions prepared for independent work. **Topics of the recommended computational and graphical works:** 1.Task-S1. Determination of the support reaction forces of a rigid body. 2.Task-K1. Determination of the velocity and acceleration of a point according to the given equations of motion. 3.Task-D1. Integrating the differential equations of motion of a material point under the influence of constant forces. **IV. IV. Independent study and independent work** 1. Simplification of a system of forces located on a plane. 2. Equilibrium of a system of forces located in space. 3. Kinematics of a point. Special cases of motion. 4. Parallel motion of a rigid body in a plane. 5. Forced oscillatory motion of a material point. Resonance phenomenon. The ability to solve problems in science is of great importance. The main way to study certain topics in depth and solve problems is to be able to work independently with textbooks and manuals. The ability to work independently with a book is not only the basis of training an engineer, but also the basis of all his activities. In addition, it is recommended that students use lecture texts for independent mastery of the topics covered. Students' independent mastery of topics is not assessed separately, they are reflected in the current, intermediate and final assessments. Independent study is a mandatory training course for students and is planned in nature. Independent work topics consist of lecture and practical topics planned for independent study. Independent study strengthens students' theoretical knowledge and helps them to master the topics well. It is recommended that students make notes, prepare presentations, prepare abstracts and present them on topics that are independently studied.
Exam form	Written
Teaching/learning and examination requirements	Complete mastery of theoretical and methodological concepts and practical knowledge of the discipline, the ability to correctly reflect the results of analysis, independently reason about the processes being studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control. When drawing up final exam questions, deviations from the content of the discipline program are not allowed. The bank of final exam questions for each discipline is discussed at the meeting and approved by the head of the department. No later than 1 week before the start of the final control, tickets signed by the head of the department, enclosed in an envelope, are sealed by the Dean’s office and opened 5 minutes before the start of the

	exam in the presence of students. Final exam duration is 80 minutes. Answers to final exam questions are recorded in copybooks with the seal of the Dean's office. After completion of the final work, the work is immediately encrypted by a representative of the Dean's office, and the copybooks are handed over to the commission for verification. From the moment of completion of the final exam, a period of 72 hours is allotted for checking and posting the results on the electronic platform. The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers. Student(s) who are dissatisfied with the final exam results may submit a written or oral appeal within 24 hours of the publication of the final exam results. Complaints submitted after 24 hours from the publication of the final exam results will not be accepted.
Scope of assessment criteria and procedure	CURRENT CONTROL Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics. Instructions: The student's activity in daily classes is assessed through the student's mastery of course topics, as well as constructively interpreting and analyzing the educational material, developing module-specific skills, acquiring practical skills (in terms of quality and the specified number) and competencies, solving problem situations aimed at applying professional practical skills, working in a team, preparing presentations, etc. Current control form: Activity in lessons Preparing educational materials Working with sources within the subject Using educational technologies Working in a team Preparing presentations Working with projects. MIDTERM CONTROL Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course. Form and procedure of intermediate control: Midterm examination is held during the semester during the training sessions after the completion of the relevant module of the curriculum of the subject. Midterm examination is held once in written form within the framework of this subject. Midterm examination questions cover all topics of the subject. INDEPENDENT LEARNING Purpose: Independent learning is aimed at fully covering the content of this course, expanding the theoretical knowledge acquired, and establishing independent learning activities for students. Form and procedure of independent education: independent work assignments are completed in the form of an educational project, presentation, case study, problem solving, information search, digest, colloquium, essay, article, abstract, etc. Completed assignments for independent study are placed in the electronic system and checked based on the anti-plagiarism program and evaluated by the subject teacher. In this case, the uniqueness of the completed assignment should not be less than 60%, otherwise the assignment will not be accepted for assessment. The number of independent work assignments, depending on the nature of the subject, should not be less than 3 for one subject (module). Independent work assignments account for 60% of the points allocated for current and intermediate control. FINAL CONTROL Purpose: The final examination is held at the end of the semester to determine the level of mastery of the student's theoretical knowledge and practical skills in the relevant subject. The final examination is held at a

specified time according to the examination schedule created by the Registrar's Office on the electronic platform.

Requirements: The student must have passed the current control, intermediate control and independent learning assignments by the deadline for the final control type in the relevant subject. A student who has not passed the current control, intermediate control and independent learning assignments, as well as who has received a score in the range of "0-29.9" for these assignments and control types, is not included in the final control type. Also, a student who has missed 25 percent or more of the classroom hours allocated to a subject without a reason is excluded from this subject and is not included in the final control type and is considered not to have mastered the relevant credits in this subject. A student who has not passed or was not included in the final control type and has received a score in the range of "0-29.9" for this type of control is considered to be an academic debtor.

Final control form: The final examination in this subject will be conducted in written form. If the final examination is conducted in written form, the requirements for assessment must also be reflected.

Criteria for assessing student knowledge

5 grade	100 points		Assessment criteria
5	90-100	Excellent	When a student is considered to be able to make independent conclusions and decisions, think creatively, observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and have an idea about the subject.
4	70-89,9	Good	When the student is considered to be able to observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and has an idea about the subject.
3	60-69,9	Satisfactory	When the student is found to be able to apply the knowledge he has gained in practice, understands, knows, can express, and narrate the essence of the subject, and has an idea about the subject.
2	0-59,9	Unsatisfactory	When it is determined that the student has not mastered the science program, does not understand the essence of the subject, and does not have an idea about the science.

Course assessment criteria and procedure

Assessment type	Total points allocated	Control (task) form	Distribution of points	Qualifying score
Current assessment	30 points	System tasks	20 points (divided by the number of tasks)	18 points
		Student activity (in seminars, practical, laboratory classes)	10 points	
Midterm assessment	20 points	Supervision: Written work	10 points	12 points
		System tasks	10 points	

			(divided by the number of tasks)	
Final assessment	50 points	Written assignment (5 questions)	50 points (10 points per question)	30 points
* Note: 60% of the points allocated for current and intermediate control are allocated to independent work assignments. Independent work assignments are evaluated as system assignments through the electronic platform.				

Recommended Literature

Main literature:

1. Sh.A.Shoobidov, X.N.Habibullayeva, F.D.Fayzullayev "Nazariy mexanika" Toshkent "Yangi asr avlodi" nashriyoti 2008 yil.
2. P.Shohaydarova, Sh.Shoziyotov, J.Zoirov. "Nazariy mexanika", "O'qituvchi" nashriyoti. Toshkent-1981.
3. B.A.Fayzullayev "Nazariy mexanika" Cho'lpon nomidagi nashriyot-matbaa ijodiy uyi Tashkent 2011 yil
4. J.Zoirov, B.Ahmadxo'jayev. "Nazariy mexanika" II qism, O'zbekiston Respublikasi Fanlar akademiyasi "Fan" nashriyoti. Toshkent-1998. 157 – 160-betlar.
5. V.I. Szolga, «Theoretical mechanics», Berlin, part-1,2013 y., -204 p.
6. V.I. Szolga, «Theoretical mechanics», Berlin, part-2,2013 y., -261 p.
7. F.Smith and W.R. Longley «Theoretical mechanics», New York-London, 2014 y,-288 p.
8. Meshcherskiy l.V. Nazariy mexanikadan masalalar to'plami. O'quv qo'llanma. – T. O'qituvchi, 1990 . – 448 6.
9. Mirsaidov M.M., Boymurodova L.I., Giyasova N.T. Nazariy mexanika. O'quv qo'llanma – T.:O'zbekiston, 2008. – 246 b.
10. Яблонский А.А. Сборник задач для курсовых работ по теоретической механике. Москва: 2000. – 240 с.

Additional literature

1. Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. PF-4947 "On the Strategy of Actions for the Further Development of the Republic of Uzbekistan".
2. Karimov K.A., Habibullayeva X.N. «Mexanik sistema harakatini o'rganishda sistema kinetik energiyasining o'zgarishi haqidagi teoremani qo'llash» Uslubiy ko'rsatma. T.:TDTU, 2013.
3. Karimov K.A., Habibullayeva X.N. «Mexanik sistema harakatini o'rganishda sistema kinetik energiyasining o'zgarishi haqidagi teoremani qo'llash» Uslubiy ko'rsatma. T.:TDTU,2013.
4. Мещерский И.В. Сборник задач по теоретической механике. Учебное пособие.СПб.: Лань,2005. —448с.
5. Бутенин Н.В., Лунц Я.Л., Меркин Д.Р. Курс теоретической механики: Учебник. Спб.:Лань, 2008. – 736 с
6. T. Bultakov, G'.G'.Egamnazarov, X.X.Igamberdiyev Nazariy mexanika. Praktikum. Statika.

Information sources

1. www.lex.uz – National database of legislative documents of the Republic of Uzbekistan.
2. www.ziyonet.uz – Education portal of the Republic of Uzbekistan.
3. www.ilm.uz.
4. www.zivo.net.
5. http://www.zivo.net
6. http://www.nazmex.ru

http://www.books.google.ru