

AN EFFECTIVE WAY TO ASSESS STUDENT KNOWLEDGE IN  
THEORETICAL MECHANICS

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**Abstract:** It is important to use modern methods in the assessment of theoretical mechanics in higher educational institutions. The proposed method for fair determination of students' knowledge level and increasing their activity in classes using the method of interactive confused logical chain. By using the method for one subject, section and whole part of the science of theoretical mechanics, the possibilities of fair, transparent and quick assessment of students' knowledge level are shown.

**Key words:** theoretical mechanics, statics, kinematics, dynamics, force, equation, system of meeting forces, condition of analytical balance, couple force, force system located in a plane, instantaneous center of velocities, axiom, motion, speed, acceleration, rotational motion.

Nowadays, great changes are being made in the field of education all over the world. In particular, the number of students of higher educational institutions and the number of educational fields is constantly expanding and increasing. Our opinion is evidenced by the fact that 5 more state and non-state higher educational institutions have been added to the existing 3 higher educational institutions in Namangan region alone. Therefore, the increase in the number of students makes it necessary to provide them with quality education and to use methods of fair, quick and transparent assessment of the level of knowledge. Therefore, the issue of using the recently widely used confused logical chain method in science training is urgent.

"Confused logical chain" method has become one of the most effective methods for determining the level of students' knowledge of theoretical mechanics. This method is distinguished by its ease of use within one subject of science, in the process of conducting intermediate evaluation, and in the stage of conducting final evaluation. When using this method, the student is able to combine concepts related to the studied topic such as formulas, phrases, definitions, theorems related to the science of theoretical mechanics with information on several studied topics, and to match the correct ones from among them. should be able to. In this case, the set of facts related to the topic is presented to the attention of students in a case where the chronological order of cause and effect is confused (broken). Students should be able to correctly place the task in order.

Let's see the application of the method in the teaching process of the topic "Center of gravity of a solid body" of the statics department of theoretical mechanics. Information about quantities and formulas on the subject is provided by the method of confused logical chain. The teacher distributes copies of tables corresponding to the number of students in the audience to the students of the group. After studying the given table in detail, students write down the answer number for each question listed on the left and the corresponding number on the right. Then the teacher collects the answers from all the students, checks them and announces the results. Below is a table corresponding to the above topic.

Determine compatibility:

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1	Show the expression of the theorem about three forces	1	If the lines of action of the system of forces acting on a rigid body intersect at one point
2	Show the conditions of analytical equilibrium of the system of opposing forces	2	$\sum F_{kx} = 0$
3	Show the formula for finding the amount of an effector of equal mass in a system of opposing forces	3	Equal to the diagonal of the parallelogram built on these equally acting forces, it is directed along the diagonal
4	What kind of system of forces is called a system of opposing forces	4	If a body is in equilibrium under the action of three non-parallel forces lying in the same plane, the lines of action of these forces intersect at one point
5	How to find the equal effects of two forces in different directions placed on the same point	5	$R = \sqrt{(\sum F_{kx})^2 + (\sum F_{ky})^2 + (\sum F_{kz})^2}$
6	Show the conditions of analytical equilibrium of the system of forces directed along a straight line	6	$\sum F_{kx} = 0$ , $\sum F_{ky} = 0$ , $\sum F_{kz} = 0$

**Correct answers (4,6,5,1,3,2).**

We will now use the method of entangled logic chain for a branch of theoretical mechanics - the branch of statics. The results of this score can be used to test students' knowledge in a non-traditional way to determine the level of mastery of the studied unit by the student and to determine midterm assessment scores. In this case, the number of questions will be more compared to the evaluation of one subject. Because the higher the number of questions, the higher the level of objectivity. At the beginning of the academic year, professors of the department create a bank of questions, which are regularly filled and improved. Below is the table covering all the topics of Statics of Theoretical Mechanics:

Determine compatibility:

1	What is the direction of the string tension force?	1	Perpendicular to the supporting plane
2	When is the moment of force about the point equal to zero	2	A pair of forces perpendicular to the plane, when viewed from the end of this vector, the force rotates the body in the counterclockwise direction

3	Show the analytical equilibrium equations of the system of forces located arbitrarily in the plane	3	$\sum F_{kz} = 0, \sum m_x(\vec{F}_k) = 0, \sum m_y(\vec{F}_k) = 0$
4	A light bulb weighing 45 n is hanging from the ceiling. What is the tension in the rope from which the light bulb hangs?	4	20 nm
5	What is the direction of the torque vector	5	If the line of action of the force passes through the moment center
6	Show the main term of statics	6	The effects of two bodies on each other are equal in amount and directed in opposite directions along a straight line.
7	State the axiom of reaction to action	7	When a system of forces located arbitrarily in space is brought to a center, it is exchanged with a principal vector equal to the geometric sum of the given forces and a principal moment equal to the geometric sum of the moments of the added pair of forces
8	What is the direction of the reaction force of the movable joint support	8	Depending on the hanging point along the string
9	What is the torque obtained from the pair of forces with a magnitude of 10 n and a force shoulder of 2 m relative to an arbitrary point in the pair plane?	9	45 n
10	Show the conditions of analytical balance of parallel forces in space	10	$\sum F_{kx} = 0, \sum F_{ky} = 0, \sum m_A(\vec{F}_k) = 0$

**Correct answers** (8,5,10,9,2,7,6,1,4,3).

As a result of using the studied method to determine the level of knowledge acquired by students in the entire field of theoretical mechanics, it is possible to quickly, transparently and fairly evaluate their level of knowledge. In this case, the teacher selects materials from the question bank from the departments of statics, kinematics and dynamics of science. Below is a table covering all sections of science. It is natural that the number of questions offered to students increases as the weight of the material increases. However, after a certain number of questions (40-50) using the method of confused logical chain causes a number of inconveniences. Therefore, it is necessary to use this method without increasing the number of questions to 25 when conducting the final assessment.

Determine compatibility:

1	Show the expression of the theorem about the change of the momentum of a material point	1	$x_c = \frac{\sum l_k \cdot x_k}{\sum l_k}$ , $y_c = \frac{\sum l_k \cdot y_k}{\sum l_k}$ , $z_c = \frac{\sum l_k \cdot z_k}{\sum l_k}$
2	State the law of free oscillating motion	2	$\vec{a}_B = \vec{a}_A + \vec{a}_{AB}$
3	Show the formula for finding the Coriolis acceleration	3	$\sum F_{kx} = 0$ , $\sum F_{ky} = 0$ , $\sum F_{kz} = 0$ $\sum m_x (\vec{F}_k) = 0$ , $\sum m_y (\vec{F}_k) = 0$ , $\sum m_z (\vec{F}_k) = 0$
4	State the rate of flat traffic	4	A point of a flat shape where the velocity is zero at a given time
5	Show the methods of determining the center of gravity of a solid body	5	Perpendicular to a smooth surface
6	Show the conditions of analytical equilibrium of a system of forces located arbitrarily in space	6	$\vec{a}_{kor} = 2 \vec{\omega}_e \times \vec{v}_r$
7	What is the direction of the smooth surface reaction force?	7	Symmetry, division, negative surfaces, integration, experience
8	What is the instantaneous center of velocity	8	If the angular velocity does not change during the rotation of the body
9	A wheel with a radius of 1.5 m is moving at a speed of 30 m/s on a level road. What is the amount of angular velocity?	9	$\frac{(x-8)^2}{81} + \frac{(y+4)^2}{144} = 1$ , <i>ellips</i>
10	Movement $x=9\sin 5t+8$ m, $y=12\cos 5t-4$ m find the equation of the trajectory of a point moving in a plane by the law	10	$\omega = 20$ 1/s
11	State D'alambert's principle for a material point	11	Given the mass of a material point and the law of motion, the acting force is found

12	Define static definite problem	12	If the axis and the force lie in the same plane
13	Show the formula for determining the center of gravity of a line	13	$m\vec{v}_1 - m\vec{v}_0 = \vec{S}$
14	Show the formula for finding the acceleration of an arbitrary point of a body moving parallel to the plane	14	$x = c_1 \cos k t + c_2 \sin k t$
15	When is the moment of force relative to the axis equal to zero	15	If the number of unknowns in the given problem is greater than the number of equilibrium equations
16	State the first problem of dynamics	16	If we add the inertial forces to the series of active forces acting on the material point, the connection reaction forces, their geometrical sum is equal to zero.

**Correct answers** (13,14,6,8,7,3,5,4,10,9,16,15,1,2,12,11).

So, as a result of using the method of confused logical chain, students have the ability to organize the subjects they have studied in science, to divide them into components, to compare them with other parts of the subject, to understand information about the newly studied subject. skills are formed. Regular use of this method in lectures gives students the opportunity to systematically study science materials, organize, divide and differentiate what they have learned. As a result of the above facts, the level of knowledge of students will increase significantly. The activity of students in the lessons also increases. The ability of the teacher to objectively determine the level of knowledge of students in a quick way, to successfully conduct intermediate and final evaluations increases.

When planning to evaluate students' knowledge using the method of confused logical chain, it is necessary to pay attention to the following:

- it is necessary to expand the bank of questions related to science by topic.
- a bank of questions should be created separately for each subject, chapter and part of the science.
- it is necessary to create a bank of logical, easy-to-solve examples and problems related to the topics.
- in order to determine the level of mastery of the subject of science, it is necessary to compile the options of tables consisting of 5-10 questions at least equal to the number of students in the group.
- the professor-teacher offers the option of tables consisting of 10-20 questions to students for mid-term assessment.

- it is recommended to prepare tables of 15-25 questions for the final control assessment.
- Samples of the question bank and example-problem bank and the order of execution should be regularly published on the website of the department.
- the bank of questions and the bank of example problems should be updated every academic year.

In short, the method of the confused logical chain is one of the modern and convenient methods for determining the level of students' knowledge. This method is distinguished from other assessment methods by the fact that it is especially effective in checking students' knowledge on one topic of science, on one chapter of science, and during midterm control.

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