Innovative Approaches in Higher Education on the Example of the Course «Engineering Mechanics»

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Theoretical mechanics is a fundamental and basic discipline in engineering education.

Focusing on the engineering content of educational material and modern digital technologies is the way that the authors chose when creating a new digital educational content with the expectation of its widespread use in the higher education system of Russia in various forms of organization of the educational process.
The online course "Engineering mechanics" 180 hours (5 credits) lasting 18 weeks in Russian, created in 2015 and placed on the National platform of open education, is aimed at radical modernization and significant increase in the efficiency of the educational process in technical universities of the Russian Federation in the discipline of theoretical mechanics.
- lectures
- practical example
- base of training tasks (simulators)
- homework
- demonstration of video materials
Homework and study assignments

Домашнее задание

Задание

7 возможных баллов (оценивается)

Найдите скорость движения велосипеда при ускоренной передаче в его трансмисии, если частота вращения резиновой (капсулы) 55 об/мин, количество зубьев у передних (ведущих) звездочек - 23, 32, 42, а у задних (ведомых) - 11, 15, 17, 19, 21, 24, 30.

\[ D = 20 \text{ "} \] - диаметр колеса в дюймах.

Автомобиль Mercedes-Benz Sedan (2010 года) осуществляет движение по криволинейному участку дороги. Характеристики автомобиля: колеса \( w = 2.12 \text{ м} \), колесная база \( l = 3.16 \text{ м} \), расстояние от задней
Tests

1. A gymnast jumps into water with a weight of 600 N. The trampoline has a weight of 800 N. Find the reaction forces at point A, given that a = 1.1 m, b = 2.7 m, c = 5.4 m.

2. A revolute joint mechanism rotates with a constant angular velocity \( \omega = 5.5 \) rad/s. The cylinder 3 is at a specified position. Find the angular velocity (rad/s) of cylinder 3 in the given position of the mechanism.

3. The cylinder 3 rotates with a constant angular velocity \( \omega = 0.5 \) rad/s. Cylinder 2 and the undercarriage are connected by a revolute joint. Find the relative acceleration (mm/s²) of the undercarriage when \( \varphi = 45^\circ \).
Interactive tool
Basic project

- on an individual task
- consists of 5 stages.
Comparative academic performance of students of internal form of training of the Ural Federal University in theoretical mechanics

- With the use of the online course "Engineering mechanics": 84% academic performance
- Traditional form of education: 62% academic performance
Models of the use of online courses in the educational process

• **ONLINE LEARNING**
  with consulting support of the course by teachers

• **MIXED FORM OF EDUCATION**
  PART of the materials is transferred to online training

• Multimedia support in the **TRADITIONAL** form of education
The number of students in basic engineering training courses placed in a single window of a single digital educational environment.
Online course "Engineering mechanics" on the international platform edx.org

- first course of UrFu hosted on the international platform edx.org

- the total number of international students is 17,819 from 155 countries.
Percentage of countries launching the online course "Engineering mechanics" in 2019

- India: 1.7%
- United Kingdom: 1.7%
- Germany: 2.7%
- Indonesia: 3.4%
- Turkey: 4.4%
- Philippines: 6.3%
- Unknown Country: 6.7%
- United States of America: 9.7%
- Other country: 13.8%
- Canada: 14.2%

Engineering Mechanics
- A radical change in the content and form of presentation of traditional material on mechanics.

- Creation of bright visual image, strict mathematical model and rational solution of examples and problems

- Currently, there are no analogues of the course in Russia, both in the number of students and in the set of author's solutions that allow the most effective use of all the possibilities of modern educational platforms.

- Online course "Engineering mechanics" allows for one of the most popular disciplines in the training of technical specialists to significantly improve the quality of training, reduce costs, increase motivation of students, more effectively use the work of teachers.
Thanks for your attention!