Subject programme

1. Subject name / subject module: **Elective Subject: Analitycal mechanics**
2. Lecture language: **English**
3. The location of the subject in study plans:
   - Area or areas of the studies: **Computer Control Systems Engineering**
   - Degree of the studies: **2nd degree studies**
   - Field or fields (implementation of effects standard): **Mechatronics**
4. Supervision of subject implementation:
   - The Institute / Another unit: **The Institute of Informatics and Mechatronics**
   - The person responsible for the subject: **Szczutkowski Marek, dr inż.**
   - People cooperating in the development of the programme of the subject:
5. The number of hours and forms of teaching for individual study system and the evaluation method

Teaching activities with the tutor																							Total
Form of classes / Mode of study		SOW	ECTS	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	ECTS
Full-time studies				24	26	2																**2**
Part-time studies																						
Credit rigor	...			Graded assigment																		

6. Student workload – ECTS credits balance
   1 ECTS credit corresponds to 25-30 hours of student work needed to achieve the expected learning outcomes including the student's own work

Activity (please specify relevant work for the subject)	**Hourly student workload (full-time studies/part-time studies)**
Participation in laboratory classes	**24**
Preparing reports	**10**
Preparing homeworks	**14**
Participation in an exam / graded assignment / final grading	**2**
Total student workload	**50**
ECTS credits	**2**
* Student's workload related to practical forms	**50**
Student's workload in classes requiring direct participation of academic teachers	**24**

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:

   Necessary mathematics skills in order to develop knowledge in machine design.

   Recommended duration of the subject is taken from the course plan.
8. Specific learning outcomes – knowledge, skills and social competence

Specific learning outcomes for the subject		Form	Teaching method	Methods for testing of (checking, assessing) learning outcomes
Outcome symbol	Outcome description			
Knowledge				
K_W01	**Student is able to define the basic concepts and phenomena of analytical mechanics.**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
K_W03	**Student has an ordered, theoretically founded general knowledge that allows him to solve selected problems in the area of analytical mechanics.**			
K_W04	**Student can provide simple examples of the application of analytical mechanics in the field of mechatronics.**			
Skills				
K_U01	**Student is able to gather, intergrate, interpret, analyze and present information in the area of analytical mechanics.**	**Laboratory work**	**Inquiry methods**	**Student learning activities**

Social competence				
K_K02	Student is ready to recognize knowledge in order to solve various problems in the area of analytical mechanics as well as is able to interact and work in a group trying to find the best solution.	Laboratory work	Inquiry methods	Student learning activities

9. Assessment rules / criteria for each form of education and individual grades

0% - 50%	ndst	**81% - 90%**	db
51% - 70%	dst	**91% - 93%**	db+
71% - 80%	dst+	**94% - 100%**	bdb

Activity	Grades	Calculation	To Final
Reports	**bdb(5)**	**5*50%**	**2,5**
Activity during classes	**Example: db, dst, bdb(4,3,5)**	**Avg. (4+3+5)/3=4->4*20%**	**0,8**
Homeworks	**Example: ndst, bd, dst (2, 4, 3)**	**Avg. (2+4+3)/3=3->3*20%**	**0,6**
Attendance	**On 75% of all classes**	**10%**	**0,375**

10. The learning contents with the form of the class activities on which they are carried out

(Laboratory work)

1. Movement equations: Generalized coordinates; principle of least action; principle of relative importance of Galilee; function of the Lagrange free point of material; function of the Lagrange layout of physical points;

2. Retention rights: Energy; momentum; Mechanical polarity;

3. Integrating motion equations: One-dimensional movement; Determination of potential energy from vibration period

4. Rigid body movement: Inertia peak; hard body momentum; Rigid body movement equation; Euler equation and equation; Rigid body contact;Principle of smallest action; Movement in non-inertial reference system ;5. Canonical equations: Hamilton equations; Routhha function; function as a function of coordinates; Maupertuis principle; Liouville drilling; Hamilton-Jacobago equation; Function of Routhha; Function as a function of coordinates; Principle of the Maupertuis; drilling of Liouville; Equalization of Hamilton-Jacobago; Distribution of variables; Properties of multidimensional traffic;

6. Mechanical vibration; Motor-operated movement phases; Pink vibration movement; Minimum operating principle; Free movement of the system with one degree of freedom; Force vibration of the system with one degree of freedom; Principle of smallest action

7. Vibrations in multi-degree systems

11. Required teaching aids

Laboratory classes - specialist laboratory

12. Literature:

a. Basic literature:

Hand L.N. , Finch J.D., Analytical Mechanics, Cambridge University Press, 1998

a. Supplementary literature:

Fasano A., Marmi S., Analytical Mechanics, Oxford University Press, 2006

Lurie A.I. , Analytical Mechanics, Springer-Verlag Berlin Heidelberg 2002

b. Internet sources:

https://www.iaa.csic.es/~dani/ebooks/Mechanics/Analytical%20mechanics%20-%20Hand,%20Finch.pdf, 12.2020

http://homepage.sns.it/marmi/papers/Fasano,%20A.%20&%20Marmi,%20S.%20-%20Analytical%20mechanics%20(Oxford,%202006).pdf, 12.2020

http://fy.chalmers.se/~tfemc/mekanikkompendium.pdf, 12.2020

13. Available educational materials divided into forms of class activities (Author's compilation of didactic materials, e-learning materials, etc.)

14. Teachers implementing particular forms of education

Form of education	Name and surname
1. Laboratory classes	Szczutkowski Marek, dr inż.