SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Automation and Computer Science
1.3	Department	Automation
1.4	Field of study	Systems Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Automation and Applied Informatics (in English)
1.7	Form of education	Full time
1.8	Subject code	28.00

2. Data about the subject

2.1	Subject name			Mechanical Engineering			
2.2	Subject area			Mechanical Engineering			
2.3	Course responsible/lecturer			S.l.dr.ing. Ciprian-Radu RAD - ciprian.rad@mdm.utcluj.ro			
2.4	Teachers in charge of seminars			S.l.dr.ing. Ciprian-Radu RAD - ciprian.rad@mdm.utcluj.ro			
2.5 Year of study	2	2.6 Semester	4	2.7 Assessment	C	2.8 Subject category	DID DI

3. Estimated total time

3.1 Number of hours per week	4	3.2 of which, course:	2	3.3 applications:	2
3.4 Total hours in the curriculum	100	3.5 of which, course:	28	3.6 applications:	28
Individual study					hours
Manual, lecture material and notes, bibliography					10
Supplementary study in the library, online and in the field					10
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					18
Tutoring					3
Exams and tests					3
Other activities					0

3.7	Total hours of individual study	44
3.8	Total hours per semester	100
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Physics, Mathematics, Informatics
4.2	Competence	Mathematics, Physics, Informatics, Measurement Techniques, Technical Drawing

5. Requirements (where appropriate)

5.1	For the course	Face to face: video projector, blackboard with white and colored chalk, whiteboard with colored markers.

5.2	For the applications	Face to face: video projector, blackboard with white and colored chalk, whiteboard with colored markers, hands on sessions on representative equipment from laboratory.

6. Specific competences

Professional competences	C1 - Operating with basic Mathematical and Physical knowledge, Measurement Techniques, Technical Drawing, Mechanical Engineering, Chemistry and Electronics in the field of Automation and Applied Informatics (4 credits).
Cross competences	CT2 - Identify roles and responsibilities in an interdisciplinary team, making decisions and assigning tasks, applying techniques and effective work relationships within the team.

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	• To know the structure, operation, and the bases of design of mobile mechanical systems that can be found in the structure of mechatronic systems, and which integrates mechanical components, electrical, electronics and information technology. • To know the main types of mobile mechanical systems (mechanisms), the main problems related to their study, the terminology, and the dedicated technical drawing language and the specific aided design methods.
7.2	Specific objectives	• To communicate effectively in writing and orally with specialists from the field of mechanical engineering. • To use methods and systems for measuring functional parameters of various mobile mechanical systems. • To use mathematical concepts and the suitable methods and software packages to simulate various rigid and mobile mechanical systems. • To participate and apply the obtained knowledge in interdisciplinary research and design teams. • To analyze and interpret experimental data from the field of mechanical engineering. • To understand and to critically analyze technical solutions from the field of mechanical engineering.

8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
C1. Introduction to Mechanical Engineering. Hardware structure of mechatronic systems. The role of mechanisms and mechanical transmissions in their structure (2 hours)	Free exposure at blackboard combined with multimedia presentations	-
C2. Structural analysis of planar mechanisms – Part 1 (2 hours)		
C3. Structural analysis of planar mechanisms – Part 2 (2 hours)		
C4. Kinematic analysis of planar mechanisms (2 hours)		
C5. Static force analysis of planar mechanisms (2 hours)		
C6. Dynamic force analysis of planar mechanisms (2 hours)		
C7. Introduction to mechanical engineering design (2 hours)		
C8. Spur gear design (2 hours)		
C9. Analysis and synthesis of gear mechanisms – Part 1 (2 hours))		
C10. Analysis and synthesis of gear mechanisms – Part 2 (2 hours))		
C11. Analysis and synthesis of cam mechanisms (2 hours)		
C12. The balancing of mechanisms and machines (2 hours)		
C13. Mechanisms for industrial robots (2 hours)		
C14. Mechanical engineering basics for pneumatics (2 hours)		

Bibliography

[1] Robert L. Norton, Design of Machinery: An Introduction to The Synthesis and Analysis of Mechanisms and Machines, Fifth Edition, McGraw Hill, 2011.
[2] Robert L. Norton, Machine Design: An Integrated Approach, Fifth Edition, Prentice Hall, 2011.
[3] David H. Myszka, Machines & Mechanisms: Applied Kinematic Analysis, 4th Edition, Pearson, 2011.
[4] Eric Constants, Karl B. Dyer, Introduction to Mechanism design with computer applications, 1st edition, CRC Press, 2018.
[5] Antonio Simón Mata et al., Fundamentals of Machine Theory and Mechanisms, Springer, 2018.
[6] Ye Zhonghe, Lan Zhaohui, M.R. Smith, Mechanisms and Machine Theory, Higher Education Press, 2001.
[7] Cyrus Raoufi, Design of Mechanism with SolidWorks Motion Analysis and MATLAB/Simscape, KYRA Engineering Serices Inc., Canada, 2019.
[8] John J. Uicker, Jr. et al., Theory of Machines and Mechanisms, Fifth Edition, Oxford University Press, 2016.
[9] Calin Rusu, Mecanisme, U.T. Press, Cluj-Napoca, 2021.
[10] V. Handra-Luca, Organe de mașini și mecanisme, Editura didactică și pedagogică București, 1975.
[11] Voinea, R., ş.a., Introducere în mecanica solidului cu aplicații în inginerie, Ed.Academiei, București, 1985.
[12] Szekely, E., Dali, A., Mecanisme, Ed.UT Pres, Cluj-Napoca, 1993.

8.2. Applications/Seminars	Teaching methods	Notes
S1. The role of mechanisms and mechanical transmissions in the structure of mechatronic systems. Examples (2 hours)		
S2-S3. Structural analysis of the mechanisms. Kinematic elements, kinematic joints, kinematic chains, mechanisms. Examples, specific		

symbols used for representation in the kinematic schemes. Substituting mechanisms and mobility (to be used and facilities for demonstrations existing in the labs of the department) (4 hours)	Free exposure at blackboard combined with multimedia presentations	-
S4. Kinematic analysis of the mechanisms. Vectorial and analytical methods (2 hours)		
S5. Calculation of the reaction forces in the kinematic joints and the power of the motors used to drive the mechanism (2 hours)		
S6. Determination of center of mass and moments of inertia for various kinematic elements found in planar mechanisms (2 hours)		
S6. Gear mechanisms (gearings). Gear trains (to be used the experimental setups). Structural and kinematic analysis. (2 hours)		
S7. Project theme: Gear box based on a spur gear (an elementary gearing) (2 hours) Input data: Power to be transmitted; Speed of the driving gear; Transmission ratio. Parameters to be calculated: Geometrical elements of the gears and the contact ratio of the gearing; The dimensions of the shafts and the bearings. Graphical documentation: The assembly scheme of the gear box and the execution draw for a shaft.		
S8-S10. Gear mechanisms (gearings). Gear trains (to be used the experimental setups). Structural and kinematic analysis. Approaches related on the semester project (6 hours)		
S11. Virtual prototyping and rapid prototyping of planar mechanisms based on mechatronic intelligent modules and specialized software (2 hours)		
S12. Balancing the mechanisms and machines. Applications based on the laboratory setup (2 hours)		
S13. Project evaluation (2 hours)		
S14. Project evaluation (2 hours)		

Bibliography

[1] Robert L. Norton, Design of Machinery: An Introduction to The Synthesis and Analysis of Mechanisms and Machines, Fifth Edition, McGraw Hill, 2011.
[2] Robert L. Norton, Machine Design: An Integrated Approach, Fifth Edition, Prentice Hall, 2011.
[3] David H. Myszka, Machines & Mechanisms: Applied Kinematic Analysis, 4th Edition, Pearson, 2011.
[4] Olimpiu Tatar, Elemente de inginerie mecanică : îndrumător de laborator. Partea 1, U.T.Press, Cluj-Napoca, 2013.
[5] Calin Rusu, Mecanisme, U.T. Press, Cluj-Napoca, 2021.
[6] Handra-Luca, V., Mecanisme, Ed.UT Pres, Cluj-Napoca, 1981.
[7] Handra-Luca, V., ş.a.– Introducere în teoria mecanismelor, Editura Dacia, Cluj-Napoca, vol. I-II, 1982, 1983.
[8] Maros, D., ş.a. – Mecanisme, Indrumător de lucrări, Lito. I.P.C-N, Cluj-Napoca, 1984.
[9] Szekely, E., Dali, A., Mecanisme, Ed.UT Pres, Cluj-Napoca, 1993.

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The course curriculum exists in universities and faculties in the country and abroad. Its content is in conjunction with the expectations of community representatives, professional associations, and employers in the field of Automation and Applied Informatics.
By learning theoretical concepts and addressing practical aspects included in the discipline entitled Mechanical Engineering, students acquire a consistent stock of knowledge, in accordance with partial competencies required for possible occupations provided in Grid 1 – RNCIS.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The course ends with a face-to-face exam (multiple choice and short answer questions test). Mark: CM (from 1 to 10)	The mark is evaluated based on the score obtained at the face-to-face exam	50%
10.5 Applications	Every student gets a mark for his seminary activity Mark: SM (from 1 to 10)	The mark is evaluated based on the end-of-semester project	50%
10.6 Minimum standard of performance			
The final grade is calculated using the following formula: FM = 0.5·CM + 0.5·SM Mandatory condition to pass the exam: CM≥5; SM≥5;			

Date of filling in:		**Title Surname Name**	**Signature**
14.04.2023	Lecturer	S.l.dr.ing. Ciprian-Radu RAD	
	Teachers in charge of application	S.l.dr.ing. Ciprian-Radu RAD	

Date of approval in the department

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Head of department
Prof.dr.ing. Honoriu VĂLEAN

Date of approval in the faculty

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Dean
Prof.dr.ing. Liviu MICLEA