SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	18.00

2. Data about the subject

2.1	Subject name	Physical Metallurgy				
2.2	Course responsible/lecturer	Associate professor Traian Florin Marinca, marinca.traian@stm.utcluj.ro				
2.3	Teachers in charge of seminars	Associate professor Traian Florin Marinca, marinca.traian@stm.utcluj.ro				
2.4 Year of study	2	2.5 Semester	1	2.6 Assessment	examination	
2.7 Subject category	Formative category					DD
	Optionality					DI

3. Estimated total time

3.1 Number of hours per week	4	of which	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	2	3.3 Project	0
3.4 Total hours in the curriculum	56	of which	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	28	3.6 Project	0

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	28
(b) Supplementary study in the library, online and in the field	12
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(d) Tutoring	5
(e) Exams and tests	5
(f) Other activities	5

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	69
3.9 Total hours per semester (3.4+3.8)	125
3.10 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1	Curriculum	General knowledge in Physics and Materials Science and Engineering
4.2	Competence	Good knowledge in physics and materials science and engineering

5. Requirements (where appropriate)

5.1	For the course	Presence at Technical University of Cluj-Napoca at Materials

		Science and Engineering Department
5.2	For the applications (laboratory)	Presence at Technical University of Cluj-Napoca at Materials Science and Engineering Department laboratories

6. Specific competences

Professional competences	The student, after attending the course and performing laboratory work will be able to: - To know the formation and transformation of the structure of metallic materials during metallurgical, mechanical processing operations and heat treatments; - To know and interpret the metallurgical, physico-chemical and technological phenomena specific to materials engineering; - To identify the typical metallographic constituents, according to the specific characteristics; - To understand according to the microstructural characteristics the processing state of a metallic material; - To analyse and interpret the influence of thermal and mechanical processing on the structure of metallic materials. - To have the ability to interpret the microstructures for metallic materials and to identify the structural features. - To solve technical problems by identifying the structural deviations that appeared as a result of the materials processing and establishing their cause.
Cross competences	- To acquire a specific engineering scientific language. - To improve their skills and abilities to operate with laboratory equipment. - To know how to evaluate the data in relation to given references. - To know how to analyse microstructural and structural data. - To know how to correlate the microstructural characteristics with the properties of the material. - To correlate the characteristics of a material at a certain stage of processing with the technological flow of processing.

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

7.1	General objective	Development of competencies in the field of structural changes of materials.
7.2	Specific objectives	- Assimilation of theoretical knowledge on the mechanisms of formation and modification of the structure of an alloy by applying heat treatments; equilibrium diagrams; - Obtaining skills for interpreting the metallographic structure of materials.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Equilibrium in metallic systems	3	Lecture	
2. Bicomponent systems with three phases in equilibrium. Phase diagrams	3		

3. Diffusion and autodiffusion mechanisms	3	PowerPoint presentation Interactive teaching mode Dialogue - conversation professor - student	Multimedia Blackboard
4. The theory of solid-state phase transformation	3		
5. Polymorphic transformation	1		
6. Precipitation from supersaturated solid solution	3		
7. Eutectoid transformation in ferrous and non-ferrous alloys	2		
8. Martensitic transformation	3		
9. Bainitic transformation	2		
10. Ferrite-cementite mixtures transformation in austenite	2		
11. Massive transformation	1		
12. Order disorder transformation	2		

Bibliography

[1]. Traian Florin Marinca – course notes
[2]. F.C. Campbell, Elements of Metallurgy and Engineering Alloys, ASM International, SUA, 2008,
[3]. R. E. Smallman, R.J. Bishop, Modern Physical Metallurgy and Materials Engineering - Science, Process, Applications, Sixth Edition, Butterworth-Heinemann, Marea Britanie, 1999.
[4]. T. B. Massalski, Binary Alloy Phase Diagrams – Second Edition, ASM International, SUA, 1990.
[5]. C.E. Campbell, Diffusivity and Mobility Data, ASM Handbook, Volume 22A: Fundamentals of Modeling for Metals Processing, SUA, 2009.
[6]. R. Abbaschian, L. Abbaschian, R.E. Reed-Hill, Physical Metallurgy Principles, Fourth Edition, Cengage Learning, SUA, 2009.
[7]. W.D. Callister, Jr., D.G. Rethwisch, Materials Science and Engineering - An Introduction – Eight Edition, John Wiley & Sons, SUA, 2010.
[8]. D.A. Porter, K.E. Easterling, Phase Transformations in Metals and Alloys, Second Edition, Springer-Science+Business Media, B.Y., Marea Britanie, 1992.
[9]. G.F. Van der Voort, ASM Handbook, Metallography and Microstructures, Volumul 9, ASM International, SUA, 2004
[10]. R.E. Smallman, A. H. W. Ngan, Modern Physical Metallurgy, Eighth Edition, Elsevier, SUA, 2014.
[11]. F.C. Campbell, Phase Diagrams – Understanding the Basics, ASM International, SUA, 2012.
[12]. Van Vlack, Elements of Materials Scienece-An Introduction Text for Engineering Students, Second Edition, Addison-Wesley Publishing Company, SUA, 1966.

8.2. Laboratory	Number of hours	Teaching methods	Notes
1. Study of typical metallographic constituents (from the laboratory's collection of metallographic samples)	4		
2. The influence of heat treatment and cold plastic deformation on the structure of metallic materials with one or more structural constituents	3		
3. Phase diagrams - correlation of metallographic	3		

constituents with phase diagrams.		Explication, conversation, Case Study.	Blackboard, computer, specialized software
4. Diffusion study. Diffusion calculus	2		
5. Analysis and study of some structures resulting from welding.	2		
6. Study of polymorphic transformation structures obtained by applying different cooling rates	2		
7. Analysis of formation conditions and study of structures obtained by precipitation from supersaturated solid solutions. Metastable precipitates and equilibrium precipitates	2		
8. Bainite type microstructures in ferrous and non-ferrous alloys - forming mechanisms and properties	2		
9. The study of some structures obtained by martensitic transformation of irreversible type - formation mechanisms and properties.	2		
10. Study of structures obtained by reversible martensitic transformation (shape memory alloys) - formation mechanisms and properties.	2		
11. The study of order-disorder transformation structures.	2		
12. Study of structures obtained through various mechanisms in ceramic materials, biomaterials and composite materials.	2		

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[1]. Traian Florin Marinca – course notes
[2]. R. E. Smallman, R.J. Bishop, Modern Physical Metallurgy and Materials Engineering - Science, Process, Applications, Sixth Edition, Butterworth-Heinemann, Marea Britanie, 1999.
[3]. T. B. Massalski, Binary Alloy Phase Diagrams – Second Edition, ASM International, SUA, 1990.
[4]. R. Abbaschian, L. Abbaschian, R.E. Reed-Hill, Physical Metallurgy Principles, Fourth Edition, Cengage Learning, SUA, 2009.
[5]. W.D. Callister, Jr., D.G. Rethwisch, Materials Science and Engineering - An Introduction – Eight Edition, John Wiley & Sons, SUA, 2010.
[6]. D.A. Porter, K.E. Easterling, Phase Transformations in Metals and Alloys, Second Edition, Springer-Science+Business Media, B.Y., Marea Britanie, 1992.
[7]. G.F. Van der Voort, ASM Handbook, Metallography and Microstructures, Volumul 9, ASM International, SUA, 2004
[8]. F.C. Campbell, Phase Diagrams – Understanding the Basics, ASM International, SUA, 2012.

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

Skills will be required for employees who will work as technological engineers. The acquired competencies will be used by those who will carry out their activity within departments whose activity is the elaboration, characterization and testing of materials, as well as within the departments that are

authorized to certify the quality of a material.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The exam consists of written test (C). The written test contains grid topics and broader topics that need to be developed. The written exam is carried out as follows: students enter the exam room after being invited to the room by the teacher and occupy the place indicated by the teacher, having on them only writing instruments and paper support on which to write; the number of writing instruments, exam sheets and auxiliaries (ruler, eraser and the like) is announced at the beginning of the exam by the teacher. Failure to comply with the requirements will result in removal from the exam. The exam subjects are either dictated by the teacher or a printed copy is handed to each student. The presence of a mobile phone or other electronic devices on students during the exam is considered copied.	Written test (C) - 2 hours	70%
10.5 Laboratory	At each laboratory the students receive a mark regarding their implication (I). The students receive notes on the laboratory tests (T) - $T=(T_1+\ldots T_n)/n$ (n - number of tests). The final laboratory mark (L) is $L=0,5I+0,5T$. Each mark should be at least 5.	Oral test (I) - continuous assessment. Tests (T) – 1 hour – theoretical and practical tests	30%
10.6. Minimum standard of performance			
$T \geq 5$, $I \geq 5$, $C \geq 5$, E (the general examination mark) = 0,7 C+0,3L with L=0,5I+0,5T			

Date of filling in:		**Title Surname Name**	**Signature**
14.05.2023	Lecturer	Assoc.prof. Traian Florin MARINCA	
	Teachers in charge of application	Assoc.prof. Traian Florin MARINCA	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	19.00

2. Data about the subject

2.1	Subject name			Mechanics			
2.2	Course responsible/lecturer			*Lecturer dr.eng. Claudiu SCHONSTEIN –* Claudiu.Schonstein@mep.utcluj.ro			
2.3	Teachers in charge of laboratory			*Lecturer dr.eng. Claudiu SCHONSTEIN –* Claudiu.Schonstein@mep.utcluj.ro			
2.4 Year of study	2	2.5 Semester	1	2.6 Assessment			E
2.7 Subject category	Formative category						DD
	Optionality						DI

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	-
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	56
(b) Supplementary study in the library, online and in the field	14
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	7
(d) Tutoring	-
(e) Exams and tests	3
(f) Other activities	-
3.8 Total hours of individual study (summ (3.7(a)...3.7(f)))	80
3.9 Total hours per semester (3.4+3.8)	132
3.10 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	Mathematics notions
4.2	Competence	-

5. Requirements (where appropriate)

5.1	For the course	Attendance at the course is not mandatory, but is recommended.
5.2	For the applications	Attendance at the Laboratory is mandatory, for admittance at exam session.

6. Specific competences

Professional competences	After completing the discipline, the students will be able to: • calculate the parameters of mass geometry for rigid bodies and systems of bodies; • establish and interpret the conditions of static equilibrium of the forces acting on mechanical bodies and systems; • determine the parametricequations of motion, the distribution of velocities and accelerations for a material point and/or a rigid body; •model a mechanical phenomenon under static, kinematic and dynamic aspect.
Cross competences	Continuous training and efficient use of information sources and communication resources (Internet, specialized software applications, databases, online courses)

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

7.1	General objective	Learning and know how to apply the general principles and theorems that govern the equilibrium and movement of mechanical systems.
7.2	Specific objectives	• Acquiring knowledge regarding notions related to: reduction of forces; mass geometry; balance of mechanical systems; determination of trajectories; calculation of velocities and accelerations in case of point and rigid motion; ➢ Understand the mechanic phenomena, principles and theorems of the dynamics of a material point and the systems; ➢ Correct evaluation of parameters that characterizing the dynamic behavior of material point and the material point system.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Chapter 1 - Introduction to mechanics. Notions of vector calculus. Reduction of forces: polar moment, axial moment, variation of the polar moment. Torque. Moment of a force couple. Reduction torsor, central axis, minimal torsor.	4	Graphic tablet - Multimedia presentations. Board presentations.	
Chapter 2 - Mass geometry: Center of mass. Center of mass for a material point system. The mass center of a irregular body geometric shape. The mass center for a system of bodies.	2		
Chapter 3 - Statics of solid rigid body. Position and orientation parameters. Simple rotation matrices. Equilibrium equations of free rigid body. The equilibrium of the rigid body subjected to links (general study). The equilibrium of rigid body subjected to frictionless links. Statics of rigid body subjected to frictional links. Sliding friction. Rolling friction. Pivot friction.	4		

Chapter 4. Kinematics of the material point. The trajectory of the material point. Acceleration of the material point. Velocity and acceleration components in different reference systems. (Cartesian, cylindrical (polar), intrinsic, spherical coordinates.	2		
Chapter 5. Kinematics of the rigid body. Parametric equations of motion of free rigid body. Definition of specific kinematic parameters: linear and angular velocity acceleration. Distribution law for velocity. Distribution law for accelerations. Study of particular movements for the rigid body.	4		
Chapter 6. Dynamics of a particle (fundamental notions and theorems). The linear momentum of a particle. The linear momentum of a system of points. The linear momentum theorem for a particle. Mass centre theorem. The angular momentum of the particle. The angular momentum for a system of material points. The angular momentum theorem for a particle. The angular momentum theorem for a system of material points. The angular momentum theorem in relation to the centre of mass. The mechanical work. Kinetic energy. The kinetic energy theorem for a particle. The kinetic energy theorem for a system of material points. Moment of inertia. Definition expressions of moments of inertia. Variation law for moments of inertia in relation to parallel axis.	6		
Chapter 7. Dynamics of the rigid body (fundamental notions and theorems). The linear momentum. Mass center theorem. The angular momentum. The angular momentum theorem. The mechanical work of the forces applied to the rigid. Mechanical power. Mechanical efficiency. Kinetic energy. Kinetic energy theorem.	4		
Chapter 8. Analytical mechanics. The torsor of inertial forces. The D`Alembert principle. Kineto-static method. The principle of virtual mechanical work. Lagrange's equations.	2		

Bibliography

- *Negrean, C. Schonstein, K. Kacso, A. Duca, Mecanică. Teorie şi aplicaţii, Editura UT PRESS, ISBN 978-973-662-523-7, Cluj – Napoca, 2012.*
- *Negrean, I., Schonstein, C., s.a., Mechanics – Theory and Applications, Editura UT Press, 2015, ISBN 978-606-737-061-4.*
- Bratu, P.P., Mecanica Teoretică- Editura IMPULS-Bucuresti-2006.
- Itul, T.-P., Mecanica. Cinematica şi Dinamica, Ed. Mediamira, Cluj-Napoca, 2004.
- Itul, T.-P., Mecanica. Statica, Editura Risoprint, Cluj-Napoca, 2000.
- Itul, T.-P., Haiduc, N., Mecanica, Editura UTPRESS, Cluj-Napoca, 2012.
- Ispas V., ş.a., Mecanică tehnică, Dinamica, Lito. IPCN, 1989.
- Ispas V., ş.a., Mecanica, Editura Dacia, Cluj-Napoca, 1997.

Ispas V., Deteşan O. A., Petrişor S. M., Mecanica. Statica, EDP, Bucureşti, 2007.

8.2. /Laboratory/	Number of hours	Teaching methods	Notes
1. Analytical and graphical reduction of coplanar forces system.	2	Presentation of stands/experimental work. combined with	
2. Analytical and graphical determination of mass center for a homogenous plate with irregular	2		

geometrical shape.		challenging students through questions. Then the students perform measurements, calculations / graphs individually.	
3. Establishing of sliding and rolling friction coefficients .	2		
4. Determination of velocities and accelerations in the motion of a plane mechanism.	2		
5. Determination of gravitational acceleration by simple pendulum method.	2		
6. Determination of axial inertia moments by using rotation around a fixed axis.	2		
7. Determination of the dynamic coefficient of friction on the inclined plane.			

Bibliography

1. C. **Schonstein**, G. Fodor, A.F. Cristea, - Applied Mec hanics - Laboratory Works/Applications, in process of publications.

2. Gabriel Fodor, Aurora Felicia Cristea, Mecanică apl icată : lucrări de laborator , Cluj-Napoca, UTPress, 2019.

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

The discipline is related to the field of "Mechanical Engineering" and provides fundamental technical knowledge useful in understanding the phenomena and processes in the mechanical field. Every engineer must have the necessary knowledge to perform calculations of: reduction of forces, determination of the center of gravity of a body, kinematics and dynamics of the particle and rigid body. The notions acquired in this discipline are useful in other disciplines from years II, III and IV (Strength of materials, Fluid mechanics, Machine parts, etc.).

The corroboration of the contents of the discipline with the expectations of the representatives of the epistemic community, of the professional associations and of the employers is achieved through regular discussions scheduled by the faculty with representatives of the employee.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Exam with theory questions and problems, grouped by topics. Each subject being marked with a certain score.	Verification of knowledge (theory and applications) in writing for 3 hours.	75 %
10.5 Laboratory	The laboratories are appreciated and marked with grades from 1-10 if they are handed in at the established deadlines.	Oral verification of knowledge.	25 %
10.6 Minimum standard of performance			

Satisfactory problem solving and correct answers to questions. To pass the exam, each student must obtain a minimum grade of 5 .

Date of filling in:		**Title Surname Name**	**Signature**
17.05.2023	Lecturer	Claudiu SCHONSTEIN	
	Teachers in charge of application	Claudiu SCHONSTEIN	

Date of approval in the department

26.06.2023

Head of department

Ass.prof.dr.eng. Mariana Pop

Date of approval in the faculty

10.07.2023

Dean

Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	20.00

2. Data about the subject

2.1	Subject name			Materials Technology I			
2.2	Course responsible/lecturer			Lecturer Dr. Eng. Gabriel Batin			
2.3	Teachers in charge of seminars			Lecturer Dr. Eng. Gabriel Batin			
2.4 Year of study	2	2.5 Semester	3	2.6 Assessment	E	DD DI	
2.7 Subject category	Formative category						
	Optionality					Mandatory	

3. Estimated total time

3.1 Number of hours per week	4	of which	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	2	3.3 Project	0
3.4 Total hours in the curriculum	56	of which	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	28	3.6 Project	0

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	18
(b) Supplementary study in the library, online and in the field	6
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	18
(d) Tutoring	3
(e) Exams and tests	3
(f) Other activities	0

3.8 Total hours of individual study (summ (3.7(a)...3.7(f)))	44
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Mathematics, Technical Drawing, Chemistry, Materials Science
4.2	Competence	Elements of calculation: algebra and vectors; Notions of technical drawing: views, sections, cotation, symbols; Elements of general inorganic chemistry; Elements of materials science: Fe-C diagram, alloys, materials symbolisation and classification.

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications seminarului / laboratorului / proiectului	All practical activities are mandatory.

6. Specific competences

Professional competences	To know from a structural point of view the materials used in industry; to know technical drawing; to understand the connection between the processing technology, the properties of the materials, the quality of the finished product and its cost price; evaluate the manufacturing technologies of the semi-finished products and relate them to the available application possibilities; to synthesize the requirements imposed on the elaborated materials and semi-finished products. After completing the discipline students will be able to: • Characterization of materials used in industry, from a mechanical point of view; • Knowledge of the technological possibilities of elaborating some metals and the properties acquired by them; • Ability to design technologies for developing metals and alloys; • Knowledge of the equipment used in the elaboration of metals and alloys as well as of the environmental protection equipment used in the elaboration of cast iron; • Knowledge of how the process of making metals and alloys determines their properties. • To know how to use the material characterization equipment; • Know how to schedule tests for det. mechanical characteristics of materials; • To know how to analyse the execution drawings or the parts used as a model; • To know how to establish the optimal manufacturing technology related to availability; • To know how to establish the succession of operations and technological phases; • To know how to interpret experimental results.
Cross competences	• Knowledge of software used in materials technology; • Knowledge of material properties; • Knowledge of the functionality of some equipment; • Knowledge of the connection of the elaboration processes with the environment.

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

7.1	General objective	Development of skills in the field of materials development technology in support of vocational training.
7.2	Specific objectives	1. Assimilation of theoretical knowledge on the development of materials and its influence on the properties of developed alloys. 2. Obtaining skills regarding the elaboration and characterization of materials.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Raw materials for making metals and alloys. Ore preparation.	2	Exposition, discussions	Videoprojector
Processes for the rough extraction of metals from ore. Raw metal refining processes.	2		
Development of foundry casting and refining cast iron. Cast iron properties and their destination.	2		
Principles of refining raw iron for refining.	2		
Steelmaking by conversion.	2		
Steelmaking in hearth furnaces.	2		
Deoxidation of steels. Deoxidation processes and properties of deoxidized steels	2		
Casting of steels in ingots. Continuous casting.	2		
Elaboration of aluminium. Ores. Development technology. Installations. Properties of aluminium.	2		
Magnesium processing. Ores. Development technology. Installations. Properties of magnesium.	2		
Zinc production. Ores. Development technology. Installations. Properties of zinc.	2		
Copper production. Ores. Development technology. Installations. Properties of copper.	2		
Lead processing. Ores. Development technology. Installations. Properties of lead.	2		
Elaboration of titanium. Ores. Development technology. Properties of titanium. Special metalworking processes.	2		

Bibliography

1. Ashby M., Materials Selection in Mechanical Design, Second Edition, Butterworth-Heinemann, Oxford, 1999.
2. N. Vintilă – Tehnologia metalelor, Vol. I-II, Lit. Institutului Politehnic Cluj, 1978.
3. A. Palfalvi şi alţii – Tehnologia materialelor, E.D.P. Bucureşti, 1985.
4. M. Golumba – Tehnologia materialelor, Lit. Institutului Politehnic Timişoara, 1981.
5. D.R. Mocanu – Încercările materialelor, Vol I-II, Editura Tehnica Bucureşti, 1982.

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
Notions regarding the properties of materials.	2	Exposition, discussions,	
Determination of linear contraction when solidifying alloys.	2		
Determination of volume contraction when solidifying alloys.	2		

Forming into two frames.	2	applications	
Core formation.	2		
The influence of plastic deformation on some properties of materials.	2		
Determining the pulling force of some materials through the die.	2		
Determination of sheet deformation capacity.	2		
Tensile and compression test.	2		
Bending test.	2		
Impact bending test.	2		
Determination of Brinell and Vickers harness.	2		
Determination of Rockwell hardness.	2		
Hardness determination of plastic materials.	2		

Bibliography

1. N. Vintilă – Tehnologia metalelor, Vol. I-II, Lit. Institutului Politehnic Cluj, 1978.
2. A. Palfalvi şi alţii – Tehnologia materialelor, E.D.P. Bucureşti, 1985.
3. M. Golumba – Tehnologia materialelor, Lit. Institutului Politehnic Timişoara, 1981.
4. D.R. Mocanu – Încercările materialelor, Vol I-II, Editura Tehnica Bucureşti, 1982.
5. L. Brânduşan, C. Pavel, R. Mureşan, Tehnologia Materialelor, Îndrumător pentru lucrări de laborator, Editura U.T. PRES 1999, Cluj-Napoca.

Programe:

1. Program de Selecţie a Materialelor.
2. Program de prelucrare a datelor experimentale.

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

The acquired competencies will be necessary for the employees who carry out their activity within the sections for elaboration and characterization of the materials.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	On-going evaluation based on tests and a final evaluation (questionnaire with 20 questions, recognition of equipment and development of a manufacturing technology in theory). During the exam, students are forbidden to carry a phone, smartwatch or other source of information than those	On-site	80%

	communicated in the last course.		
10.5 Seminars /Laboratory/Project	On-going evaluation based on discussions and by self-evaluation together with a final evaluation by test.	On-site	20%
10.6 Minimum standard of performance			
Promoting the application activity; Obtaining a grade of 5 based on the points accumulated in the final evaluation. Final grade: N = 0.8xE + 0.2xL E- examination, E The laboratory N≥5, E≥5, L≥5.			

Date of filling in: 20.06.2023		**Title Surname Name**	**Signature**
	Lecturer	Lecturer Dr. Eng. Gabriel Batin	
	Teachers in charge of application	Lecturer Dr. Eng. Gabriel Batin	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	Physical Chemistry

2. Data about the subject

2.1	Subject name			Physical Chemistry		
2.2	Course responsible/lecturer			Assoc. prof. chem. Mihaela-Ligia Ungureşan mihaela.unguresan@chem.utcluj.ro		
2.3	Teachers in charge of seminars			Lecturer chem. Liviu Bolunduţ liviu.bolundut@chem.utcluj.ro		
2.4 Year of study	II	2.5 Semester	1	2.6 Assessment	Exam	
2.7 Subject category	Formative category					DD/DI
	Optionality					-

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	-
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	58
(b) Supplementary study in the library, online and in the field	24
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	16
(d) Tutoring	10
(e) Exams and tests	8
(f) Other activities	-

3.8 Total hours of individual study (summ (3.7(a)...3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	General knowledge of chemistry in high school
4.2	Competence	Arithmetic, Algebra, Mathematical analysis; Physics.

5. Requirements (where appropriate)

5.1	For the course	Blackboard, computer, video projector

5.2	For the applications	The laboratory is endowed with: 1. Apparatus, modern instruments and accessories: laboratory tools, glassware, stands with clips, supports for pipettes and micro pipettes, electronic balances, analytical balance, pipettes and micropipettes, manual and electronic devices for dispensing, magnetic stirrers, computers, mechanical stirrer, Ph-meter with thermostat and electronic display, niche, gas bulbs, specific reactives, freezer. 2. Interactive applications using the laboratory apparatus - experimental assemblies, computer assisted 3. Computers with Internet connection, tables, chairs, video- projector, screen, blackboard Attendance at scheduled laboratory classes is compulsory.

6. Specific competences

Professional competences	C2. To associate the knowledge, principles and methods of the technical sciences of the field with graphical representations in order to solve specific tasks. C2.1 To identify, define and describe the notions of physical chemistry (chemical thermodynamics, chemical kinetics, electrochemistry, surfaces, physico-chemical models) and methods for obtaining physico-chemical parameters, using learned laws and graphical representations. C2.2 The use of basic knowledge, principles and methods of technical sciences to explain concepts regarding the design and implementation of tasks and processes specific to materials engineering. C2.3 The application of knowledge, principles and methods in the technical sciences of the field and their association with graphical representations, in order to solve the specific tasks to the field of materials engineering. C2.4 Appropriate use the standard evaluation criteria and methods to assess the quality of the association of knowledge, principles and methods in the technical sciences of the field with graphical representations, for solving specific tasks.
Cross competences	

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

7.1	General objective	Throughout the semester, this course will touch on many different aspects in the field of physical chemistry. This lecture course covers most topics of classical thermodynamics and its applications in the chemical sciences. It also introduces the basic concepts of quantum chemistry, statistical thermodynamics, and kinetics will be discussed. At the end of this course, you will have gained a thorough understanding and practical knowledge of thermodynamics. - a topic that is central to all chemistry as well as the natural and applied sciences. Upon successful completion of this course, students will be able: - to classify basic forms of matter; - to perform mathematical unit conversions; - to monitor the automated methods for the implementation of fixing the coefficients of chemical reactions; - to predict, depict and describe the gas behavior; - to determinate the direction of chemical reactions based on thermodynamic parameters;

		- to know the factors to affect the rate of the chemical reaction and of their mechanism; - to identify the equilibrium processes and the factor tohat affect the position of equilibrium; - to deepen the phenomena of electrolysis, electroplating, cathodic deposition, the phenomena of corrosion and corrosion protection.
7.2	Specific objectives	- To know how to use the apparatus and glassware from the chemistry laboratory, how to measure temperature, pressure, concentration, titre or the purity of some substances or solutions; how to analyse the experimental chemical data obtained. Understand the behaviour of matter and transformation between different forms of energy as they relate to expansion and compression of gases, phase transitions, and chemical reactions. The students will be able to: - analyse the chemical substances in a qualitatively and quantitatively mode; - to develop an experiment, to perform it and to make the interpretation of the results; - know how to interpret graphical results obtained as a result of the kinetic study of chemical reactions, of the thermodynamics of a chemical process.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Thermodynamics concepts General presentation, classification, thermodinamic system state; state parameters; chemical process.	2	Power point presentations (ppt.) Microsoft Teams, presentations on graphics tablet, discussions.	
The gaseous state (law gases; kinetic molecular theory of gases; real gases; virial coefficients; Van der Waals equation).	2		
First law of thermodynamics and its consequences. Enthalpy - definition, enthalpy in chemical reaction systems, Robert-Mayer's equation, the calculation of the reaction enthalpy at different temperatures. Thermochemistry (calorimetry; Lavoisier-Laplace's law, Hess's law; applications)	2		
Enthalpy of phase transition, ionization enthalpy, enthalpy of fusion, enthalpy of reaction, the formation enthalpy, bond enthalpy, Born-Haber cycle). Second law of thermodynamics and its consequences Spontaneous and nonspontaneous processes, reaction entropy, variation of the reaction entropy with temperature.	2		
Chemical potential, Helmholtz free energy, free enthalpy (Gibbs free energy); Chemical equilibrium (masses action law; chemical equilibrium in homogeneous systems; relations between K_p, K_c and K_x; heterogeneous chemical equilibrium; dimensions characteristic to chemical equilibrium; applications).	2		
The equilibrium of the phase transitions The equilibrium conditions between phases. The phases law. Phase equilibriums within mono-component systems. Clapeyron equation. The solid/liquid equilibrium. The liquid/gas equilibrium. The Clausius-Clapeyron equation. The solid/gase equilibrium. The phase diagram for water, CO_2, carbon, the stability of phases, Raoult law.	2		

Spectroscopy and molecular structure - Electrical properties of molecules - polarity and symmetry of molecules, dipole moment, Clausius - Mosotti equation. - Magnetic properties of molecules. Magnetochemistry. - Optical properties of molecules. Atomic and molecular refraction. The activity of atomic refractions. The Lorentz-Lorentz relationship. Applications to the determination of molecular structure and other applications in chemistry. - Molecular spectroscopy. Molecular absorption spectra. Rotation spectra. Electronic spectra. - Combined diffusion spectrum; the elementary theory of the Raman spectrum.	2		
Surface chemistry and intermolecular forces: wetting, surface tension, surfactants, Laplace pressure, amphiphilic molecules, surface films, surface excess, self-assembly and self-associating systems, Born energy.	2		
Chemical kinetics Rate of a reaction- factors influencing the rate of a reaction such as concentration, temperature, pressure, solvent, light and catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions - zero order, first order, second order, pseudo order, half life and mean life. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.	2		
Kinetic of complex reaction (successive, parallel, opposite, with preequilibrium). Reaction in chain; explosions.	2		
Catalysis: characteristics of catalysed reactions, classification of catalysis, characterization of catalysts, enzyme. Enzyme kinetics, competitive and noncompetitive inhibition. Industrially important catalysts and processes such as oxidation, processing of petroleum and hydrocarbons, synthesis gas and related process.	2		
Electrochemistry (electrolytic dissociation; electrodes; potentials of electrodes; electrolysis; Butler-Volmer equation; Nernst equation, galvanic cells; accumulators, combustion and solar cells)	2		
The electromotive force measurements. Electrochemical sensors. Biosensors. Determination of pH; potentiometric titration, examples. Electrochemical methods for investigating the chemical reactions of materials. Polarography, rotating disk, cyclic voltammetry, electrochemical impedance.	2		
Corrosion and anticorrosion protection General terms, influencing factors in the process of corrosion; monitoring methods based on thermodynamic stability of the metal; corrosion protection methods. Electrochemical waste treatment processes.	2		

Bibliography

From UTC-N library:

1. M.-L. Ungureşan, D.-M. Gligor, *General Chemistry*, Ed. UTPRESS, Cluj-Napoca, 2012.
2. M.-L. Ungureşan, L. Jantschi, *Termodinamică şi. cinetică chimică*, Ed. Mediamira, Cluj-Napoca, 2005.
3. G. Niac, O. Horovitz, *Chimie-Fizică*, vol. 1-2, Lito. Inst. Politehnic, Cluj-Napoca, 1986.
4. P. W. Atkins, *Tratat de Chimie-Fizică,* Ed. Tehnică, Bucureşti, 1996.

From other libraries:

1. L. Oniciu, L, Mureşan, „*Electrochimie aplicată*", Ed. Presa Universitară Clujeană, 1998.
2. I. G. Murgulescu, T. Oncescu, E. Segal, „*Introducere în Chimia Fizică*", Vol. II, 2, „*Cinetică şi Cataliză*", şi IV, „*Electrochimie*", Ed. Ştiinţifică, Bucureşti, 1981.

8.2. Laboratory	Number of hours	Teaching methods	Notes

Presentation of the applications. Labor protection. The calculus of errors.	1	Presentation, experimental works in the laboratory, mathematical modeling and numerical simulations of some physico-chemical processes	Computer, soft, experimental apparatus
Determining the constant of a calorimeter (KCl). Determining the hydration heat of copper sulphate	1		
The calculus of enthalpy, entropy and free enthalpy for a chemical reaction at different temperatures.	1		
Thermal analysis.	1		
The kinetics of simple and complex reactions.	1		
Adsorption at the liquid-solid interface.	1		
The kinetic theory of gases and the laws of the ideal gases.	1		

Bibliography

From UTC-N library:
1. A. Mesaroş, L. Bolunduţ, M.-L. Ungureşan, *Experimente de Chimie Generală*, Ed. Galaxia Gutenberg, Colecţia Tehne 5, ISBN: 978-973-141-228-3, 2010, pg. 197.
2. M.-L. Ungureşan, *Chimie Fizică. Experimente de Cinetică şi Dinamică Moleculară*, Ed. Amici, Cluj-Napoca, 2003.
Virtual teaching materials (on-line):
3. http://mihaela.academicdirect.ro/free/Indrumator_laborator.pdf
Toate materialele (curs+lucrări laborator) sunt încărcate pe Microsoft Teams (fisiere)

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

The competences will be needed by the future engineers who will work within the departments for processing materials and technological engineering.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The theoretical and practcal knowledge withint he course	Quiz test on-line (Microsoft Teams) - 16 questions, each one with 5 choices, one correct answer. The exam will take place with all the materials at the students' disposal. The duration of the exam: 30 minutes.	80%
10.5 Laboratory	The experimental knowledge, mathematica modelling and numerical simulation of the phisico-chemical processes obtained within the laboratory.	Each received essay (Microsoft Teams or e-mail) is graded by the teacher and, at the end, the average will represent the grade for the laboratory.	20%
10.6 Minimum standard of performance			
• Grade exam ≥ 5 • Grade laboratory ≥ 5			

Date of filling in:		Title Surname Name	Signature
20.04.2023	Lecturer	Assoc. prof. chem. Mihaela-Ligia UNGUREȘAN	
	Teachers in charge of application	Lecturer chem. Liviu BOLUNDUȚ	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	22

2. Data about the subject

2.1	Subject name			Strength of Materials		
2.2	Course responsible/lecturer			Prof.dr.ing Mircea Cristian Dudescu		
2.3	Teachers in charge of seminars			Prof.dr.ing Mircea Cristian Dudescu		
2.4 Year of study	II	2.5 Semester	3	2.6 Assessment	exam	
2.7 Subject category DD DI	Formative category					DD
	Optionality					DI

3. Estimated total time

3.1 Number of hours per week	4	of which	3.2 Course	2	3.3 Seminar	1	3.3 Laboratory	1	3.3 Project	-
3.4 Total hours in the curriculum	100	of which	3.5 Course	28	3.6 Seminar	14	3.6 Laboratory	14	3.6 Project	-

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	21
(b) Supplementary study in the library, online and in the field	7
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	7
(d) Tutoring	4
(e) Exams and tests	4
(f) Other activities	1

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	44
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Math, physics, mechanics (statics), technical drawing
4.2	Competence	Computer skills

5. Requirements (where appropriate)

5.1	For the course	N/A
5.2	For the applications	Presence is compulsory

6. Specific competences

Professional competences	**C1.1.** Identifying the concepts, principles, basic theorems and mathematical methods, physics, chemistry, technical drawing, computer programming. **C1.2.** Using basic knowledge in the fundamental disciplines for theoretical explanation and interpretation of results, theorems, phenomena, or specific processes of industrial engineering. **C1.3.** Applying the theorems, principles and basic methods of fundamental disciplines, for basic engineering calculations in design and operation of technical systems specific to industrial engineering, under qualified assistance **C2.1.** Defining the principles and the methods of basic science industrial engineering field associated with graphics – technical drawing. **C2.2.** Using the knowledge from the basic engineering sciences to explain and interpret the theoretical and experimental results, the drawings and the specific industrial engineering phenomena and processes. **C2.3.** Applying the principles and methods from basic science of industrial engineering domain and associated with graphics - technical drawing, for strength calculations, sizing, establishing the technical conditions, establishing correspondence between features and functional role prescribed, and so on, in specific applications of industrial engineering under qualified help.
Cross competences	Applying the values and the ethics of the profession of engineer and the responsible execution of the professional duties under limited autonomy and qualified assistance. Promoting the logical reasoning, convergent and divergent, the practical applicability and the assessment and self-evaluation decisions. Objective self-evaluation of the need of continuous training for labor market insertion and the accommodation to its dynamic requirements and for personal and professional development. Effective use of language skills and knowledge of information technology and communication.

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

7.1	General objective	• To understand the basics of strength of materials, to know simple and composed loadings of the materials. • To understand that the discipline it's a practical one, connected to the engineering calculations. • To know how to interpret the results of different calculations about practical applications
7.2	Specific objectives	• To know how to solve strength calculations based on theoretical skills and engineering handbooks. • To know how to reduce practical problems to theoretical calculation models used in strength of materials. • To know how to interpret the calculation results and to propose engineering solutions to optimize it. • To know how to measure experimentally displacement, strains and stresses in mechanically loaded components or structures.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Introduction in Strength of Materials. Strain & Stresses.	2	Classical methods, practical elements,	Web site: https://sites.google.com/site/rezmatclui/
Axially loaded members	2		
Statically indeterminate problems axially loaded	2		
Shear: internal forces, strains and stresses	2		

Calculus of detachable joints (screw joints, bolt joints, key joints, groove joints)	2	presentations, educational software for mechanics of materials (MDSolids), On-line resources	
Calculus of fixed joints (riveted joints, welded joints)	2		
Plane stress	2		
Centroids and moments of inertia of plane areas.	2		
Bending of beams. Shear force & bending moment diagrams.	2		
Normal stresses in beams. Flexure formula (Navier).	2		
Shear stresses in beams. Shear stress formula (Jouravski).	2		
Equal strength beams. Composed beams.	2		
Deflection of beams.	2		
Torsion of circular bars. Torsion of non-prismatic bars.	2		

Bibliography

1. Dudescu, M.C., *Lecture notes in Strength of Materials*, available online
2. Dudescu, M.C., *Rezistenţa materialelor. Noțiuni fundamentale.* Editura U.T.Pres, Cluj-Napoca, 2013.
3. Păstrav I., *Rezistenţa materialelor şi teoria elasticităţii.* Lito U.T.C.N., 1993.
4. Şomotecan, M., Hărdău, M., Bodea, S. *Rezistenţa materialelor*. Editura U.T.PRES, Cluj – Napoca, 2005
5. Gere, J., Goodno, B., *Mechanics of Materials*. *Brief Edition*, Cengage Learning, Toronto, 2012.
6. Philpot, T., *Mechanics of Materials: An Integrated Learning System*, Wiley, 2012.
7. Hibbeler, R.C, *Mechanics of Materials* , Pearson, (10th edition), 2016

8.2. Seminars /Laboratory	Number of hours	Teaching methods	Notes
S1. Bar with different diameters axially loaded	2	Lab works: measurements on experimental stands Seminars: classical methods and educational software On-line resources	Web site: https://sites.google.com/site/rezmatclui/
L1. Mechanical tests: tensile, bending, torsion, impact.	2		
S2. Statically indeterminate structure axially loaded.	2		
L2. Determination of stress concentration factor for an axially loaded member by photoelasticity.	2		
S3. Calculus of welded / riveted joint	2		
LE3. Measurement of shear force in a beam subjected to plane bending	2		
S4. Centroids and moments of inertia of a composed area	2		
LE4. Measurement bending moment in a beam subjected to plane bending	2		
S5. Bending of beams. Shear force & bending moment diagrams.	2		
LE5. Stresses in beams measurement by strain gauge technique.	2		
S6. Normal and shear stresses in beams. Design & Verification	2		
LE6. Study of bars with circular cross-section subjected to torsion	2		
S7. Torsion of bars having circular cross-section.	2		
LE7. Optical methods of experimental stress analysis	2		

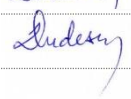
Bibliography
1. Hardau, M., Dudescu, M.C. Suciu, M., Simion, M., Chiorean, C., Rad, I., Metode experimentale in *Rezistenta Materialelor. Indrumator de lucrari de laborator*. Editura U.T.Press, Cluj-Napoca, 2018 / available on-line
3. MDsolids – Educational Software for Mechanics of Materials, www.mdsolids.com
4. Structures – software pentru lucrările experimentale (TecQuipment, UK)

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

The course contains theoretical aspects and applications from industrial environment that develops the student's skills to solve practical problems of engineering calculations based on analytical models and references in the field of mechanics of materials.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Understanding of theory presented at courses	Writing exam	1/3
10.5 Seminars /Laboratory	Ability to solve problems / Laboratory activity	Writing exam	2/3
10.6 Minimum standard of performance			
N=0,33*C +0,33*S + 0,33*L. Requirements for passing: C≥5; S≥5; L≥5			

Date of filling in:		**Title Surname Name**	**Signature**
10.05.2023	Lecturer	Prof.dr.ing Mircea Cristian Dudescu	
	Teachers in charge of application	Prof.dr.ing Mircea Cristian Dudescu	

Date of approval in the department
26.06.2023

Head of department
Ass.prof.dr.eng. Mariana Pop

Date of approval in the faculty
10.07.2023

Dean
Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	23.00

2. Data about the subject

2.1	Subject name			Electrotechnics			
2.2	Course responsible/lecturer			Lecturer Dr. Eng. Andrei CECLAN			
2.3	Teachers in charge of seminars			Lecturer Dr. Eng. Andrei CECLAN			
2.4 Year of study	2	2.5 Semester	1	2.6 Assessment	colloquium		C
2.7 Subject category	Formative category						DS
	Optionality						DI

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	-
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	13
(b) Supplementary study in the library, online and in the field	3
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
(d) Tutoring	3
(e) Exams and tests	4
(f) Other activities	-

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	33
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	General knowledge related to physics and energy.
4.2	Competence	Basic physics.

5. Requirements (where appropriate)

5.1	For the course	Classroom equipped with blackboard and Video Projector - Muncii Blvd. Alternatively, ONLINE on TUCN's TEAMS platform.
5.2	For the applications –	Classroom equipped with blackboard and Video Projector – Muncii

	laboratory.	Blvd., no. 128-130. Alternatively, ONLINE on TUCN's TEAMS platform.

6. Specific competences

Professional competences	The ability to use specific electricity and energy analytics instrumentation and to manage on both energy use and generation on different energy users and energy carriers, closely related to materials science. The ability to understand the actual energy transition world is going through and the impact of materials science is playing in relation to new energy technologies.
Cross competences	The ability to have an enhanced understanding of the electricity and energy impact on the materials science and materials technologies and their interaction with the energy sector. The ability to identify and foster opportunities and detail energy sustainability solutions.

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

7.1	General objective	Evidenced based knowledge transfer and case study-based experiences regarding the Electrotechnics and energy transition based on electricity as a carrier, so as to empower the participants to act in good knowledge of the energy impact on materials science.
7.2	Specific objectives	Integrative knowledge of the Electrotechnics and energy transition context, based on electricity as a carrier and use in the materials science. Knowledge of the Maxwell electromagnetic field theory and electric and magnetic circuits modeling. The ability to effectively use energy management tools and implement energy sustainability solutions.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Course 1 **Inaugural introductive course – basics** Electrotechnics from energy to engineering Energy transitions during human evolution Energy carriers – electricity the most flexible carrier Electrotechnics modelling using field and/or circuits	2	Presentation of concepts, theories, modeling and analysis. Debates on available for the students materials and contents. Sessions of questions and answers. Case studies	
Course 2 **The material world – substance and field** The electric energy state of understanding Physical and mathematical instruments and modelling Practical applications	2		
Course 3	2		

Electric charge and field in action Electric charge Electric current Practical applications		presentations. Use of online interactive instruments – mentimeter – use of power point presentations and board writing Practical examples of energy analytics tools.	
Course 4 **Electromagnetism** Forces in electric and magnetic field Electric and magnetic field Electromagnetic induction Resistance, capacity and inductivity Energy storage Practical applications	2		
Course 5 **Energy transformation** Eddy currents Electrical transformer Classical electrical machines Special electrical machines Electricity balances Practical applications	2		
Course 6 **Energy flow through conductors** Electrical circuits modelling Direct current electrical circuits Practical applications	2		
Course 7 **Energy flow through conductors** Alternative current electrical circuits The interpretation of resistance, capacitor and inductivity significance in the electric circuits models Power definitions and balances Practical applications	2		
Course 8 **Power transfer** Connexions in three phase circuits Symmetry and equilibrium in three phase circuits Resonance in the electric circuits Practical applications	2		
Course 9 **Transitory regime** Commutation theorems R, L, C transitory models Practical applications	2		
Course 10	2		

Electromagnetic waves Wave guide Electromagnetic waves propagation Practical applications			
Course 11 **Electricity fields and interaction with other energy fields** Electricity conversion Electrical installations Smart electric domains Thermotechnics and Electrotechnics Practical applications	2		
Course 12 **An approach to energy and environment** Energy management concept, from opportunity to impact Energy generation, transportation, distribution and use Electricity impact on the environment Practical applications	2		
Course 13 **Innovative energy Horizon 2020 projects** Concepts, demo pilots presentation Electricity role in the energy transition context Practical applications and business models	2		
Course 14 **Review** Brief review of the presented topics.	2		

Bibliography

1. R.V. Ciupa, "Bazele Electrotehnicii. Teorie și aplicații", Vol I. Ed. Casa Cărții de Știință, Cluj-Napoca 2006.
2. R.V. Ciupa, "Bazele Electrotehnicii.Teorie și aplicații", Vol II. Ed. Casa Cărții de Știință, Cluj-Napoca 2006.
3. D.O. Micu, R. Marschalko, "Electrostatica", Ed. Mediamira, Cluj-Napoca, 1997.
4. A. Timotin, V. Hortopan, "Lecții de Bazele Electrotehnicii", EDPB 1970.
5. E. Simion, T. Maghiar, "Electrotehnică", EDPB 1981.
6. D.D. Micu, L. Darabant s.a. "Teoria circuitelor electrice - probleme", UT Press Cluj-Napoca, 2016.
7. R. Morar, A. Iuga, E. Man, V. Neamtu, L. Dascalescu. Electrotehnica si Masini Electrice. Institutul Politehnic Cluj-Napoca, 1991.
8. R. Morar, E. Man, V. Neamtu, L. Dascalescu, A. Iuga. Electrotehnica si masini electrice. Probleme. Institutul Politehnic Cluj-Napoca, 1987.
9. A. Samuila. Masini si actionari electrice cu turatie variabila. Editura Mediamira, Cluj-Napoca, 1998.
10. R. Morar, Gh. Mindru, A. Iuga. Electrotehnica si Masini Electrice. Lucrari practice. Institutul Politehnic Cluj-Napoca, 1978.
11. R. Morar, L. Dascalescu, A. Iuga, V. Neamtu, E. Man. Electrotehnica si Masini Electrice. Lucrari practice. Institutul Politehnic Cluj-Napoca, 1985.

8.2. Laboratory	Number of hours	Teaching methods	Notes
Laboratory 1 **Security and Safety measurements and rules**	2	Presentation of laboratory	

Instruction Presentation of the laboratory works and schedules experiments Practical applications – problem solving		works. Experiments perform. Interpretation of results. Debates on available for the students materials and contents. Sessions of questions and answers. Case studies presentations. Use of online interactive instruments – mentimeter – use of power point presentations and board writing. Practical examples of energy analytics tools.	
Laboratory 2 **Electric field and voltage spatial distribution** Experiment consisting in the representation of the equipotential voltage and electric field lines Practical applications – problem solving	2		
Laboratory 3 **Rotating magnetic field at work** Experiment consisting in the generation of a static and then rotating magnetic field distribution Practical applications – problem solving	2		
Laboratory 4 **R, L, C circuit modelling** Experiment consisting in the presentation of the basic electric circuit elements, their role and significance within different circuit configurations Resonance state in R, L, C circuits Power balances Power factor correction and capacitor banks Practical applications – problem solving	2		
Laboratory 5 **Three phase electric circuits and transitory states** Experiments consisting in the two and three phase electrical supply Experiment consisting in transitory states for different R, L, C circuit configurations Practical applications – problem solving	2		
Laboratory 6 **Electric mobility** Experimentation of electrical drives start, stop, protection, speed control, braking and coupling Practical applications – problem solving Review of the laboratory works	2		

Bibliography

1. D.D. Micu, L. Darabant s.a. “Teoria circuitelor electrice - probleme”, UT Press Cluj-Napoca, 2016.
2. R. Morar, E. Man, V. Neamtu, L. Dascalescu, A. Iuga. Electrotehnica si masini electrice. Probleme. Institutul Politehnic Cluj-Napoca, 1987.
3. R. Morar, Gh. Mindru, A. Iuga. Electrotehnica si Masini Electrice. Lucrari practice. Institutul Politehnic Cluj-Napoca, 1978.
4. R. Morar, L. Dascalescu, A. Iuga, V. Neamtu, E. Man. Electrotehnica si Masini Electrice. Lucrari practice. Institutul Politehnic Cluj-Napoca, 1985.

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

The preparation and periodical update of the course will take into account the existent curricula at international level, the consultation of relevant professional associations and authorities, the legal frame evolution and national and international implemented projects in Electrotechnics and energy transition context.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Oral and written evaluation	Individual interviews and quiz	60%
10.5 Laboratory	Laboratory test	Individual test completion	40%
10.6 Minimum standard of performance			
Participation at the courses – minimum 80% of the available time and full presence in the laboratory meetings as conditions to enter to the colloquium. Evaluation grade (G); Course (C); Laboratory (L); Calculation formula of the grade $G = 0.6 \times C + 0.4 \times L$ Condition for obtaining credits: $G > 5.0$; where $C > 5.0$, $L > 5.0$.			

Date of filling in:		**Title Surname Name**	**Signature**
10.05.2023	Lecturer	Lecturer Dr. Eng. Andrei CECLAN	
	Teachers in charge of application	Lecturer Dr. Eng. Andrei CECLAN	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	24

2. Data about the subject

2.1	Subject name			Electronics and automation			
2.2	Course responsible/lecturer			Prof. Dr. Eng. Abrudean Mihail Ioan, Mihai.Abrudean@aut.utcluj.ro			
2.3	Teachers in charge of seminars			Prof. Dr. Eng. Abrudean Mihail Ioan, Mihai.Abrudean@aut.utcluj.ro			
2.4 Year of study	II	2.5 Semester	1	2.6 Assessment	C		
2.7 Subject category	Formative category					DD	
	Optionality					DI	

3. Estimated total time

3.1 Number of hours per week	2	of which	3.2 Course	1	3.3 Seminar	0	3.3 Laboratory	1	3.3 Project	0
3.4 Total hours in the curriculum	50	of which	3.5 Course	14	3.6 Seminar	0	3.6 Laboratory	14	3.6 Project	0

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	7
(b) Supplementary study in the library, online and in the field	5
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	5
(d) Tutoring	2
(e) Exams and tests	3
(f) Other activities	0

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	22
3.9 Total hours per semester (3.4+3.8)	50
3.10 Number of credit points	2

4. Pre-requisites (where appropriate)

4.1	Curriculum	Courses in Mathematics, Physics, Electrical Engineering
4.2	Competence	-

5. Requirements (where appropriate)

5.1	For the course	-

5.2	For the applications seminarului / laboratorului / proiectului	Attendance at Laboratory s is mandatory

6. Specific competences

Professional competences	• Know the main aspects regarding the rectifier circuits, for pulses, modulation and demodulation, logic circuits, etc. • To know and interpret electronic circuits and installations with applications in the field of materials science and engineering; • C3.1 Identification, analysis of concepts, theories and specific methods for solving technical problems in the control of industrial materials processing systems • C3.2 Use of basic knowledge to explain and interpret the technical and economic conditions of the processes in the profile sectors • 3.3 Application of basic principles and methods for solving problems in the optimal management of processes in the profile sectors • 3.4 Adequate use of standard evaluation criteria and methods for the analysis of the conditions for optimal operation of technological processes in the professional sectors • C3.5 Elaboration of professional projects with the use of principles and methods established in the field, for the optimal control of the processes in the profile sectors After completing the discipline students will be able: • To know and be able to use the electronic measuring devices and control equipment in the laboratory; • To know how to represent the graphical characteristics of electronic devices and control structures • To identify and analyze concepts, theories and specific methods for designing materials processing technologies • To form practical skills in the execution of electronic assemblies • To draw up automation schemes; • To know how to interpret the graphic representations obtained after performing experiments.
Cross competences	Applying the values and ethics of the engineering profession and responsible execution of professional tasks in conditions of limited autonomy and qualified assistance. Promoting logical, convergent and divergent reasoning, practical applicability, evaluation and self-evaluation, in decision making. Carrying out activities and exercising the specific roles of teamwork, on different hierarchical levels. Promoting the spirit of initiative, dialogue, cooperation, positive attitude, respect for others, diversity and multiculturalism and the continuous improvement of one's activity. The objective self-assessment of the need for professional training continues, in order to be inserted on the labor market and to adapt to the dynamics of its requirements and for personal and professional development. Effective use of multilingual skills and knowledge of information and communication technology

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

7.1	General objective	Knowledge and deepening of knowledge in industrial electronics and automation of industrial processes.
7.2	Specific objectives	• Acquiring knowledge about rectifier circuits, amplifiers, oscillators, integrated logic circuits, etc. • Interpretation of electronic schemes and installations with applications in the field of engineering and environmental protection in industry. • Elements of systems theory and process automation.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Single-phase and three-phase rectifier circuits.	2	Exposure, Interactive teaching methods, blackboard teaching.	
2. Electronic amplifiers and oscillators	2		
3. Integrated logic circuits with com	2		
4. Voltage stabilizers and controlled rectifiers	2		
5. Continuous, sampled and random signals, transfer function	2		
6. Transfer functions algebra, ideal and real elements: P, I, D, PI, PD, PID	2		
7. Control structures for flow, level, pressure, temperature, etc.	2		

Bibliography

1.M. Abrudean, Electronică industrială, Ed. UT Pres, Cluj-Napoca, 1998, ISBN 973-98380-4-9, 275 pag.
2. Cl.Feştilă, M. Abrudean, Eva Dulf, Electronică de putere în automaticã, Mediamira, 2004.
3. T. Coloşi, A. Aştilean, M. Abrudean, T. Leţia, D. Bălan, I. Naşcu, Dispozitive şi circuite electronice. Îndrumător de laborator, 1995.
4.M. Abrudean,Teoria sistemelor si reglare automata,Editura Mediamira,1998
5. T. Coloşi, L. Feştilă, Elemente de electronică industrială, Vol. I şi II, Institutul Politehnic Cluj-Napoca, 1978, 580 pag.
6.J. Love, Procces Automation Handbook,A guide to theory and practice,Springer,2007

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
1. Semiconductor diode	2	Exposure, experimental work in the laboratory, mathematical modeling and numerical simulations	
2. Single-phase rectifier	2		
3. Bipolar junction transistor	2		
4. Amplifiers, oscillators	2		
5. Integrated circuits (gates, counters, information movement registers)	2		
6. Applications with transfer function, systems identification	2		

7. Stability of systems, control structures, applications	2		

Bibliography

1. T. Coloşi, A. Aştilean, M. Abrudean, T. Leţia, D. Bălan, I. Naşcu, Dispozitive şi circuite electronice. Îndrumător de laborator, 1995.
2. Cl. Feștila, R. Both, Electronică - Îndrumător de lucrări, Ed. U.T. Press, Cluj Napoca, 2009.
3. Cl. Feștilă, Echipamente electrice şi electronice - Îndrumător de laborator, Cluj-Napoca, 1981.
4. **** The Internet

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

Collaboration with INCDTIM Cluj, ICIA Cluj-Napoca

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Exam	Online multiple-choice test or written exam	80%
10.5 Seminars /Laboratory/Project	Laboratory colloquium	On site or Online multiple-choice test	20%
10.6 Minimum standard of performance			
Exam grade ≥ 5 Laboratory grade ≥ 5			

Date of filling in:		**Title Surname Name**	**Signature**
18.04.2023	Lecturer	Prof. Dr. Eng. Abrudean Mihail Ioan	
	Teachers in charge of application	Prof. Dr. Eng. Abrudean Mihail Ioan	

Date of approval in the department
26.06.2023

Head of department
Ass.prof.dr.eng. Mariana Pop

Date of approval in the faculty
10.07.2023

Dean
Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	25.10

2. Data about the subject

2.1	Subject name			Special Mathematics		
2.2	Course responsible/lecturer			Lect. Dr. Daniela Marian		
2.3	Teachers in charge of seminars			Lect. Dr. Daniela Marian		
2.4 Year of study	I	2.5 Semester	I	2.6 Assessment	Nota	
2.7 Subject category	Formative category					DF
	Optionality					DO

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	1	3.3 Seminar	2	3.3 Laboratory	-	3.3 Project	-
3.4 Total hours in the curriculum	42	of which	3.5 Course	14	3.6 Seminar	28	3.6 Laboratory		3.6 Project	

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	9
(b) Supplementary study in the library, online and in the field	8
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
(d) Tutoring	3
(e) Exams and tests	3
(f) Other activities	

3.8 Total hours of individual study (summ (3.7(a)...3.7(f)))	33
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	N/A Electronic Course
5.2	For the applications seminarului / laboratorului /	Individual work

	proiectului	

6. Specific competences

Professional competences	**C1.1.** Identifying the concepts, principles, basic theorems and mathematical methods, physics, chemistry, technical drawing, computer programming. **C1.2**. Using basic knowledge in the fundamental disciplines for theoretical explanation and interpretation of results, theorems, phenomena or specific processes of industrial engineering. **C1.3.** Applying the theorems, principles and basic methods of fundamental disciplines, for basic engineering calculations in design and operation of technical systems specific to industrial engineering, under qualified assistance **C1.4.** Appropriate use of standard assessment criteria and methods of fundamental disciplines for identification, modelling, analysis and qualitative and quantitative assessment of characteristics of the phenomena and parameters as well as the processing and interpretation of the results from specific industrial engineering processes. **C1.5.** Developing of specific industrial engineering projects and models based on identification, selection and use of principles, optimal methods and acknowledged solutions from the fundamental disciplines.
Cross competences	**CT1.** Applying the values and the ethics of the profession of engineer and the responsible execution of the professional duties under limited autonomy and qualified assistance. Promoting the logical reasoning, convergent and divergent, the practical applicability and the assessment and self-evaluation decisions. **CT3.** Objective self-evaluation of the need of continuous training for labor market insertion and the accommodation to its dynamic requirements and for personal and professional development. Effective use of language skills and knowledge of information technology and communication.

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

7.1	General objective	To obtain knowledge about the basic results of special mathematics and their application in other discipline
7.2	Specific objectives	• To recognise the different types of differential equations and to find their solutions • To solve systems of differential equations • To solve first order partial differential equations • To solve second order partial differential equations • To know applications of special mathematics in different domains

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Differential equations -the basic notions. The Cauchy's problem. Separable equations. Homogeneous equations (in the sesnse of Euler)	1	Oral presentation, notes on blackboard and	
First order linear differential equations. Bernoulli equations. Ricatti equations	1		

Clairaut equations. Lagrange equations. Equations with exact differentials. Integrating factor	1	multimedia presentatation Students are asked and encouraged to ask questions	
Linear differential equations order n, with variable coefficients. Linear differential equations order n, with constant coefficients	1		
Euler equations. Systems of differential equations. Symmetrical systems	1		
First order partial differential equations	1		
Second order partial differential equations	1		

Bibliography

1. D. Marian, L. Blaga, Differential Equations. Theory and Problems, Ed. Mediamira, Cluj-Napoca, 2014.
2. N. Lungu, V. Dincuta, D. Inoan, A. Novac, M. Rus, Differential equations, Matrix Rom ,Bucuresti, 2009
3. R. Bronson, Differential equations, McGraw Hill, 2007
4. K. Armbruster, Introductory differential equations. From linearity to chaos, Addison-Wesley, 1996

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
First order linear differential equations. Bernoulli equations. Ricatti equations	2	Practical problems Students are asked and encouraged to ask questions	
Clairaut equations. Lagrange equations. Equations with exact differentials. Integrating factor	2		
Linear differential equations order n, with variable coefficients. Linear differential equations order n, with constant coefficients	2		
Euler equations. Systems of differential equations. Symmetrical systems	2		
First order partial differential equations	2		
Second order partial differential equations	2		
The heat equations	1		
The wave equation	1		

Bibliography

5. D. Marian, L. Blaga, Differential Equations. Theory and Problems, Ed. Mediamira, Cluj-Napoca, 2014.
6. N. Lungu, V. Dincuta, D. Inoan, A. Novac, M. Rus, Differential equations, Matrix Rom ,Bucuresti, 2009
7. R. Bronson, Differential equations, McGraw Hill, 2007
8. K. Armbruster, Introductory differential equations. From linearity to chaos, Addison-Wesley, 1996

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

A good engineer must have solid knowledge of mathematics to apply in the domain in which he works because the professional community requires well prepared engineers.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The ability to answer to theoretical questions and to solve practical problems	Written test (mark T)	T is 70%
10.5 Seminars /Laboratory/Project	The activity during classes is appreciated	Questions on each class. Activity of seminar (mark AS) Homework (mark H)	AS is 20% H is 10%
10.6 Minimum standard of performance N=0,7T+0,2AS+0,1H;			
The final credit can be received only if each of the mark's components is fulfilled: N≥5; T≥5			

Date of filling in:		**Title Surname Name**	**Signature**
14.05.2023	Lecturer	Lect.Dr. Daniela Marian	
	Teachers in charge of application	Lect.Dr. Daniela Marian	

Date of approval in the department
26.06.2023

Head of department
Ass.prof.dr.eng. Mariana Pop

Date of approval in the faculty
10.07.2023

Dean
Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	25.20

2. Data about the subject

2.1	Subject name			Numerical methods		
2.2	Course responsible/lecturer			Lect. Dr. Daniela Marian		
2.3	Teachers in charge of seminars			Lect. Dr. Daniela Marian		
2.4 Year of study	II	2.5 Semester	I	2.6 Assessment	Nota	
2.7 Subject category	Formative category					DF
	Optionality					DO

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	1	3.3 Seminar	2	3.3 Laboratory	-	3.3 Project	-
3.4 Total hours in the curriculum	42	of which	3.5 Course	14	3.6 Seminar	28	3.6 Laboratory		3.6 Project	

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	9
(b) Supplementary study in the library, online and in the field	8
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
(d) Tutoring	3
(e) Exams and tests	3
(f) Other activities	
3.8 Total hours of individual study (summ (3.7(a)...3.7(f)))	33
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	Basic knowledge of Differential and Integral Calculus
4.2	Competence	Competences in elementary Differential and Integral Calculus: derivatives, integrals, series.

5. Requirements (where appropriate)

5.1	For the course	N/A Electronic Course
5.2	For the applications	Individual work

	seminarului / laboratorului / proiectului	

6. Specific competences

Professional competences	**C1 –** Operating with basic Mathematical, Engineering and Computer Science concepts (5 credits) **C1.1 –** Recognizing and describing concepts that are specific to the fields of calculability, complexity, programming paradigms, and modeling computational and communication systems **C1.3 –** Building models for various components of computing systems **C1.5 –** Providing a theoretical background for the characteristics of the designed systems
Cross competences	**CT1.** Applying the values and the ethics of the profession of engineer and the responsible execution of the professional duties under limited autonomy and qualified assistance. Promoting the logical reasoning, convergent and divergent, the practical applicability and the assessment and self-evaluation decisions. **CT3.** Objective self-evaluation of the need of continuous training for labor market insertion and the accommodation to its dynamic requirements and for personal and professional development. Effective use of language skills and knowledge of information technology and communication.

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

7.1	General objective	A presentation of the concepts, notions, methods and fundamental techniques used in differential calculus.
7.2	Specific objectives	Use of the differential calculus in order to solve problems in engineering.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Elements of Error Theory. Floating Point Arithmetic. Absolute and Relative Errors.	2	Explanation Demonstration Collaboration Interactive activities Multimedia presentatatio n Students are asked and encouraged to ask questions Collaboration Interactive	
Numerical Methods in Linear Algebra. Special Types of Matrices. Norms of Vectors and Matrices. Eigenvalues and Eigenvectors. Error Estimation. Matrix Equations. Pivoting Elimination. Improved Solutions of Matrix Equations. Partitioning Methods for Matrix Inversion. LU Factorization. Doolittle's Factorization. Choleski's Factorization Method. Iterative Techniques for Solving Linear Systems. Jacobi Iterative Method. Gauss-Seidel Iterative Method. Relaxation Methods. Characteristic Polynomial: Leverrier Method. Characteristic Polynomial: Fadeev-Frame Method.	2		
Solutions of Nonlinear Equations. Method of Successive Approximation.	2		

The Bisection Method. The Newton-Raphson Method. The Secant Method. False Position Method. The Chebyshev Method. Numerical Solutions of Nonlinear Systems of Equations. Newton's Method for Systems of Nonlinear Equations. Steepest Descent Method.		activities	
Elements of Interpolation Theory. Lagrange Interpolation. Divided Difference. Mean Value Properties in Lagrange Interpolation. Approximation by Interpolation. Hermite Interpolating Polynomial. Finite Differences. Interpolation of Multivariable Functions. Scattered Data Interpolation. Shepard's Method. Splines. B-splines.	2		
Elements of Numerical Integration. Richardson's Extrapolation. Numerical Quadrature. Error Bounds in the Quadrature Methods. Trapezoidal Rule. Richardson's Deferred Approach to the Limit. Romberg Integration. Newton-Cotes Formulas. Simpson's Rule. Gaussian Quadrature.	2		
Elements of Approximation Theory. Discrete Least Squares Approximation. Orthogonal Polynomials and Least Squares Approximation. Rational Function Approximation. Padé Approximation. Trigonometric Polynomial Approximation. Fast Fourier Transform. Bernstein Polynomial. Bézier Curves. *METAFONT.*	2		
Integration of Ordinary/Partial Differential Equations. The Euler Method. The Taylor Series Method. The Runge-Kutta Method. The Runge-Kutta Method for Systems of Equations. **Integration of Partial Differential Equations** Parabolic Partial-Differential Equations. Hyperbolic Partial Differential Equations. Elliptic Partial Differential Equations.	2		
Bibliography Bibliography 1. Mircea Ivan and Kálmán Pusztai. Numerical Methods with Mathematica. Mediamira, Cluj-Napoca, 2003. ISBN 973-9357-41-5. 2. Mircea Ivan and Kálmán Pusztai. Mathematics by Computer. Comprex Publishing House, Cluj-Napoca, 1992.			

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
The applications follow the topics of the courses.	28	Practical problems Collaboration Interactive	

		activities	

Bibliography

1. Mircea Ivan and Kálmán Pusztai. Numerical Methods with Mathematica. Mediamira, Cluj-Napoca, 2003. ISBN 973-9357-41-5.
2. Mircea Ivan and Kálmán Pusztai. Mathematics by Computer. Comprex Publishing House, Cluj-Napoca, 1992.

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

A good engineer must have solid knowledge of mathematics to apply in the domain in which he works because the professional community requires well prepared engineers.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The ability to answer to theoretical questions and to solve practical problems	Written test (mark T)	T is 70%
10.5 Seminars /Laboratory/Project	The activity during classes is appreciated	Questions on each class. Activity of seminar (mark AS) Homework (mark H)	AS is 20% H is 10%
10.6 Minimum standard of performance N=0,7T+0,2AS+0,1H;			
The final credit can be received only if each of the mark's components is fulfilled: N≥5; T≥5			

Date of filling in:		**Title Surname Name**	**Signature**
14.04.2023	Lecturer	Lect.Dr. Daniela Marian	
	Teachers in charge of application	Lect.Dr. Daniela Marian	

Date of approval in the department
26.06.2023

Head of department
Ass.prof.dr.eng. Mariana Pop

Date of approval in the faculty
10.07.2023

Dean
Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	26.10 Modern language III English 26.20 Modern language III French 26.30 Modern language III German

2. Data about the subject

2.1	Subject name			English French German III			
2.2	Course responsible/lecturer			-			
2.3	Teachers in charge of seminars			Conf. dr. Sanda Pădureţu – Lb. engleză Sanda.Paduretu@lang.utcluj.ro			
2.4 Year of study	II	2.5 Semester	I	2.6 Assessment	C		DC/DO
2.7 Subject category	Formative category English, French, German language						
	Optionality DC/DO						

3. Estimated total time

Year / Sem	Name of the discipline	Nr. weeks	Course	Applications			Course	Applications			Individual study	TOTAL	Credit
			[ore/săpt.]				[ore/sem.]						
				S	L	P		S	L	P			
I	Modern language	14	-	2	-	-	-	28	-	-	22	50	2

3.1	Number of hours per week	2	3.2	of which, course:	-	3.3	applications:	2
3.4	Total hours in the curriculum	50	3.5	of which, course:	-	3.6	applications:	28

Individual study	Ore
Manual, lecture material and notes, bibliography	7
Supplementary study in the library, online and in the field	2
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	8
Tutoring	2
Exams and tests	3
Other activities	-

3.7	Total hours of individual study	22
3.8	Total hours per semester	28
3.9	Number of credit points	2

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	Minimum level of knowledge of the modern language B1 / B2 (English) and A1 / A2 (French) (cf. CEFR - Common European Framework of Reference for Languages)

5. Requirements (where appropriate)

5.1	For the course	N/A
5.2	For the applications	Class attendance, individual study Rooms B 102, B 103 / M102, M 104 - onsite MS Teams Platform – online

6. Specific competences

Professional competences	Application of grammar, format rules and conventions regarding the writing of technical documents in the foreign language Elaboration, reformulation, summary and synthesis of texts in formal technical style
Cross competences	Ability for foreign language documentation, useful for academic and / or professional careers Oral and written communication skills in multicultural professional teams.

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

7.1	General objective	Development of linguistic and communicative skills in a foreign language in professional situations.
7.2	General objectives	Assimilation of the basic lexicon in the fields of interest and related of materials science and engineering. Effective use of language and communication skills in the foreign language.

3. Contents

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
1. Diagnostic and self-assessment test	2	Communicative and interactive strategies.	Online platform, Interactive board, CD
2. Academic life and professional career	2		
3. Materials technology. Recyclable materials	2		
4. Material resistance	2		

5. Solid materials	2	Integrated skills, flipped learning, blended learning	Player, video projector
6. Chemical compounds and chemical reactions	2		
7. Corrosion	2		
8. Oxidic materials. Glass	2		
9. Ceramic materials	2		
10. Plastic materials	2		
11. Materials with special properties. Optical fiber	2		
12. Appliances	2		
13. Written test	2		
14. Oral assessment	2		

Bibliography

Glendinning, E. and Alison Pohl, Technology 1, OUP, 2008
Aspects of English Grammar in Technical Contexts, U.T. Press, Cluj-Napoca, 2015
Ibbotson, M., Cambridge English for Engineering, CUP, 2009.
Ioani, M., Le français de la communication scientifique et technique, Ed. Napoca Star, Cluj-Napoca, 2002.
Tescula, C., Le francais de la technique, UT.Press, Cluj-Napoca,2005.
File „Présenter en français" (disponibil la biblioteca facultăţii).
Paris, D.; Foltete Paris, B., Environnement.com, CLE International, Paris, 2009.
E. Cloose, Le français du monde du travail, Grenoble, PUG, 2009.
J. L. Penfornis Français.com, nouvelle édition, Paris, CLE International, 2012.

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

Optimizing communication with the interlocutor / partner on the labor market

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Seminar Applications		Fulfilling work tasks at the written test, taking part in a conversations or a monologue, seminar activity, homework		Written exam Oral exam		30% 40%
				Practical assessment (seminar activity, homework)		30%
10.4 Minimum standard of performance: The student is accepted at the final evaluation, if his/her contribution to the seminar topics is 80%. The grade is calculated if each component is correctly done at least 60%.						
Final grade: 0,3 Ts + 0,4 Po + 0,3 P						

Date of filling in	Professor in charge with the discipline	Teachers in charge of the seminar
20.05.2023	Conf. dr. Sanda Pădureţu	Conf. dr. Sanda Pădureţu

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	27

2. Data about the subject

2.1	Subject name			Thermotechnics			
2.2	Course responsible/lecturer			S.L. dr.ing Socaciu Lavinia - lavinia.socaciu@termo.utcluj.ro			
2.3	Teachers in charge of seminars			S.L. dr.ing Socaciu Lavinia- lavinia.socaciu@termo.utcluj.ro			
2.4 Year of study	2	2.5 Semester	2	2.6 Assessment	Exam		
2.7 Subject category	Formative category						DD
	Optionality						DI

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	1	3.3 Project	0
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	14	3.6 Project	0

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	48
(b) Supplementary study in the library, online and in the field	0
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	7
(d) Tutoring	0
(e) Exams and tests	3
(f) Other activities	0

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Physics, Mathematics, Materials science, Materials technology
4.2	Competence	Use of personal computer. Recognition of materials and component mechanisms from different installations

5. Requirements (where appropriate)

5.1	For the course	Active and interactive learning conditions, didactic activities carried out in a heuristic, problematic spirit; teaching aids: PC, teaching

		aids: PowerPoint presentation, teaching film, course support in PDF format
5.2	For the applications Laboratory	Rules of conduct of students in the thermotechnics laboratory. Practical-applicative learning conditions, in a heuristic, problematic spirit. Laboratory with material endowments specific to the thermotechnics and sheet metal laboratory. Attendance at applications is mandatory

6. Specific competences

Professional competences	C2-The managing and solving of specific environmental problems for sustainable Development C2.1-The description and application of the concepts, theories and practical / technological /engineering methods for determining the state of environmental quality C2.3-Applying basic technical and technological knowledge in defining and explaining specific concepts of engineering and environmental protection C3-The application of general principles of technological calculation C3.4-The evaluation of installations, in conditions of qualified assistance, using the specific documentation of the technological calculation C3.5-The use of the concepts, theories and calculation methods in the field of environmental engineering for the elaboration of professional projects
Cross competences	CT2-Identifying roles and responsibilities in a multidisciplinary team and applying relational techniques and efficient work within the team CT3- The efficient use of information sources and communication resources and assisted professional training (portals, Internet, specialized software applications, databases, online courses, etc.) both in Romanian and in a language of International circulation

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

7.1	General objective	Development of skills in the thermal field, forms of energy, their production and use in various industrial processes and environmental impact
7.2	Specific objectives	Notions and applications related to: forms of energy, air, steam, fuels, thermodynamic cycles, heat transfer, machines and thermal installations

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Introduction. General notions of thermodynamics. The object of thermotechnics. General study methods. Thermodynamic system.	2	Classical, focused on the student and on the results of acquiring the knowledge	Classical teaching methods (exposure to the blackboard)
Thermodynamic equilibrium state. Status sizes. Thermodynamics postulates. The first principle of thermodynamics. Internal energy. Mechanical work. The	2		

heat.		taught in the course; Interactive lecture; Presentation, Debate, Participatory Discussions; Individual and group exercises	combined with multimedia methods
Formulations of the first principle of thermodynamics. Mathematical expressions of the first principle of thermodynamics for open systems and closed systems	2		
Applications of the first principle of thermodynamics in technology	2		
The perfect gas. General. The specific heat of perfect gases.	2		
Simple state transformations (thermodynamic processes) of perfect gases.	2		
The second principle of thermodynamics. Entropy. Cyclic processes (thermodynamic cycles). Carnot's theorem. The entropy of perfect gases. Entropic diagrams.	2		
Vapor. Vaporization at constant pressure. Thermodynamic diagrams of vapors.	2		
The humid air. Thermophysical properties. Enthalpy-humidity diagram. Simple transformations of humid air	2		
Heat transfer. Fundamentals of heat transfer. Heat transfer through conduction. Conductive heat transfer, in permanent regime, unidirectional, without internal heat sources. Thermal conductivity of bodies.	2		
Convective heat transfer (thermal convection) without changing the state of fluid aggregation. Thermal radiation. Radiation heat transfer.	2		
Heat exchangers.	2		
Refrigeration installations and heat pumps	2		
Compressors and fans	2		
Bibliography 1. Socaciu Lavinia - Termotechnics - Electronic form course support. 2. Yunus Cengel and Michael Boles - Thermodynamics: An Engineering Approach, 9th Edition, 2019 3. Michael J. Moran ,Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, FUNDAMENTALS OF ENGINEERING THERMODYNAMICS , Eighth Edition, 2014, http://krodriguez.net/libros/moran.pdf			
8.2. Laboratory	Number of hours	Teaching methods	Notes
1. Labor protection rules Temperature measurement	2	Laboratory experiment Interactive and conventional, student-centered Individual and group exercises	Specific equipment to the thermotechnics laboratory
2. Pressures measurement	2		
3. Determination of the thermal convection coefficient at a pipe bundle Determination of the overall heat transfer coefficient and equivalent thermal conductivity of an electrically heated furnace	2		
4. Numerical applications	2		
5. Determining the state quantities of humid air	2		

6. Determining the main characteristics of the heat pump	2		
7. Recovery of laboratory works (according to the ECTS regulation) and test to evaluate knowledge acquired in laboratory works	2		
Bibliography 1. http://www.termo.utcluj.ro/termo_sinteza_lucrari/index.html 2. Socaciu L., Giurgiu O. – Termotehnică – Lucrări de laborator, Ed. UTPRESS, Cluj-Napoca, 2015, ISBN 978-606-737-089-8			

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

The approached contents cover fundamental topics of the discipline that ensure the Students familiarity with the specific issues of the discipline (concepts, theories, laws, principles and methods of knowledge, research, transfer in the practical-productive sphere) The curriculum of the discipline is designed so as to facilitate the forming of professional competencies (specific to the profession, provided in the RNCIS documents) and transversal competencies) The contents approached include current topics (local, national, international) that are the subject of interest and / or debates / research conducted by professional associations and / or employers. The contents of the discipline were selected as a result of the collaboration of teachers with other teachers from universities in the country and / or abroad, as a result of the collaboration with the business environment

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Knowledge of the basic concepts of the discipline and explanation of the interdependencies between them Communication of information using correctly the scientific language, specialized in the discipline of Thermotechnics Learning the issues covered in the course	Written exam in the exam session; the topics cover the whole subject	40%
	Ability to apply theoretical knowledge in solving practical problems (topics)	Solving some problems (applications)	30%
10.5 Laboratory	Knowledge of the operation of measuring devices, of experienced	Oral evaluation in each laboratory. Written and oral evaluation in	20%

	equipment and installations, of the module for determining the different parameters, analysis of experimental results and formulation of personal conclusions / observations	the final laboratory	
10.6 Minimum standard of performance			
• Knowledge of the basic concepts of the discipline and their explanation • Communicating information using the correct, specialized scientific language • Solving some problems (applications) in the field of thermotechnics			

Date of filling in:		**Title Surname Name**	**Signature**
22.04.2023	Lecturer	S.L.dr.ing. Socaciu Lavinia	
	Teachers in charge of application	S.L.dr.ing. Socaciu Lavinia	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	28.00

2. Data about the subject

2.1	Subject name			Materials technology II			
2.2	Course responsible/lecturer			Lecturer dr.eng. Monica Sas-Boca-Monica.Sas.Boca@ipm.utcluj.ro			
2.3	Teachers in charge of seminars			Lecturer dr.eng. Monica Sas-Boca-Monica.Sas.Boca@ipm.utcluj.ro			
2.4 Year of study	II	2.5 Semester	4	2.6 Assessment	E		
2.7 Subject category	Formative category					DI/DD	
	Optionality						

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	-
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	28
(b) Supplementary study in the library, online and in the field	18
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	9
(d) Tutoring	
(e) Exams and tests	3
(f) Other activities	

3.8 Total hours of individual study (summ (3.7(a)...3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	General knowledge of technical drawing, technological procedures for obtaining and processing materials

5. Requirements (where appropriate)

5.1	For the course	Projector, computer, on site/on-line at Technical University of Cluj-Napoca
5.2	For the applications seminarului / laboratorului / proiectului	Technical University of Cluj-Napoca laboratories (E10)

6. Specific competences

Professional competences	- Characterization of materials used in industry, from a mechanical point of view; - Knowledge of the technological possibilities of obtaining semi-finished products and finished parts; - Ability to design manufacturing technologies in advantageous economic conditions; - Establishing the conditions and technologies for reconditioning some parts. After completing the discipline students will be able to: • To use the equipment for technological characterization of materials; • To establish the conditions for determining the technological characteristics in relation to the requirements imposed by the specifications; • To analyse the execution drawings of the piece and to establish the shape and dimensions of the starting semi-finished product; • To establish the optimal manufacturing technology related to the application possibilities; • To know how to establish the succession of operations and technological phases; • To know the technological possibilities of reconditioning used parts; • To know how to interpret the experimental results, the characteristics of the obtained pieces and to draw the necessary conclusions. After completing the discipline students will be able to: - to use the equipment for material characterization; - to establish the sequence of operations for obtaining finished parts; - to identify the appropriate manufacturing technologies for obtaining certain types of components.
Cross competences	To know from a structural point of view the materials used in industry; To know technical drawing; Evaluate the manufacturing technologies of semi-finished products and relate them to the available application possibilities; To synthesize the requirements imposed on the elaborated materials and semi-finished products.

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

7.1	General objective	Understand the connection between manufacturing technology, material properties, quality of the finished product and relate them to the possibilities of application in industry
7.2	Specific objectives	• To analyze the execution drawings of the piece and to establish the shape and dimensions of the starting semi-finished product; • To establish the optimal manufacturing technology related to the application possibilities;

		• To know how to establish the succession of operations and technological phases; • To know the technological possibilities of reconditioning used parts; • To know how to interpret the experimental results, the characteristics of the obtained pieces and to draw the necessary conclusions.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Tehnologia fabricării pieselor turnate: domenii de aplicare, condiţii impuse pieselor şi etape ale procesului	2	On-site/on-line/ presentation	Each process is illustrated by video applications.
2. Procedee tehnologice de obţinere a formelor de turnătorie (modelul de turnatorie si amestecurile de formare), a fabricarii pieselor turnate si defectele acestora	2		
3. Elaborarea pieselor prin turnare de precizie si prin turnare centrifugala	2		
4. Tehnologia elaborării semifabricatelor laminate	2		
5. Prelucrarea materialelor prin tragere şi trefilare	2		
6. Procedee tehnologice de laminare şi tragere a ţevilor	2		
7. Prelucrarea materialelor prin forjare: condiţii impuse pieselor şi etape ale procesului	2		
8. Prelucrarea materialelor prin forjare liberă şi matriţare	2		
9. Prelucrarea materialelor prin extrudare	2		
10. Prelucrarea tablelor prin forfecare ştanţare şi ambutisare	2		
11. Tehnologia fabricării pieselor sudate şi procedee de recondiţionare a acestora	2		
12. Elaborarea pieselor prin metalurgia pulberilor	2		
13. Notiuni generale privind prelucrarea materialelor prin aschiere	2		
14. Tehnologii neconventionale de obtinere a pieselor	2		

Bibliography

1. N. Vintilă – Tehnologia metalelor, Vol. I-II, Lit. Institutului Politehnic Cluj, 1978.
2. A. Palfalvi şi alţii – Tehnologia materialelor, E.D.P. Bucureşti, 1985.
3. M. Golumba – Tehnologia materialelor, Lit. Institutului Politehnic Timişoara, 1981.
4. I. Mălureanu-Tehnologia materialelor, Ed. Gh. Asachi, Iaşi, 1999.
5. D.R. Mocanu – Încercările materialelor, Vol I-II, Editura Tehnica Bucureşti, 1982.
6. L. Brânduşan C. Pavel, R. Mureşan, Tehnologia Materialelor, Îndrumător pentru lucrări de laborator, Editura U.T. PRES 1999, Cluj-Napoca.
7. Tratat de stiinta si ingineria materialelor metalice. Vol. IV. Tehnjologii de procesare primara a

<table>
<tr><td colspan="4">materialelor metalice; Coordonare generala: Rami Saban, Constantin Dumitrescu; Responsabil volum IV: Iulian Riposan; Editura AGIR ISBN: 978-973-720-064-0
8. Tratat de stiinta si ingineria materialelor metalice. Vol.5. Tehnologii de procesare finala a materialelor metalice; Coordonare generala: Prof.univ.dr.ing.Rami Saban, Prof.univ.dr.ing.Constantin Dumitrescu; Editura: A.G.I.R. ISBN: 978-973-720-391-5; 2012.</td></tr>
<tr><td>8.2. Seminars /Laboratory/Project</td><td>Number of hours</td><td>Teaching methods</td><td>Notes</td></tr>
<tr><td>1. Technological tests of pipes</td><td>2</td><td rowspan="8">The equipment is described, the technician exemplifies the way of working.</td><td rowspan="8">Students perform the measurements, write down the data, perform individually different operations specific to the related works and determine by calculation the results obtained.</td></tr>
<tr><td>2. Determination of the deformation capacity of the sheets by alternating bending. Determining the behavior of the sheets for double bending and bending of the strips</td><td>2</td></tr>
<tr><td>3. Determination of the stamping capacity of sheets and strips by the Erichsen method</td><td>2</td></tr>
<tr><td>4. Determination of the deformation capacity by discharge of materials Establishment of material processing operations in order to obtain parts of different configurations</td><td>2</td></tr>
<tr><td>5. Determining the mass of the starting semi-finished product to obtain parts by forging.</td><td>2</td></tr>
<tr><td>6. Technological properties of powders</td><td>2</td></tr>
<tr><td>7. Non-destructive testing methods; Control with liquids and penetrating radiation</td><td>2</td></tr>
<tr><td colspan="4">Bibliography
1. I. Mălureanu-Tehnologia materialelor, Ed. Gh. Asachi, Iaşi, 1999.
2. D.R. Mocanu – Încercările materialelor, Vol I-II, Editura Tehnica Bucureşti, 1982.
3. L. Brânduşan C. Pavel, R. Mureşan, Tehnologia Materialelor, Îndrumător pentru lucrări de laborator, Editura U.T. PRES 1999, Cluj-Napoca.</td></tr>
</table>

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

The acquired competencies will be applied in the design activities of the technological processes in the industry and of the activity sectors.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The exam consists of checking the knowledge in writing or orally.	Online / written	75%
10.5 Seminars /Laboratory/Project	Exam note (online, oral or written); Laboratory (note L);	Evaluation of laboratory works	25%
10.6 Minimum standard of performance N = 0.75 + 0.25L			

Condition for obtaining credits ECTS: N≥5; L≥5

Date of filling in: 10.05.2023		**Title Surname Name**	**Signature**
	Lecturer	Lecturer dr.eng. Ioana Monica Sas-Boca	
	Teachers in charge of application	Lecturer dr.eng. Ioana Monica Sas-Boca	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	29

2. Data about the subject

2.1	Subject name			Materials properties			
2.2	Course responsible/lecturer			Conf. Dr. Phys. Florin Popa – florin.popa@stm.utcluj.ro			
2.3	Teachers in charge of seminars			Conf. Dr. Phys. Florin Popa – florin.popa@stm.utcluj.ro			
2.4 Year of study	2	2.5 Semester	2	2.6 Assessment	Examination		
2.7 Subject category	Formative category						DID
	Optionality						DOB

3. Estimated total time

3.1 Number of hours per week	4	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	2	3.3 Project	-
3.4 Total hours in the curriculum	104	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	28	3.6 Project	-

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	23
(b) Supplementary study in the library, online and in the field	10
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
(d) Tutoring	2
(e) Exams and tests	3
(f) Other activities	-

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	48
3.9 Total hours per semester (3.4+3.8)	104
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	Physics, chemistry, and material science knowledges

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications seminarului / laboratorului /	

	proiectului	

6. Specific competences

Professional competences	**Theoretical knowledge (What he needs to know)** - To know the general physical, mechanical, and technological properties of materials, their variation limits applied to material classes and inside material classes - To understand material properties, how and why some properties change after modifying external conditions (temperature, deformation, time, etc.) or internal conditions (composition, structure, etc.) - To understand dependence material-structure-properties-usage. - To evaluate the engineering materials for their property aspect **Acquired skills (what he needs to do)** - To use properly the measurement units of different properties - To use correlation between material-structure-property in order to modify the material properties - To know (as fundamental) the methods of material property determination - To be able of analysing the material data, and to make correlation between material properties and their practical usage - To know how to produce new materials, new manufacturing technologies, and finding rational usage of materials **Acquired skills (what equipment he knows to use)** - After following the lecture, the undergraduate will be able to use dilatometer, Thomson Bridge, thermal and electrical conductivity setup, oscilloscope, electromagnets. - To realize experimental setups for different physical measurements
Cross competences	- To acquire a scientific language, with engineering terms - To transfer analysis method to different material types - - to correlate the microstructure properties with physico-mechanical properties of materials - To be able to exercise the specific roles of teamwork, on different hierarchical levels - To promote the spirit of initiative, dialogue, cooperation, positive attitude, respect for others, diversity / multiculturalism, continuous improvement of his professional activities - To objectively self-assess the need for continuous professional training - Be able to use multilingual skills and knowledge of information technology effectively.

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

7.1	General objective	Material properties field competence development and properties characterisation methods knowledge
7.2	Specific objectives	To understand the material properties in their complexity – how and why some properties change after modifying external conditions (temperature, deformation, time, etc.) or internal conditions (composition, structure, etc.) To understand dependence material-structure-properties-usage. To evaluate the engineering materials for their property aspect

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Material properties and classification. Structural properties.	2	Lecture PowerPoint presentation Interactive teaching mode Dialogue - conversation professor – student Student participation at supplementary practical activity is encouraged	Multimedia Blackboard
2. Structural properties of materials (part II).	2		
3. Thermal properties of materials (thermal expansion, specific heat, thermal conductivity).	2		
4. Electrical properties of materials. Conducting materials.	2		
5. Electrical properties of materials. Semiconductors and insulators.	2		
6. Magnetic properties of materials. Hysteresis cycle and magnetic material classification.	2		
7. Magnetic properties of materials. Extrinsic and intrinsic magnetic properties.	2		
8. Optical properties of materials	2		
9. Mechanic properties of materials (resilience, elasticity, plasticity. Variation ranges of mechanical properties function materials types)	2		
10. Mechanic properties of materials (Influence factors)	2		
11. Dislocation theory and mechanic properties of materials	2		
12. Technological properties of materials	2		
13. Liquid state material properties	2		
14. High temperature properties. Thermoelectric, thermomagnetic, and galvanometric effects.	2		

Bibliography

1. Gh. Matei, Teoria structurală a proprietăţilor metalelor, Lito UTCN, 1986.
2. V. Pop, I. Chicinaş, Proprietăţile fizice ale metalelor şi aliajelor, Lito Univ. "Babeş-Bolyai" Cluj-Napoca, 1997.
3. V. Pop, I. Chicinaş, N. Jumate, Fizica materialelor. Metode experimentale, Ed. Presa universitară clujeană, Cluj-Napoca, 2001
4. I. Chicinaş, Mărimi magnetice de material, Ed. Casa Cărţii de Ştiinţă, Cluj-Napoca, 2002
5. N. Jumate, I. Chicinaş, Aliaje amorfe şi nanocristaline, Editura UT Pres, Cluj-Napoca, 2002
6. S.V. Wonsovshi, Magnetismul, Editura tehnica Bucuresti, 1981.
7. M. Ursache, D. Chirica, Proprietatile metalelor, E.D.P. Bucuresti, 1982.
8. Dieter G. jr. Metalurgie mecanica, Editura Tehnica Bucuresti, 1970.
9. A. Domsa, S. Domsa, Materiale metalice in constructii si instalatii, Editura DACIA, Cluj-Napoca, 1981.
10. D.R. Mocanu si col., Incercarea materialelor, vol.I, Ed. Tehnică, Bucuresti, 1988

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
1. Measurement error theory basics	2	4 laboratories are performed with all students.	Before each laboratory students presents an abstract of
2. Temperature influence study on resilience and plasticity of steels	2		
3. Elastic module comparative analysis for ferrous and nonferrous materials	2		

4. Thermal expansion coefficient determination and crystallographic transformation temperature observation by dilatometric measurements	2	10 activities are splited in two, and students performs activity in small groups by rotation.	work to be done. After activity students performs computations and realize graphics.
5. Thermal conductivity measurement for metals and alloys.	2		
6. Electrical resistivity of metals. Resistivity dependence on composition and mechanical deformation	2		
7. Electrical resistivity coefficient measurement for metals	2		
8. Band gap measurement in a semiconductor (thermistor)	2		
9. Piercing electric field of an insulator measurement	2		
10. Measurement of hysteresis cycle parameters for soft and hard magnetic materials	2		
11. Curie temperature measurements for ferromagnetic materials	2		
12. Emission band measurement for semiconducting devices	2		
13. Signal transmission by optical fibres study.	2		
14. Semiconductors excess charge carriers lifetime measurements	2		
Bibliography 1.V. Pop, I. Chicinaş, Proprietăţile fizice ale metalelor şi aliajelor, Lito Univ. "Babeş-Bolyai" Cluj-Napoca, 1997. 2. D.R. Mocanu si col., Incercarea materialelor, vol.I, Ed. Tehnică, Bucuresti, 1988			

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

The acquired competencies will be necessary for the technological engineers who will carry out their activity within the specialized industrial companies.
Knowledge of how to evaluate the properties of materials are prerequisites for the correct materials use on specific applications.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Knowledge of the general physical, mechanical, and technological properties of materials - understanding the factors leading to material properties change - understand	Write and oral examination Written examination has two parts: 1. fast test (FT) on measurements units (9 question/90s) 2. test (T) with questions from lectures	N=0.25FT+0.75T (if N>7) N=((0.25FT+0.75T)+O)/2 (if N<7)

	dependence material-structure-properties-usage - theoretical knowledge usage application on real cases - properly usage of the measurement units - understanding of material-structure-property relation -to know at principal level the measurements methods of material properties	Oral (O) examination for students with grades below 7.	
10.5 Seminars /Laboratory/Project	notebook with calculations is required to be fulfilled before examination		
10.6 Minimum standard of performance			
N≥5			

Date of filling in: 20.04.2023		**Title Surname Name**	**Signature**
	Lecturer	Associate professor Florin Popa	
	Teachers in charge of application	Associate professor Florin Popa	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	30

2. Data about the subject

2.1	Subject name			Applied Informatics I			
2.2	Course responsible/lecturer			Assoc. Prof. PhD.Eng. Adriana NEAG adriana.neag@ipm.utcluj.ro			
2.3	Teachers in charge of seminars			Lect.dr.eng. Dan NOVEANU - dan.noveanu@ ipm.utcluj.ro			
2.4 Year of study	2	2.5 Semester	2	2.6 Assessment	V		
2.7 Subject category	Formative category						
	Optionality						

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	1	3.3 Seminar		3.3 Laboratory	2	3.3 Project	
3.4 Total hours in the curriculum	42	of which	3.5 Course	14	3.6 Seminar		3.6 Laboratory	28	3.6 Project	

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	
(b) Supplementary study in the library, online and in the field	
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	
(d) Tutoring	
(e) Exams and tests	
(f) Other activities	

3.8 Total hours of individual study (summ (3.7(a)...3.7(f)))	
3.9 Total hours per semester (3.4+3.8)	
3.10 Number of credit points	2

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	General knowledge of PC operation. Understanding how to read technical drawings.

5. Requirements (where appropriate)

5.1	For the course	

5.2	For the applications	Attendance at the laboratory is mandatory.

6. Specific competences

Professional competences	After completing the course students will be able to: -use the AutoCAD program to create 2D technical drawings; -be able to modify 2D drawings; -be able to dimension and set up the 2D format according to the norms of the technical drawing; -interpret the meaning of toleranced dimensions and geometric tolerance symbols ; -comprehend geometrical details of common engineering objects; -draw sectional views of simple engineering objects.
Cross competences	Improving PC operating knowledge. Developing communication skills.

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

7.1	General objective	Skill development in the field of assisted design using AutoCAD. Medium level 2D assisted design in the mechanical field.
7.2	Specific objectives	Students will learn: -basic principles of 2D design in AutoCAD; - general aspects regarding CAD design.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
CAD products. Basic concepts of computer aided graphics.	2	Presentation	
Introduction to AutoCAD. Management of screen menus commands. Introduction to drawing entities.	2		
Coordinate systems: Cartesian, polar and relative coordinates. Drawing limits, units of measurement and scale.	2		
Editing/modifying drawing entities: selection of objects, object snap modes, editing commands,	2		
Dimensioning: use of annotations, dimension types, properties and placement, adding text to drawing	2		
Layering: organizing and maintaining the integrity of drawings.	2		
Templates settings in AutoCAD.	2		

Bibliography

1. Brad L., Itu A.M., AutoCAD 2000, Indrumator de laborator, Editura Todesco 2000, Cluj-napoca, ISBN 973-99780-8-8

2. https://www.autodesk.com/education/edu-software			
8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
Interface Tour. Features. Configuring the work environment. Quick Access toolbars.	2	Learning by doing	
Create basic geometric objects in your own drawing template. Multiple selections.	2		
Perform editing operations such as: erase, move, trim and extend on the objects in a drawing.	2		
Create objects using offset, mirror, and array command.	4		
Scaling and dimensioning the objects in a drawing. Types of dimensions.	4		
Hatching and creating notes and labels in a drawing.	4		
Advanced drawing commands. Create the objects' projections.	4		
Drawing objects using layers and setting up of templates	4		
Evaluation	2		
Bibliography			

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

The acquired competencies will be necessary for the employees who carry out their activity within the design and manufacturing departments.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Written test		25%
10.5 Seminars /Laboratory/Project	Individual independent projectwork/drawing in AutoCAD		75%
10.6 Minimum standard of performance			
• Min 5			

Date of filling in:		**Title Surname Name**	**Signature**
12.03.2023	Lecturer	Assoc. Prof. PhD.Eng. Adriana NEAG	
	Teachers in charge of application	Lect.dr.eng. Dan NOVEANU	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	31

2. Data about the subject

2.1	Subject name			Fluid Mechanics			
2.2	Course responsible/lecturer			Dr.ing. Corina Giurgea			
2.3	Teachers in charge of seminars			Dr.ing. Corina Giurgea			
2.4 Year of study	II	2.5 Semester	IV	2.6 Assessment	Exam		
2.7 Subject category	Formative category						DI
	Optionality						-

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	-
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	14
(b) Supplementary study in the library, online and in the field	20
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
(d) Tutoring	
(e) Exams and tests	4
(f) Other activities	

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Mandatory: Basics in physics, mathematics (mathematical analysis, special mathematics) and mechanics
4.2	Competence	Mathematical understanding, Calculus (derivative and integral of a function), good understanding of the basic principles of physics and mechanics and ability to apply them to solve simple practical problems; ability to plot and interpret graphs

5. Requirements (where appropriate)

5.1	For the course	Internet access, Multi-media projector, , Blackboard
5.2	For the applications	Internet access, Laptop/Computers as the Laboratory worksheets/tests should be filled in for each laboratory class

6. Specific competences

Professional competences	C2.2. Using the knowledge concerning the fluid mechanics and other basic engineering sciences to explain and interpret the theoretical and experimental results, the drawings and the specific materials engineering phenomena and processes C2.3. Applying the principles and methods from fluid mechanics and other basic science of engineering domain for strength calculations, sizing, establishing the technical conditions, establishing correspondence between features and functional role prescribed, and so on, in specific applications of materials engineering under qualified help. C2.4. Appropriate use of the standard assessment criteria and methods from basic engineering sciences, for: identification, modeling, experimentation, analysis and assessment of the qualitative and quantitative aspects, phenomena and definitive parameters as well as gathering and processing data, analysis of the results from specific materials engineering trials
Cross competences	CT1. Applying the values and the ethics of the profession of engineer and the responsible execution of the professional duties under limited autonomy and qualified assistance. Promoting the logical reasoning, convergent and divergent, the practical applicability and the assessment and self-evaluation decisions. CT3. Objective self-evaluation of the need of continuous training for labor market insertion and the accommodation to its dynamic requirements and for personal and professional development. Effective use of language skills and knowledge of information technology and communication

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

7.1	General objective	Acquiring knowledge of the fundamental concepts, principles and equations of fluid mechanics and practicing them through solving some problems / technical applications
7.2	Specific objectives	After the completion of this course, students will be able: • to measure fluid/fluid flow parameters • to use the laboratory equipment • to analyse and solve a variety of problems involving fluid flows as well as to explain and discuss the results • to calculate/design a simple flow loop

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Introduction. The concept of fluid. Forces in fluid mechanics.	2	Interactive Lectures (on site and/or on Teams Platform)	Exploit the movies,images and medias (reference to [6] and [7])
Properties of the fluids I. Mass, Density, Specific Gravity and Pressure definition	2		

Properties of the fluids II. Compressibility of fluids. The State Equation.	2	Selected additional problems will be solved	
Properties of the fluids III. Viscosity. Newtonian and non-Newtonian fluids	2		
Properties of the fluids IV. Vapor pressure and cavitation phenomenon. Surface tension	2		
Fluid statics I. Pressure variation in a fluid at rest. Pascal Law. Measurement of pressure. Manometry	2		
Fluid statics II. Hydrostatic force on plane surfaces. Hydrostatic force on curved surfaces	2		
Fluid statics III. Buoyancy. Stability of immersed and floating bodies	2		
Fluids in motion. Velocity field. Pathlines and Streamlines. Classification of flows. The flowrate. Instruments and methods for measurement of flowrates	2		
Inviscid flows. The continuity equation. Bernoulli equation and applications	2		
Inviscid flows. Linear momentum equation. Application of the linear momentum equation	2		
Viscous flow in pipes. Major and minor losses in pipes flow	2		
Dimensionless groups, Similarity and Model Development in Fluid Mechanics	2		
Trends in fluids engineering	2		

Bibliography

1. Giurgea C., Lecture Notes in Fluid Mechanics (e-version), UTPRESS Cluj Napoca, 2016, ISBN 978-606-737-176-5
2. http://www.slideshare.net/ArchieSecorata/fluid-mechanicsfundamentals-and-applications-by-cengel-cimbala-3rd-c2014-txtbk
3. Munson B.R., Young D.F., Okiishi T.H., Fundamentals of Fluid Mechanics, Fifth edition, John Wiley &son, 2006
4. Munson B.R., Young D.F., Okiishi T.H., Fundamentals of Fluid Mechanics. Student Solutions Manual and Study Guide, Fifth edition, John Wiley &son, 2006
5. Evett J.B., Cheng Liu, 2500 Solved Problems in Fluid Mechanics and Hydraulics, McGraw-Hill, 1989
6. Homsy G.M. et all, Multimedia Fluid Mechanics (DVD), Second edition, Cambridge
7. Different documents posted to Teams Platform

8.2. Laboratory	Number of hours	Teaching methods	Notes
Dimensions and units. Dimensional Homogeneity and units. Systems of units. Unit conversion	2	Short presentation of the theoretical aspects/method and procedure Experimental work Assignments (quiz/test + lab worksheet)	
Establishing the compressibility factor and the bulk modulus of one fluid	2		
Measuring the viscosity of fluids by using the Hoppler apparatus and the Rheotest apparatus. Understanding the effect of temperature on the viscosity	2		

Observation of the cavitation phenomenon in a liquid	2		
Measuring the energy losses in pipes and bends. Investigating the effects of laminar and turbulent flow regimes	2		
Measurement of flow rates	2		

1. Banyai D., Giurgea C., Marcu L., Nascutiu L., Opruta D., Vaida L., *Mecanica Fluidelor – Lucrari Practice*, U.T. Press, Cluj Napoca, 2014, ISBN 978-973-662-934-1
2. Armfield _ Engineering Teaching&Research Equipment Instruction Manual
3. Gunt Laboratory Guide and Equipment Instruction Manual
4. Munson B.R., Young D.F., Okiishi T.H., Fundamentals of Fluid Mechanics. Student Solutions Manual and Study Guide, Fifth edition, John Wiley &son, 2006
5. Evett J.B., Cheng Liu, 2500 Solved Problems in Fluid Mechanics and Hydraulics, McGraw-Hill, 1989
6. Laboratory classes material posted on Teams

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

Nowadays the presence of fluids in technological devices is ubiquitous, starting from power systems to artificial heart. In order to predict the fluids motion, a future engineer not only should be familiar with the basic principles of fluid mechanics but should also have a deeper physical insight into the behaviour of fluids. In particular, “the majority of engineers who are not fluid dynamicists still will need to interact, on a technical basis, with those who are quite frequently;and a basic competence in fluid dynamics will make such interactions more productive”(J.McDonough, Lectures in Elementary Fluid Dynamics: Physics,Mathematics and Applications, University of Kentucky, 2009)

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The ability to answer the theoretical questions and the practical problem-solving skills	Written final test (FT)	40%
	The familiarity and ability to work on a Fluid Mechanics subject. The ability to work in team (groups of 4-5 students) and to make a presentation and a report on a subject related with Fluid Mechanics	Homework (H): Written report Oral presentation Q&A session	30%
10.5 Laboratory	The ability to answer to questions regarding the instruments and procedures used in laboratory classes + Activity during the lab classes	Laboratory sheet filling (LS)+ activity during laboratory classes appreciation (LA) L=0.7(LS) +0.3 (LA)	30%
10.6 Minimum standard of performance			

The final mark N=0.4 (FT)+0.3·(H)+0.3·(L) will be determined using the weighting above. The final credit can be received only if each of the mark's components is fulfilled: N≥5; FT≥5; H≥5; L≥5.
Mandatory requirement: A pass mark (of minimum 5) at each Laboratory activity (LT and LA) is compulsory for taking the final written test.

Date of filling in:		**Title Surname Name**	**Signature**
21.03.2023	Lecturer	dr. ing. Corina Maria Giurgea	
	Teachers in charge of application	dr.ing. Corina Maria Giurgea	

Date of approval in the department
26.06.2023

Head of department
Ass.prof.dr.eng. Mariana Pop

Date of approval in the faculty
10.07.2023

Dean
Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	32

2. Data about the subject

2.1	Subject name			Materials analysis and characterisation techniques			
2.2	Course responsible/lecturer			Assoc.Prof. Bogdan Viorel Neamtu Assoc.Prof. Traian Florin Marinca			
2.3	Teachers in charge of seminars			Assoc.Prof. Bogdan Viorel Neamtu Assoc.Prof. Traian Florin Marinca			
2.4 Year of study	2	2.5 Semester	2	2.6 Assessment		C	
2.7 Subject category	Formative category					DD	
	Optionality					DI	

3. Estimated total time

3.1 Number of hours per week	4	of which	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	2	3.3 Project	0
3.4 Total hours in the curriculum	56	of which	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	28	3.6 Project	0

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	5
(b) Supplementary study in the library, online and in the field	3
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	7
(d) Tutoring	1
(e) Exams and tests	3
(f) Other activities	0

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	19
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	General knowledge of physics, chemistry, material properties, etc.
4.2	Competence	General knowledge of physics, chemistry, material properties, etc.

5. Requirements (where appropriate)

5.1	For the course	

5.2	For the applications seminarului / laboratorului / proiectului	

6. Specific competences

Professional competences	After completing the course and laboratory work, the student must: • Understand the difference between the different types of structures that appear in materials • To know how to evaluate the composition and microstructure of a material through qualitative and quantitative instrumental analyzes • To understand the operation of complex research and investigation equipment • To know the methods and means used in optical and electron microscopy • To know how X-rays interact with matter and to understand what kind of information related to the structure of materials can be obtained from this interaction. • To be able to correlate the microstructural properties with the physical-mechanical properties of a material • To know which method of analysis is suitable for characterizing a material;
Cross competences	• To acquire an adequate scientific language, with specific engineering notions. • Develop skills and the ability to operate with measurement data. • Know how to appreciate the nature and type of errors in specific laboratory measurements. • Know how to process statistics and interpret measurement data • Know how to analyze the data provided by the investigation equipment • Know how to interpret data obtained from devices that work on different principles, but that measure the same parameters of the material

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

7.1	General objective	To know how to use complex laboratory equipment correctly To develop skills and the ability to operate with: optical, electronic microscopes, structural investigation devices, etc.
7.2	Specific objectives	Interpretation of X-ray diffraction, optical, electron microscopy and AFM images. To be able to analyze EDX spectra thermal analysis curves (DSC, DTA, TG), IR spectra.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Introductory notions. The crystalline, amorphous and nanocrystalline structure of materials.	2		
2. Investigation of the structure of materials by X-ray diffraction. Production of X-rays. Continuous spectrum and discrete spectrum. X-ray diffraction	2		
3. Factors influencing the intensity of diffracted rays.	2		

X - ray diffraction methods and techniques		Lecture PowerPoint presentation Interactive teaching mode Teacher-student dialogue	Multimedia Blackboard
4. Indexing diffraction images. Qualitative and quantitative analysis of phases by X-ray diffraction. Determination of residual austenite.	2		
5. Determining the average size of crystallites. Residual internal stresses. Texture analysis. Density of dislocations. Packaging defects.	2		
6. Optical microscopy. Special techniques of optical microscopy.	2		
7. Scanning electron microscopy (SEM).	2		
8. X-ray microanalysis (EDX + WDX).	2		
9. Transmission electron microscopy (TEM). Electron diffraction	2		
10. Thermal analysis in the study of materials. Interpretation of material cooling curves	2		
11. Simple thermal analysis. Differential thermal analysis (AT + DTA).	2		
12. Differential scanning calorimetric analysis (DSC). Thermogravimetric analysis (TG).	2		
13. Infrared analysis of condensed media. Molecular spectra.	2		
14. Special methods of material analysis (AFM, MRI, RES, Mosbauer, X-ray)	2		

Bibliography

1. Shaun Wilson, Charles A. Evans, C. R. Brundle, Encyclopedia of Materials Characterization, 1992, Butterworth-Heinemann, ISBN-13: 978-0750691680
2. David Brandon Wayne D. Kaplan, Microstructural Characterization of Materials, 2008, John Wiley & Sons, Ltd, ISBN:9780470027844;
3. Naryanaswami (Mohan) Ranganathan, Materials Characterization, Modern Methods and Applications, ISBN 9789814613064, 2015, Jenny Stanford Publishing
4. Sharma Surender, Handbook of Materials Characterization, 2018, ISBN 978-3-319-92955-2, Springer International Publishing

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
1. Safety measurements. List of works. Laboratory presentation. Miller plans and indices	2	Practical measurements, data recording, spectrum interpretation, mathematical calculation.	Blackboard, computer, Specialized software and equipment
2. Indexing of X-ray diffraction images. Determining the parameters of the crystal lattice	2		
3. Determining the average size of crystalline grains. Amorphous and nanocrystalline structures	2		
4. Quantitative analysis. Determination of residual austenite in steels.	2		
5. X-ray diffraction at high temperatures	2		

6. Determination of critical points of materials by thermal methods (DTA / DSC).	2		
7. Investigation of materials by thermogravimetry	2		
8. Optical microscopy in polarized light / other techniques (qualitative, quantitative)	2		
9. Use of the stereomicroscope in the investigation of materials. Images obtained in reflection and transmission mode	2		
10. Obtaining and analyzing scanning electron microscopy images - 1	2		
11. Obtaining and analyzing scanning electron microscopy images - 2	2		
12. Chemical analyzes with X-ray microradiation in SEM (EDX) - 1	2		
13. Indexing of IR, NIR and FAR spectra	2		
14. Applications of IR spectroscopy on organic / inorganic materials	2		

Bibliography

1. Shaun Wilson, Charles A. Evans, C. R. Brundle, Encyclopedia of Materials Characterization, 1992, Butterworth-Heinemann, ISBN-13: 978-0750691680
2. David Brandon Wayne D. Kaplan, Microstructural Characterization of Materials, 2008, John Wiley & Sons, Ltd, ISBN:9780470027844;

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

The acquired competencies will be necessary for the employees who carry out their activity within a sector of manufacturing and / or processing of various types of materials. The acquired knowledge is useful for those who are also engaged in the field of quality assurance of materials.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Assessment of the knowledge taught - at the end of the semester (grade V), by solving some tests that consist of a theoretical part and problems	Written test / Oral test	80%
10.5 Seminars	Students will be evaluated	Written test / Oral test	20%

/Laboratory/Project	at each laboratory session taking into account the degree of involvement and how to process and interpret the results in practical activities. The final grade in the laboratory (L) represents the arithmetic mean of the grades from each practical session		
10.6 Minimum standard of performance			
• Colloquium note ≥ 5; Laboratory grade ≥ 5, (Colloquium grade = 0.8 V + 0.2L)			

Date of filling in:		**Title Surname Name**	**Signature**
16.05.2023	Lecturer	Assoc.Prof. Bogdan Viorel Neamtu Assoc.Prof. Traian Florin Marinca	
	Teachers in charge of application	Assoc.Prof. Bogdan Viorel Neamtu	
		Assoc.Prof. Traian Florin Marinca	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	33,00

2. Data about the subject

2.1	Subject name	Practical Activity I					
2.2	Course responsible/lecturer	Lecturer Marius Tintelecan *marius.tintelecan@ipm.utcluj.ro*					
2.3	Teachers in charge of seminars	Lecturer Marius Tintelecan *marius.tintelecan@ipm.utcluj.ro*					
2.4 Year of study	2	2.5 Semester	2	2.6 Assessment	V		
2.7 Subject category	Formative category					DS	
	Optionality					DI	

3. Estimated total time

3.1 Number of hours per week	0	of which	3.2 Course	0	3.3 Seminar	0	3.3 Laboratory	0	3.3 Project	0
3.4 Total hours in the curriculum	90	of which	3.5 Course	0	3.6 Seminar	0	3.6 Laboratory	0	3.6 Project	0

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	10
(b) Supplementary study in the library, online and in the field	0
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	0
(d) Tutoring	0
(e) Exams and tests	0
(f) Other activities	0

3.8 Total hours of individual study (summ (3.7(a)…3.7(f)))	10
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	---
4.2	Competence	General engineering knowledges

5. Requirements (where appropriate)

5.1	For the course	-
5.2	For the applications	Practice agreement with companies.

	(laboratory)	

6. Specific competences

Professional Competences	- Learning of a process/technological flux in production; - Utilising the knowledges about the materials properties in the study of the behaviour of materials in technological flux – from the raw materials to the final products. - Appreciation over the quality of the final products and materials and also of the process; - Using the industrial apparatus/installations;
Cross competences	- Teamwork; - Deadlines; - Tasks; - Familiarisation with the product processes and socialisation in the industrial environment; - Understanding the hierarchy in the enterprise/factory/company/etc

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

7.1	General objective	Be familiar and understanding the technological processes, industrial production and industrial equipments
7.2	Specific objectives	Study of the material characteristics/materials quality over the technological flux; Knowing the operation mode of the apparatus/installation from a given technological flux;

8. Contents

At company/factory/enterprise choice.

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

Skills will be required for employees who will work as engineers in production and/or quality departments.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Practical activity	The students will briefly present their activity in the company with the accent on the practical parts.	Oral tests/question and answers session (O)	50%
10.5 Laboratory	The student will present a notebook where they will describe their activity in the company. Their activities	practice notebook (N)	30%

	will be presented with a timetable.		
10.6. Minimum standard of performance			
$P \geq 5$, $O \geq 5$, $N \geq 5$, P (the general examination mark) = 0,5O+0,5N			

Date of filling in:		**Title Surname Name**	**Signature**
14.05.2023	Lecturer	Lecturer Marius Tintelecan	
	Teachers in charge of application	Lecturer Marius Tintelecan	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	34,10

2. Data about the subject

2.1	Subject name			Measurement techniques and data acquisition			
2.2	Course responsible/lecturer			Conf.dr.ing.Dan Frunza Dan.Frunza@ipm.utcluj.ro Conf. Dr. Fiz. Florin Popa – florin.popa@stm.utcluj.ro			
2.3	Teachers in charge of seminars			Conf.dr.ing.Dan Frunza Dan.Frunza@ipm.utcluj.ro Conf. Dr. Fiz. Florin Popa – florin.popa@stm.utcluj.ro			
2.4 Year of study	II	2.5 Semester	2	2.6 Assessment	C		
2.7 Subject category	Formative category						DS
	Optionality						DI

3. Estimated total time

3.1 Number of hours per week	4	of which	3.2 Course	2	3.3 Seminar		3.3 Laboratory	2	3.3 Project	
3.4 Total hours in the curriculum	56	of which	3.5 Course	28	3.6 Seminar		3.6 Laboratory	28	3.6 Project	

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	10
(b) Supplementary study in the library, online and in the field	0
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	6
(d) Tutoring	0
(e) Exams and tests	3
(f) Other activities	0

3.8 Total hours of individual study (summ (3.7(a)...3.7(f)))	19
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	Basic knowledge of physics, and programming.
4.2	Competence	Basic knowledge of physics, and programming.

5. Requirements (where appropriate)

5.1	For the course	

5.2	For the applications seminar / lab / proj.	80% Teams 20% onsite

6. Specific competences

Professional competences	- To be able to measure different physical type and be able to estimate the accuracy of these measurements. -To understand and know the operating principles of the most important types of measuring and control instruments. - To be able to correctly determine measurement errors and be able to trace regression curves of the experimental data. - To know how temperature, pressure, voltage, etc. transducers work. - To understand how to convert analogue signals into digital signals; - To know what the possibilities for data acquisition are; - understand how to process and acquire a signal.
Cross competences	- to acquire appropriate scientific language with specific engineering concepts -to know the main devices for measuring temperature, pressure, strain in the material, etc.; - to be able to understand the versatility of the different measuring devices; - to be able to apply the fit analyses in any technical field.

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

7.1	General objective	- understanding how transducers and sensors work, and how measured data can be acquired using computers and adequate software.
7.2	Specific objectives	-understanding the occurrence, role and how to minimize experimental errors; - knowledge of how the various transducers work and the measurement principles; - understanding the ways of digital conversion and acquisition of scientific data.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1.Basic concepts: terminology, physical types, transducers-definition, measuring devices.		Use: multimedia means, an interactive teaching style, student teacher partnership, encouraging the participation of students in additional practical activities	
2.Measurement scales, criteria for the classification of measuring instruments. Accuracy and precision of measuring devices.	2		
3.Analysis of experimental data. Measurement errors. Regression of experimental data.	2		
4.Transducers and basic measuring elements. Measuring temperature with thermocouples.	2		
5.Transducers and basic measuring elements. Temperature measurement with RTD (resistance temperature detectors), thermistors, integrated circuits.	2		

6.Transducers and basic measuring elements. Pressure measurement.			
7.Transducers and basic measuring elements. Measuring strain and stress in parts. Strain Gauges.	2		
8.Acquisition and processing of experimental data, Digital processing of analog signals.	2		
9.Overview of data acquisition systems.	2		
10.Data acquisition systems – specific structures.	2		
11.Architectures and communication interfaces.	2		
12.Programming in Labview graphic language.	2		
13-14. Data types, block diagram, control structures in LabView, creating programs for data acquisition and signal procesing.	4		

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1. F. Popa, D. Frunză, Note de curs
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3. D. Placko, Fundamentals of Instrumentation and Measurement, Hermes Science Publications, 2000;
4. J. R. Taylor An introduction to error analysis, 2nd edition, University science books, 1997;
5. A. S. Morris, Measurement & Instrumentation Principles, 3rd edition, Butterworth Heinemann, 2001;
6. Handbook of Modern Sensors - Physics, Designs, and Applications - 4th Ed , Edited bz J. Fraden, Springer Science + Business Media, LLC 2010;

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
1. Lab presentation, N.T.S.	2	Practical activities aim to exemplify the occurrence and how to eliminate errors. Knowledge of how transducers are constructed and operated.	80%on site 20% on line
2. Statistical analysis of repeated measurements. Eliminate aberrant errors.	2		
3.Construction and calibration of the thermocouples. The laws of the thermocouples.	2		
4. Operation of the thermopil.	2		
5.Displacement and position Measurement.	2		
6. Strain and stress measurement using strain gauges. Strain gauges types, shapes, electrical characteristics. Wheatstone bridge circuits.	2		
7. Measurement of force, pressure, using strain gouges.	2		
8.Vibration measurement	2		
9.Programming in Labview.	2		
10 Measuring temperature and displacement using the LM35 temperature sensor, Vishay resistive position sensor, LabVIEW and NI USB6001 data acquisition system.	2		
11-12.Measuring, compensation and recording of temperature using a thermocouple type k (Cromel-Alumel), LabVIEW and NI USB6211 data acquisition system.	4		
13-14 Force transducer calibrating, measuring and recording, using a beam with strain gauges,	4		

instrumentation amplifier, LabVIEW and NI USB6211 data acquisition system.			
Bibliography 1. F. Popa, D. Frunză - Măsurarea şi achiziţia de date, UTPress, Cluj-Napoca, 2014, ISBN 978-973-662-937-2 3. D. Placko, Fundamentals of Instrumentation and Measurement, Hermes Science Publications, 2000; 4. J. R. Taylor, An introduction to error analysis, 2nd edition, University science books, 1997; 5. A. S. Morris, Measurement & Instrumentation Principles, 3rd edition, Butterworth Heinemann, 2001; 6. Handbook of Modern Sensors - Physics, Designs, and Applications - 4th Ed , Edited bz J. Fraden, Springer Science + Business Media, LLC 2010;			

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

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	- understanding the concept of error - the relationship between precision and accuracy - the operation of different types of transducers	Written or quiz test – duration of evaluation 1.5-2 hours	75%
10.5 Seminars /Laboratory/Project	- evaluation of experimental errors - understanding the principles and calibration of transducers.	Continuous evaluation during semester time.	25%
10.6 Minimum standard of performance			

Date of filling in:		**Title Surname Name**	**Signature**
12.04.2023	Lecturer	Conf.dr.ing Dan Frunza Conf. Dr. Fiz. Florin Popa	
	Teachers in charge of application	Conf.dr.ing.Dan Frunza Conf. Dr. Fiz. Florin Popa	

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	34,20

2. Data about the subject

2.1	Subject name			Basic of experimental research		
2.2	Course responsible/lecturer			Lecturer Tintelecan Marius-marius.tintelecan@ipm.utcluj.ro		
2.3	Teachers in charge of seminars			Lecturer Tintelecan Marius-marius.tintelecan@ipm.utcluj.ro		
2.4 Year of study	III	2.5 Semester	2	2.6 Assessment	verification	
2.7 Subject category	Formative category					DD
	Optionality					DO

3. Estimated total time

3.1 Number of hours per week	4	of which	3.2 Course	2	3.3 Laboratory	2
3.4 Total hours in the curriculum	56	of which	3.5 Course	28	3.6 Laboratory	28
3.7 Individual study:						
(a) Manual, lecture material and notes, bibliography						9
(b) Supplementary study in the library, online and in the field						5
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays						3
(d) Tutoring						-
(e) Exams and tests						2
(f) Other activities						-

3.8 Total hours of individual study (sum (3.7(a)...3.7(f)))	19
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3,00

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications	The presence at the laboratory will be compulsory

6. Specific competences

Professional competences	- Expression through written and oral communication in technical language of the theoretical foundations in the field of experimental research; - Acquiring knowledge on the use of equipment for measuring physical quantities, processing and interpreting the results of experimental research; - Formulation and application of methods and techniques / principles specific to automotive and transport engineering, used in experimental research;
Cross competences	- Applying the techniques of relationship and efficient work in a multidisciplinary team, on various hierarchical levels, within the work teams - specific project management; - Adequate use of effective learning methods and techniques; appropriate use of information and oral and written communication.

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

7.1	General objective	- Acquiring knowledge on the use of physical quantity measuring equipment, processing and interpreting the results of experimental research.
7.2	Specific objectives	- Development of advanced applied research skills; - Operation and instrumentation with modern research and testing equipment; - Learning the methods of processing the results of experimental research.

8. Contents

8.1. **Lecture (syllabus)**		Number of hours	Teaching methods	Notes
1.	1. General considerations. Theoretical research and applied research. Experimental research. Research methods. Stages of the research process. Profile of the scientific researcher: types of researchers, research motivation, research education.	2	PowerPoint presentation Interactive teaching mode Dialogue - conversation professor - student	Multimedia Blackboard
2.	Scientific research methods. Laboratory tests, model tests, real - world operation tests, compliance, expertise and tests of expertise.	2		
3.	Planning and scheduling experimental research.	2		
4.	General principles of measurement. Measurement operation and the sizes being measured. Measurement methods. General functional diagram of measuring devices and	2		

	systems. Translators, measured variables and associated variables. Disturbing signals of entrance.			
5.	Overall performance of measuring systems. Static performance. Defining static performance and static calibration. Measuring range. Sensitivity. Linearity. Mobility threshold and resolution. Hysteresis error. Accuracy. Performances dynamic. General dynamic model of measurement systems.	2		
6.	Measurement methods. Measurement of displacements and speeds. Measurement of displacements with potentiometric, inductive, capacitive transducers. Speed measurement in translational motion. Measurement of rotational speeds.	2		
7.	Measurement of unit stresses and deformations. Resistive electrical tensometry method. Resistive tensometric transducer. Measurement principle, transducer construction, limits of request. Electrical measuring installation.	2		
8.	Pressure and flow measurement. Measurement methods. Manometers with liquid manometers, with elastic elements. transducers piezoelectric. Pressure measurement with resistive tensometric transducer.	2	PowerPoint presentation Interactive teaching mode Dialogue - conversation professor - student	
9.	Measurement of forces. Direct / indirect measurement. Capture dynamometric. Force measurement using force cells.	2		
10.	Measurement of rotational moments. Measurement systems by elastic suspension. Measuring systems with torque transducers.	2		
11.	Temperature measurement. Liquid thermometers, bimetal, manometric. Heat resistant measuring devices. Detectors temperature resistive. Thermistors. Radiant temperature measuring devices. Pyrometer.	2		
12.	Techniques for measuring and evaluating pollutant emissions.	2		
13.	Measurement errors. The distribution of random errors. Probabilistic model. Normal distribution. Measurement accuracy indicators. Methods of eliminating gross errors for σ known / unknown. Estimates of the	2		

true values of a measured quantity. Minimum number of measurements required. Average values and their estimates. Hypothesis testing. Calculation of the averages of the experimental data series and of the data series grouped by intervals. Comparison of average values. Estimate accuracy of measurements. Moments of distribution. Comparison of dispersions. Concordance criterion. Lognormal distribution.			
14. Determining the parameters of empirical formulas by the least squares method. The principle of the method, the mathematical formulation of the least squares method. Determining the parameters of approximation polynomials. (Determining the parameters of a polynomial of degree I, II, n and of Chebyshev polynomials). Interpolation of a series of experimental data. Linear interpolation. Polynomial interpolation. Spline interpolation. Other forms of interpolation. The Runge phenomenon and its avoidance.	2		

Bibliography

1. David L, I. Păunescu, Bazele cercetarii experimentale a sistemelor biotehnice, Bucureşti, 1999.
2. Duşe D. M., N. F. Cofaru, Bazele cercetării experimentale, Sibiu, 2001.
3. Filip N., Zgomotul la autovehicule : măsurarea şi reducerea zgomotului la evacuarea gazelor pentru motoarele cu ardere internă: fiabilitatea functională, Cluj Napoca, 2000.
4. Gheres M. I., Bazele cercetării experimentale. Suport de curs – format electronic. UTCN, 2018.
5. Ionescu C., M. Manoliu, Dezvoltarea durabila si protejarea mediului, Bucureşti, 1998.
6. Oprişan G., G. I. Sebe, Compendiu de teoria probabilitatilor si statistica matematica, Bucureşti, 1999.

8.2. **Laboratory**	Number of hours	Teaching methods	Notes
1. Measurement of displacements, speeds and accelerations	4	Explication, conversation, Case Study.	Blackboard, computer, specialized software
2. Measurement of forces and moments	4		
3. Pressure and flow measurement	4		
4. Measurement of pollutant emissions	4		
5. Checking the normal distribution of random errors with the criterion of concordance.	4		
6. Development of a data acquisition system for measurement temperatures.	4		
7. Develop a program using LabView software for data acquisition.	4		

Bibliography
1. Creţu G., Bazele cercetarii experimentale : indrumar de laborator, Iaşi, 1992.
2. Lupea I., Măsurători de vibraţii şi zgomote prin programare cu LabView, Cluj Napoca, 2005.

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

The acquired competencies will be necessary for the technological engineers who carry out their activity either in the design workshops / research laboratories or in the productive sections.

16. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	On-going evaluation based on 2 tests and final evaluation (problems and questions from theory)	Final written evaluation - duration of evaluation 2 hours	75%
10.5 Laboratory	On-going evaluation based on discussions and self-evaluations and final evaluation by test.	Discussions, tests - duration of evaluation 1 hour	25%
10.6 Minimum standard of performance: Minimum 50% of total activities.			

Date of filling in: 16.04.2023		**Title Surname Name**	**Signature**
	Lecturer	Lecturer Tintelecan Marius	
	Teachers in charge of application	Lecturer Tintelecan Marius	

Date of approval in the department
26.06.2023

Head of department
Ass.prof.dr.eng. Mariana Pop

Date of approval in the faculty
10.07.2023

Dean
Prof.dr.eng. Cătălin Popa

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Materials Science and Engineering
1.4	Field of study	Materials Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Materials Science
1.7	Form of education	Full time
1.8	Subject code	35.10 Modern language IV English 35.20 Modern language IV French 35.30 Modern language IV German

2. Data about the subject

2.1	Subject name			English French German IV			
2.2	Course responsible/lecturer			-			
2.3	Teachers in charge of seminars			Conf. dr. Sanda Pădureţu – Lb. engleză Sanda.Paduretu@lang.utcluj.ro			
2.4 Year of study	II	2.5 Semester	II	2.6 Assessment	C		DC/DO
2.7 Subject category	Formative category English, French, German language						
	Optionality DC/DO						

3. Estimated total time

Year / Sem	Name of the discipline	Nr. weeks	Course	Applications			Course	Applications			Individual study	TOTAL	Credit
			[ore/săpt.]				[ore/sem.]						
				S	L	P		S	L	P			
I	Modern language	14	-	2	-	-	-	28	-	-	22	50	2

3.1	Number of hours per week	2	3.2	of which, course:	-	3.3	applications:	2
3.4	Total hours in the curriculum	50	3.5	of which, course:	-	3.6	applications:	28

Individual study	Ore
Manual, lecture material and notes, bibliography	7
Supplementary study in the library, online and in the field	2
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	8
Tutoring	2
Exams and tests	3
Other activities	-

3.7	Total hours of individual study	22
3.8	Total hours per semester	28
3.9	Number of credit points	2

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	Minimum level of knowledge of the modern language B1 / B2 (English) and A1 / A2 (French) (cf. CEFR - Common European Framework of Reference for Languages)

5. Requirements (where appropriate)

5.1	For the course	N/A
5.2	For the applications	Class attendance, individual study Rooms B 102, B 103 / M102, M 104 - onsite MS Teams Platform – online

6. Specific competences

Professional competences	Application of grammar, format rules and conventions regarding the writing of technical documents in the foreign language Elaboration, reformulation, summary and synthesis of texts in formal technical style
Cross competences	Ability for foreign language documentation, useful for academic and / or professional careers Oral and written communication skills in multicultural professional teams.

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

7.1	General objective	Development of linguistic and communicative skills in a foreign language in professional situations.
7.2	General objectives	Assimilation of the basic lexicon in the fields of interest and related of materials science and engineering. Effective use of language and communication skills in the foreign language.

3. Contents

8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
1. Technology and globalization	2	Communicative and interactive strategies. Integrated	Online platform, Interactive board, CD
2. Industrial pollution and environmental protection	2		
3. Nanotechnologies	2		
4. Raw materials. Materials processing	2		

5. Casting, sintering, metal extrusion	2	skills, flipped learning, blended learning	Player, video projector
6. The furnace. Types of furnaces	2		
7. Professional oral presentation. Stages of oral presentation	2		
8. Aspects related to ensuring the success of the oral presentation	2		
9. Using visual support	2		
10. Discursive elements to facilitate message decoding	2		
11. The interactional aspect of the presentation	2		
12. Individual oral presentations on topics of professional interest	2		
13. Individual oral presentations with their evaluation in the group of students based on the grid of performance criteria established jointly with the students	2		
14. Written assessment	2		

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E. Cloose, Le français du monde du travail, Grenoble, PUG, 2009.
J. L. Penfornis Français.com, nouvelle édition, Paris, CLE International, 2012.

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

Optimizing communication with the interlocutor / partner on the labor market

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Seminar Applications		Fulfilling work tasks at the written test, taking part in a conversations or a monologue, seminar activity, homework		Written exam Oral exam		30% 40%
				Practical assessment (seminar activity,		30%

				homework)		
10.4 Minimum standard of performance: The student is accepted at the final evaluation, if his/her contribution to the seminar topics is 80%. The grade is calculated if each component is correctly done at least 60%.						
Final grade: 0,3 Ts + 0,4 Po + 0,3 P						

Date of filling in	Professor in charge with the discipline	Teachers in charge of the seminar
20.03.2023	Conf. dr. Sanda Pădureţu	Conf. dr. Sanda Pădureţu

Date of approval in the department 26.06.2023	Head of department Ass.prof.dr.eng. Mariana Pop
Date of approval in the faculty 10.07.2023	Dean Prof.dr.eng. Cătălin Popa