COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Computer Aided Design				Subject code	1.00
2.2 Course responsible/lecturer	Prof.dr.ing. Păcurar Răzvan, razvan.pacurar@tcm.utcluj.ro					
2.3 Teacher in charge of seminars/labs/projects	Prof.dr.ing. Păcurar Răzvan, razvan.pacurar@tcm.utcluj.ro					
2.4 Year of study	I	2.5 Semester	I	2.6 Assessment		E
2.7 Subject category	Formative category					DA
	Optional					DI

3. Estimated total time

3.1 Number of hours per week	3	of which:	3.2 Course	1	3.3 Seminar		3.3 Laboratory		3.3 Project	2	3.3 Practical training	
3.4 Number of hours per semester	42	of which:	3.5 Course	14	3.6 Seminar		3.6 Laboratory		3.6 Project	28	3.3 Practical training	

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	4
(b) Study of textbooks, course materials, bibliography, and lecture notes	20
(c) Additional research in the library, on specialized electronic platforms, and in the field	20
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(e) Tutoring	
(f) Other activities	
3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	Descriptive Geometry, Technical Drawing
4.2 Competence	Intermediate computer skills. Knowledge required for understanding and interpreting technical drawings.

5. Requirements (if applicable)

5.1. for the course	Multimedia projector

5.2. for the seminar/lab/project	Minimum 15 high-performance computers capable of running the CATIA software Attendance at laboratory sessions is mandatory

6. Subject-specific learning outcomes

Professional competencies	• Uses computer-aided manufacturing (CAM) software • Provides technical documentation • Interacts professionally in research and professional environments • Promotes open innovation in research • Integrates new products into the production process • Designs automation components • Prepares prototypes for production • Uses computer-aided software engineering (CASE) tools
Transversal competencies	• Demonstrates initiative • Thinks analytically • Applies scientific, technological, and engineering knowledge • Works effectively in a team environment

7. Expected learning outcomes

Knowledge	The student will acquire knowledge of: • the principles for designing complex control systems, industrial networks, and their associated hardware and software components • the tools and software used for simulation, data analysis, and computer-aided design (CAD)
Skills	• to develop and implement prototypes and solutions for automation and computer-aided manufacturing • to create innovative solutions adapted to the context of research and engineering projects, including complex control and automation systems
Responsibility and autonomy	The student will: • be able to work independently in the analysis, design, and implementation of control systems, developing an analytical approach • be able to assume responsibility for the decisions made • manage professional or research projects • be able to work effectively in teams

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Design and development of partial assemblies using intermediate-level 2D and 3D computer-aided design, as well as the explanation and interpretation of operating methods in common 2D and 3D CAD working environments.
8.2 Specific objectives	Students will learn: • the basic principles of 3D modeling in CATIA using solid and surface modeling commands; • general aspects related to design in the context of assemblies; • the basic principles of generating detail drawings and assembly drawings.

9. Contents

9.1 Course	No. of hours	Teaching methods	Notes
1. Presentation and familiarization with the general working interface of the CATIA software. Use of commands for generating profiles and 2D sketching elements in CATIA.	2	Practical applications in the CAD environment presented using a video projector.	
2. Generation of solid bodies – modeling methods using basic commands in CATIA (Part Design module).	2		
3. Generation of solid bodies – modeling methods using advanced commands in CATIA (Part Design module).	2		
4. Advanced part modeling using surface commands in CATIA (Wireframe and Surface Design module).	2		
5. Design in the context of assemblies. Assembly of models in CATIA (Assembly Design module).	2		
6. Generation of 2D documentation – detail drawings and assembly drawings in CATIA (Drafting module).	2		
7. Case studies – advanced modeling methods and assemblies created by experienced CATIA users.	2		
Bibliography 1. Damian, M. Proiectare asistată de calculator. Suport de curs. 2. Damian, M. Carean A., Roş, O., Revnic I., Caizar C. Fabricaţie asistată de calculator. Casa cărţii de ştiinţă, 2003. 3. *** Catia V5R14. Part Design in a Nutshell. Dassault Systems, 2006 4. Cursurile oficiale CATIA dezvoltate de către Dassault Systemes furnizate prin intermediului Centrului Dassault Systemes si a platformei 3DSAcademy (academy.3ds.com)			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. CATIA application interface. Presentation of previously completed case studies (project topics). Selection and definition of project topics.	2	Individual use of the CATIA software by each student in order to practice modeling commands required for completing the project assignment.	Individual completion of project assignments under the supervision of the teaching assistant.
2. Identification of the components that need to be created for the defined assembly and of the standard components that can be directly imported into the assembly using CATIA.	2		
3–5. Modeling of the assembly component parts using basic commands for generating solid bodies in CATIA (Part Design toolbar).	6		
6–8. Modeling of the assembly component parts using advanced commands for generating solid bodies in CATIA (Part Design toolbar).	6		
9–11. Advanced modeling of component parts using surface commands in CATIA (Wireframe and Surface Design toolbar).	6		
12. Assembly creation. Addition of standard components to the assembly created using CATIA.	2		
13. Design of components in the context of the assembly and preparation of the required technical documentation.	2		
14. Oral presentation of the projects completed during the semester.	2		
Bibliography 1. Damian, M. Proiectare asistată de calculator. Suport de curs.			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
2. Damian, M. Carean A., Roş, O., Revnic I., Caizar C. Fabricaţie asistată de calculator. Casa cărţii de ştiinţă, 2003. 3. *** Catia V5R14. Part Design in a Nutshell. Dassault Systems, 2006 4. Cursurile oficiale CATIA dezvoltate de către Dassault Systemes furnizate prin intermediului Centrului Dassault Systemes si a platformei 3DSAcademy (academy.3ds.com)			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

CATIA is a widely used 3D modeling solution in Romania for modeling parts and assemblies. 3D modeling is a clear requirement in almost all companies involved in the development of industrial products (either proprietary products or products manufactured under license at a broader level).

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	The ability to create a 3D model of a component starting from a 2D drawing. Correctness of sketches, geometric and dimensional constraints, as well as the 3D modeling commands used for creating an assembly. Correctness of the detail drawings produced for the modeled components/assembly. Ability to create a geometrically well-constrained assembly in the final stage.	Practical examination (test) (3 ore)	50 %
11.5 Seminar/Laboratory /Project / Practical training	Activity throughout the semester. The complexity and correctness of the 3D models and the assembly developed as the project assignment.	Project assignment: case study (assembly) developed using the CATIA software. Oral presentation of the projects completed during the semester.	50 %
11.6 Minimum performance standard • 3D modeling of a medium-complexity part using the basic CATIA commands (modeling commands for generating solid bodies). • Creation of sketches and assemblies that are correctly constrained from both geometric and dimensional perspectives for at least five components within the project assignment.			

Completion date:	Faculty members	academic rank, title, First Name SURNAME	Signature
10.09.2025	Course	Prof.dr.ing. Păcurar Răzvan	
	Practical activities	Prof.dr.ing. Păcurar Răzvan	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full-time attendance

2. Data about the subject

2.1 Subject name	Applied Mathematics in Engineering			Subject code	2.00
2.2 Course responsible/lecturer	*Prof. Dr.eng. Mircea Ancău, mircea.ancau@tcm.utcluj.ro*				
2.3 Teacher in charge of seminars/labs/projects	*Prof.Dr.eng. Mircea Ancău, mircea.ancau@tcm.utcluj.ro*				
2.4 Year of study	1	2.5 Semester	1	2.6 Assessment	C
2.7 Subject category	Formative category				DS
	Optional				DI

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	-	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	14	3.6 Seminar	28	3.6 Laboratory	-	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	18
(b) Study of textbooks, course materials, bibliography, and lecture notes	6
(c) Additional research in the library, on specialized electronic platforms, and in the field	10
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	5
(e) Tutoring	15
(f) Other activities	4
3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	Mathematical Analysis
4.2 Competence	General notions of differential and integral calculus. General notions about computer programming.

5. Requirements (if applicable)

5.1. for the course	Mathematical Analysis
5.2. for the seminar/lab/project	Computer programming, Matlab

6. Subject-specific learning outcomes

Professional competencies	To solve different types of differential equations and systems of equations. To elaborate a mathematical model of a process by means of differential equations. To know and apply a set of heuristic methods for solving different mathematical models of combinatorial optimization. To elaborate and solve mono and multi-criteria optimization problems.
Transversal competencies	Combine practical applications in industry with theoretical modeling and solve optimization problems

7. Expected learning outcomes

Knowledge	The student will be able to elaborate a mathematical model of a process optimization; to select the proper numerical optimization procedure for a specific mathematical model; and to get the optimal values for the solution.
Skills	The student will be able to use the MathCAD resources to solve problems. He will be able to build a computer program to optimally solve a mathematical model of a process.
Responsibility and autonomy	Confidence in using different optimization and numerical applications to solve practical problems in research and industry.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	combining advanced mathematical knowledge with applications in industrial engineering
8.2 Specific objectives	solving technical problems numerically using computer applications

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
Differential equations of first order and homogeneous differential equations. Differential equations that can be reduced to homogeneous differential equations.	2	Smart-board, computer, blackboard	Matlab installed
Numerical methods for solving differential equations; Runge-Kutta methods of second order.	2		
Application of differential equations to mathematical modeling of technological processes.	1		
Population models: the Lotka-Volterra prey-predator model and the Lorenz model for predicting weather forecast.	2		
Heuristic algorithms for solving TSP; application to multiple holes drilling processes.	1		

9.1 Course	No. of hours	Teaching methods	Notes
Heuristic algorithms for solving Flowshop scheduling problems (NEH, Palmer, etc.).	1		
Minkowski sums. Heuristic algorithms for optimal nesting.	1		
Numerical techniques for solving multivariable optimization problems. Penalized methods.	2		
Global optimization procedures.	2		
Bibliography Ancău, M., Nistor, L. Tehnici numerice de optimizare în proiectarea asistată de calculator. Editura Tehnică, București, 1996. Ancău, M. Optimizarea proceselor tehnologice. Editura UT Pres, Cluj-Napoca, 1999. Ancău, M. Optimizare numerică. Algoritmi și programe în C. Editura Casa Cărții de Știință, Cluj-Napoca, 2005. Cormen, T.H. et al. Introduction to Algorithms. Sec.Ed., The MIT Press, Cambridge, Massachusetts, 2003. Chapra, S.C., Canale, R.P. Numerical Methods for Engineers. Fifth Ed., McGraw-Hill, N.Y., 2006.			

9.2 Seminar/laboratory/project / practical training	No. of hours	Teaching methods	Notes
Error evaluation in the case of solving differential equations by Runge-Kutta of second, fourth, and sixth order.	4	Smart-board, computer	Matlab installed
Minimizing the tool path length in solving flowshop scheduling problems using Johnson's algorithm (n jobs on two machines), with application to PCB drilling.	4		
The solving of flowshop scheduling in the general case (n jobs on n machines): NEH algorithm.	4		
The solving of the Minkowski sum, with application to optimal nesting.	6		
General algorithm for global optimization: avoid local optima.	6		
Population models: the prey-predator model and the Lorenz model for weather forecasting.	4		
Bibliography Ancău, M., Nistor, L. Tehnici numerice de optimizare în proiectarea asistată de calculator. Editura Tehnică, București, 1996. Ancău, M. Optimizarea proceselor tehnologice. Editura UT Pres, Cluj-Napoca, 1999. Ancău, M. Optimizare numerică. Algoritmi şi programe în C. Editura Casa Cărții de Știință, Cluj-Napoca, 2005. Cormen, T.H. et al. Introduction to Algorithms. Sec.Ed., The MIT Press, Cambridge, Massachusetts, 2003. Chapra, S.C., Canale, R.P. Numerical Methods for Engineers. Fifth Ed., McGraw-Hill, N.Y., 2006.			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

Numerical optimization applications, toolpath generation for CNC machines, and optimal material cutting are of paramount importance to the industry today.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade

11.4 Course	Problem-solving (P) and a theory section (T) in written form (1.5 hours).	Summative	0.8
11.5 Seminar/Laboratory /Project / Practical training	Active participation in the seminar (S)	Summative	0.2
11.6 Minimum performance standard: N=(0,75*P+0,25*S)*0.8+0,2*S; To pass, a minimum grade of 5 is required			

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
10.09.2025	Course	*Prof. Dr.eng. Mircea Ancău*	
	Practical activities	*Prof. Dr.eng. Mircea Ancău*	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing (in English)
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Finite Element Analysis in Engineering				Subject code	3.00
2.2 Course responsible/lecturer	*Assoc. Prof. Dr.Eng. Emilia Sabău - emilia.sabau@tcm.utcluj.ro*					
2.3 Teacher in charge of seminars/labs/projects	*Assoc. Prof. Dr.Eng. Emilia Sabău - emilia.sabau@tcm.utcluj.ro*					
2.4 Year of study	I	2.5 Semester	I	2.6 Assessment		C
2.7 Subject category	Formative category					DA
	Optional					DI

3. Estimated total time

3.1 Number of hours per week	2	of which:	3.2 Course	1	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	-	3.3 Practical training	-
3.4 Number of hours per semester	28	of which:	3.5 Course	14	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study of textbooks, course materials, bibliography, and lecture notes	28
(c) Additional research in the library, on specialized electronic platforms, and in the field	14
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	28
(e) Tutoring	0
(f) Other activities	0
3.8 Total hours for individual study and evaluation (sum (3.7(a)…3.7(f))	72
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (if applicable)

4.1 Curriculum	Attending the following courses: Applied Mathematics for Engineering, Strength of Materials, and Computer Aided Design
4.2 Competence	Knowledge of the MS Windows operating system (basic level) and capability of using SolidWorks or Catia (average level)

5. Requirements (if applicable)

5.1. for the course	Multimedia projector

5.2. for the seminar/lab/project	Computers + CAD program (SolidWorks or Catia) + Finite element analysis program (Dynaform)

6. Subject-specific learning outcomes

Professional competencies	Use of software applications and digital technologies for computer-aided design (CAD) of products and manufacturing processes. Application of modeling, simulation, and finite element analysis (FEM) methods in the study, optimization, and improvement of engineering processes. Computerized processing, analysis, and interpretation of experimental data using programming tools and databases. Evaluation and use of software applications for solving complex tasks and developing technical projects specific to industrial engineering.
Transversal competencies	Responsible assumption of professional tasks, including complex tasks within interdisciplinary computer-aided projects, under conditions of autonomy, while respecting professional ethics, as well as the use of logical reasoning and critical thinking in the decision-making process. Self-assessment of the need for continuous professional training and adaptation to labor market requirements through the effective use of communication skills and information and communication technologies.

7. Expected learning outcomes

Knowledge	C1. The student/graduate demonstrates knowledge of mathematical theories applied in engineering, the principles of Finite Element Method (FEM) modelling and Computer-Aided Design (CAD) methods.
Skills	A1.1 The student/graduate is using advanced CAD software and specialized methods for the computer-aided design of molds and automotive components. A1.2 The student/graduate is using analytical mathematical calculations and implements them in CAE systems to simulate the behaviour of materials and subassemblies. A1.3 The student/graduate analyses virtual test data and interprets complex technical requirements for the topological optimization of products. A1.4 The student/graduate applies technical principles and uses virtual manufacturing to anticipate process errors and reduce time-to-market. A1.5 The student/graduate is using design software to generate the technical documentation necessary for series production.
Responsibility and autonomy	R1.1 The student/graduate assumes responsibility for testing mathematical models and virtual simulations that form the basis for designing manufacturing technologies. R1.2 The student/graduate manages the iterative design process, integrating feedback from simulations. R1.3 The student/graduate demonstrates the capacity for innovation in component design, using databases and scientific libraries.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	• Knowledge of the theory of plasticity directly usable for modelling industrial metal forming processes • Modelling, simulation, and finite element analysis of cold metal forming processes • Use of advanced computer programs for the numerical simulation of cold metal forming processes
8.2 Specific objectives	• Computer aided design of metal forming processes

9. Contents

9.1 Course	No. of hours	Teaching methods	Notes
1. Plasticity of metallic materials. Notions of the theory of plasticity. General structure of plasticity models (yield criterion, flow rule, and hardening law). Isotropic yield criteria (von Mises, Drucker, etc.)	2 hours	Multimedia projector, discussions and examples	
2. Plastic anisotropy of metallic materials. Quantities used to describe the anisotropic plasticity of metallic materials. Anisotropic yield criteria (Hill 1948, Barlat 1989, etc.)	2 hours		
3. Empirical hardening laws. Flow rule associated to a yield criterion	2 hours		
4. Limit strain states. Formability of sheet metals. Forming Limit Diagram. Calculation of the Forming Limit Diagram using localized or diffuse necking models	2 hours		
5. Numerical solution of plasticity problems. Finite element model of a cold metal forming process (Part I: General formulation of the model)	2 hours		
6. Finite element model of a cold metal forming process (Part II: Describing the frictional contact between the blank and tools)	2 hours		
7. Finite element model of a cold metal forming process (Part III: Numerical solution of the model)	2 hours		
Bibliography [1] Olszak, W., Perzyna, P., Sawczuk, A. Theory of Plasticity. Bucharest: "Editura Tehnică" Publishing House, 1970 (in Romanian). [2] Chakrabarty, J. Applied Plasticity. New York: Springer, 2009.			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. Structure of the finite element models generated by the Dynaform program. Graphical interface of the pre- and postprocessing modules	2 hours	Individual exploiting and using of CATIA program by every student in order to practice and experience the use of different types of modeling commands, which are required for finalizing their project themes	
2. Finite element simulation of a cylindrical cup deepdrawing. Part I: Preparing the geometric models of the blank and tools; importing the geometric models in the preprocessor; generating the finite element meshes of the blank and tools	2 hours		
3. Finite element simulation of a cylindrical cup drawing. Part II: Describing the deep-drawing process; numerical simulation of the deep-drawing process; postprocessing the simulation results	2 hours		
4. Finite element simulation of a sheet bending process. Springback analysis	2 hours		
5. Finite element simulation of a complex part deepdrawing. Part I: Geometric modelling of the drawing die; blank sizing with the help of the MStep modulus;	2 hours		

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
importing the geometric models of the blank and drawing die in the preprocessor; generating the finite element meshes of the blank and drawing die			
6. Finite element simulation of a complex part deepdrawing. Part II: Simulation of the gravitational distortion of the blank; simulation of the deepdrawing process; trimming simulation; springback simulation	2 hours		
7. Finite element simulation of a complex part deepdrawing. Part III: Springback compensation	2 hours		

Bibliography
[1] *** eta/Dynaform User's Manual. Version 5.6.1. Troy: Engineering Technology Associates, 2008.
[2] *** eta/Dynaform Application Manual. Version 5.6. Troy: Engineering Technology Associates, 2007.
[3] *** eta/Post User's Manual. Version 1.7.9. Troy: Engineering Technology Associates, 2008.

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The acquired knowledge will allow the students to use modern methods and computer programs for the analysis and design of cold metal forming processes.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	Presentation of a theoretical topic	Assignment report	50 %
11.5 Seminar/Laboratory /Project / Practical training	Numerical simulation of a forming process using the Dynaform computer program	Computer test	50 %
11.6 Minimum performance standard Mark 5 (five) in both parts of the evaluation (course and applications)			

Completion date:	Faculty members	academic rank, title, First Name SURNAME	Signature
18.05.2026	Course	Assoc. Prof. Dr.Eng. Emilia SABĂU	
	Practical activities	Assoc. Prof. Dr.Eng. Emilia SABĂU	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department IF Assoc. Prof. Dr.Eng. Glad CONŢIU

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc. Prof. Dr.Eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof. Dr.Eng. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Quality Management				Subject code	4.00
2.2 Course responsible/lecturer	*Bocăneț Vlad – vlad.bocanet@tcm.utcluj.ro*					
2.3 Teacher in charge of seminars/labs/projects	*Bocăneț Vlad – vlad.bocanet@tcm.utcluj.ro*					
2.4 Year of study	1	2.5 Semester	1	2.6 Assessment		E
2.7 Subject category	Formative category					DS
	Optional					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		3.3 Practical training	
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar		3.6 Laboratory	14	3.6 Project		3.3 Practical training	

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	4
(b) Study of textbooks, course materials, bibliography, and lecture notes	20
(c) Additional research in the library, on specialized electronic platforms, and in the field	16
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(e) Tutoring	4
(f) Other activities	
3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	Basic notions of tolerances and dimensional and statistical control, notions of design and production
4.2 Competence	Using CAD, GOM Inspect, and MS Excel modeling software packages

5. Requirements (if applicable)

5.1. for the course	Multimedia equipment (on site) / MS Teams account, microphone and webcam (online)

5.2. for the seminar/lab/project	Access to a PC with GOM Inspect and a CAD modeling program installed

6. Subject-specific learning outcomes

Professional competencies	C6.1 Define the principles, methods and tools used in the planning, management and quality assurance of manufacturing processes. C6.2 Acquisition and application of methods and tools in order to optimize multicriteria manufacturing, and increase processing precision. C6.3 Skills in solving specific applications in the field of production management and developing the capabilities of optimal design of control technologies C6.4 Capacity building to use tools and methods for planning-organizing production and practical training in the use of quality tools including the use of dedicated programs. C6.5 Elaboration of professional projects based on the use of the calculation technique in solving the problems of planning, management and quality assurance of manufacturing processes.
Transversal competencies	CT1 Application of the values and ethics of the engineering profession, and responsible execution of professional tasks in conditions of restricted autonomy and qualified assistance. Promoting logical, convergent and divergent reasoning, practical applicability, evaluation and self-evaluation in decision-making. CT2 Carrying out activities and exercising specific roles for teamwork on different hierarchical levels. Promoting initiative, dialogue, cooperation, positive attitude and respect for others, diversity and multiculturalism and continuous improvement of one's own activity. Communication and teamwork. CT3 Objective self-assessment of the need for continuous professional training in order to enter the labour market and adapt to the dynamics of its requirements and for personal and professional development. Effective use of language skills and knowledge of information and communication technology. Aware of the need for continuous training, team cooperation, positive attitude, respect for colleagues and assuming the leadership role

7. Expected learning outcomes

Knowledge	C1. The student/graduate has an in-depth knowledge of the principles and methods of numerical simulation applicable to industrial processes. digital transformation, the architecture of virtual and augmented reality (VR/AR) systems. C3. The student/graduate summarizes the concepts of production systems management, flow optimization strategies and methods of ensuring quality and financial viability.
Skills	A1.4 The Student/Graduate analyzes production processes in order to improve them by running alternative scenarios in the virtual environment. A3.3 The Student/Graduate implements quality management systems to ensure zero defects in digital manufacturing processes.
Responsibility and autonomy	R1.2 The Student/Graduate assumes responsibilities for the accuracy of the simulation models and for the decisions made based on the virtual results. R1.3 The student/graduate critically assesses the need for the adoption of new digital technologies in the specific context of the enterprise. R3.3 The Student/Graduate manages the budgets allocated to optimization and refurbishment projects.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Acquiring skills in planning, leading and quality assurance of manufacturing processes

8.2 Specific objectives	Assimilation of theoretical knowledge of coordinate measuring machines, quality management and non-destructive testing methods. 2. Obtaining skills for the development of CNC coordinate measurement programs

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
1. Introduction to Industry 4.0: introduction to the concept, what are the elements of Industry 4.0, how quality fits in.	4	Discussions following the individual study of the materials. Solving concrete examples and cases in the industry.	**The materials will be available online in multimedia and text format.**
2. Optical measuring equipment: general description, how it works, types of sensors and practical applications	8		
3. Quality tools, 6 Sigma methodology, FMEA, Lean methodology, etc. Practical examples.	8		
4. Statistical Process Control - SPC tools, how to use them, practical examples	8		
Bibliography: Bocăneț V. "Quality Management – course textbook", Editura UTPRESS, Cluj-Napoca, 2023, ISBN 978-606-737-680-7 Bulgaru, M., Bolboaca, L.,I., - Ingineria calității, Managementul calității, statistică și control, măsurări în 3D, Editura Alma Mater, Cluj-Napoca, 2001, ISBN 973-35153-0-0. Bulgaru, M., Bolboaca, L.,I., - Ingineria calității, Instrumentele calității, Editura Alma Mater, Cluj-Napoca, 2004, ISBN 973-8396-72-3.			

9.2 Seminar / laboratory / project / practical training	**No. of hours**	**Teaching methods**	**Notes**
Introduction to optical measurement. Getting to know the interface of the GOM Inspect program	2	Individual work and tutoring with previous preparation of theoretical elements (on site and online)	The materials will be available online in multimedia and text format. Access to software (kit or remote access) will be provided
Scanning and reverse engineering of a chosen part	2		
Modelling and evaluation of the CAD model obtained through reverse engineering	4		
Describing the steps of the manufacturing process of the part	2		
FMEA analysis of a part of the manufacturing process of the part	2		
Presentation of results obtained throughout the entire semester	2		
Bibliography Vlad BOCĂNEȚ, Marius BULGARU – „Îndrumător de lucrări – Ingineria Calității", Editura Casa Cărții de Știință, Cluj-Napoca, 2014, ISBN 978-606-17-0466-8			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The knowledge gained will be necessary for employees working in quality assurance and control services, as well as for technological engineers.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	Ability to answer theoretical questions and apply learned concepts coherently in a written project and assessment along the way	Online Assessment and/or Written Test (on site) / Quiz (online)	50%
11.5 Seminar/Laboratory /Project / Practical training	Solving practical applications during the semester.	Practical test during the semester (one hour) solved on the computer	50%
11.6 Minimum performance standard The condition for entering the exam is to solve the practical applications and obtain an average of at least 5 out of 10. The condition for passing the course is to obtain a grade of 5 in the written test.			

Completion date:	Faculty members	academic rank, title, First Name SURNAME	Signature
10.09.2025	Course	Assoc. Prof. dr. ing. Vlad Bocăneț	
	Practical activities	Assoc. Prof. dr. ing. Vlad Bocăneț	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Rapid Prototyping			Subject code	5.10
2.2 Course responsible/lecturer	*Prof.dr.eng. Petru Berce – petru.berce@tcm.utcluj.ro*				
2.3 Teacher in charge of seminars/labs/projects	*Prof.dr.eng. Razvan Pacurar, razvan.pacurar@tcm.utcluj.ro*				
2.4 Year of study	I	2.5 Semester	I	2.6 Assessment	E
2.7 Subject category	Formative category				DS
	Optional				DO

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	-	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	4
(b) Study of textbooks, course materials, bibliography, and lecture notes	24
(c) Additional research in the library, on specialized electronic platforms, and in the field	14
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(e) Tutoring	2
(f) Other activities	-

3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	Computer Aided Design (CAD), Technical Drawing, Basics of Engineering, specific manufacturing technologies and/or equivalent disciplines in industrial engineering field.
4.2 Competence	

5. Requirements (if applicable)

5.1. for the course	Classroom, equipped with multimedia equipment

5.2. for the seminar/lab/project	Laboratory, equipped with additive manufacturing equipment and computers

6. Subject-specific learning outcomes

Professional competencies	3 Analyses production process feasibility 9 Reviews engineering principles 11 Manufactures prototypes for functional testing 12 Specifies technical requirements 16 Designs prototypes 19 Optimizes production processes 25 Operates high-performance measurement equipment 28 Designs automation components
Transversal competencies	1 Demonstrates creativity and initiative 2 Assumes responsibility 3 Applies scientific and technological knowledge 4 Manages documentation and production organization

7. Expected learning outcomes

Knowledge	C2. The student/graduate has knowledge of innovative manufacturing technologies, rapid prototyping workflows, and the specifics of producing components and sub-assemblies.
Skills	A2.1 The student/graduate manufactures prototypes using rapid prototyping technologies necessary for the functional and aesthetic verification of new products. A2.2 The student/graduate designs automation components and configures manufacturing equipment specific to automotive subassemblies. A2.3 The student/graduate analyses the feasibility of the production process, the precision of manufacturing systems and technological constraints. A2.4 The student/graduate operates precision measurement equipment to evaluate the compliance of parts with required tolerances. A2.5 The student/graduate analyses production processes to improve efficiency, reduce waste and increase competitiveness.
Responsibility and autonomy	R2.1 The student/graduate makes decisions regarding the design of optimal manufacturing technology. R2.2 The student/graduate coordinates the stages of prototype manufacturing and their integration into the manufacturing flow. R2.3 The student/graduate assumes responsibility for compliance with technical standards in the design of industrial equipment and manufacturing technologies.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Knowledge and understanding the main AM technologies, as well as how to apply them in the development of industrial, functional and medical products.
8.2 Specific objectives	Particularities and specifics of additive manufacturing technologies (AM) Industrial applications of AM technologies Applications of AM technologies in the medical field

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
1. Introducere în prototiparea rapidă. Rolul și importanța tehnologiei în realizarea unui produs.	2	Presentation, discussions	Video projector

9.1 Course	No. of hours	Teaching methods	Notes
1. Introduction to rapid prototyping. The role and importance of technology in product manufacturing.	2		
2. Classification of additive manufacturing technologies. Advantages, limitations and areas of application.			
3. Additive manufacturing systems using liquid material. Principles, materials, precision and applications.	2		
4. Additive manufacturing systems using filament material, foils and plates.	2		
5. Manufacturing systems using non-metallic powders material. Polymer materials, process parameters and industrial applications.	2		
6. Manufacturing systems using metal powders. Technological parameters, defects and applications.	2		
7. How to make 3D virtual models for AM.	2		
8. Rapid tooling technologies. Silicone rubber mold manufacturing for small series production.	2		
9. Manufacture of metal parts using investment casting process.	2		
10. Quality control of AM parts. Mechanical properties, dimensional accuracy, roughness, porosity, deformations, process defects and verification methods.	2		
11. Manufacture of active elements for molds by SLS.	2		
12. Manufacture of active elements for molds through SLM.	2		
13. Medical applications of AM technologies	2		
14. New directions for the development of AM technologies	2		

Bibliography

1. Gebhardt, A., s.a, 3D Printing-Understanding Additive Manufacturing, Hanser, 2018
2. Balc N., Leordean D., Editors: "Research and Applications in Manufacturing Engineering", MATEC Web of Conferences – EDP Sciences, France, Volume 299, 2019, ISBN- ISBN: 978-2-7598-9083-5, https://www.matec-conferences.org/articles/matecconf/abs/2019/48/contents/contents.html
3. Berce, P., Balc, N., ş.a. "Tehnologii de fabricaţie prin adaugare de material şi aplicaţiile lor", Editura Academiei Romane, Bucureşti, 2014, (387 pag.), ISBN 978-973-27-2396-8.
4. Balc N, Editor: "Modern Technologies in Manufacturing", MATEC Web of Conferences – EDP Sciences, France, Volume 137, 2017, ISBN- ISBN: 978-2-7598-9083-5, https://www.matec-conferences.org/articles/matecconf/abs/2017/51/contents/contents.html
5. Balc N, Editor: "Modern Technologies in Manufacturing", Trans Tech Publications - Applied Mechanics and Materials, Switzerland, Vol. 808, 394 pagini, 2015, ISBN-13: 978-3-03835-653-0, http://www.scientific.net/AMM.808/book

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. Presentation of AM manufacturing systems from the department laboratories.	2		
2. Design of a 3D model, preparation and manufacturing using AM systems.	2		
3. Evaluation of the precision and quality surfaces of parts manufactured using AM technologies.	2		
4. Vacuum casting technology for silicone molds.	2		
5. SLA process for functional parts.	2		

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
6. Using MIMICS software in developing a virtual model of personalized implant starting from CT images.	2		
7. Manufacturing of a custom implant through the SLS/SLM process.	2		

Bibliography

1. Gebhardt, A., s.a, 3D Printing-Understanding Additive Manufacturing, Hanser, 2018
1. 2. Berce, P., Balc, N., s.a. Aplicatiile medicale ale tehnologiilor de fabricatie prin adăugare de material, Ed Acad. Ro, 2015.

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The content of the discipline is correlated with the current requirements of the academic community, professional associations and employers in the field of industrial engineering and advanced manufacturing. The discipline responds to the needs regarding the use of modern technologies of rapid prototyping and additive manufacturing, CAD design, manufacturing preparation, material selection and quality control of the manufactured parts. Through the topics covered, students acquire applicable skills in product development, rapid tooling, manufacturing of complex components and customized medical applications. The content is aligned with current trends on digitalization, innovation, reducing development time and increasing industrial competitiveness.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	Level of knowledge of new technologies and their applications	Grid Test	75 %
11.5 Seminar/Laboratory /Project / Practical training	The ability to manufacture a prototype and integrate it into an application	Prototype	25 %
11.6 Minimum performance standard Solving each topic and meeting the minimum requirements for practical activities at a minimum level (mark 5).			

Completion date:	Faculty members	academic rank, title, First Name SURNAME	Signature
10.09.2025	Course	Prof.dr.eng. Petru BERCE	
	Practical activities	Prof.dr.eng. Răzvan PĂCURAR	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing (in English)
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Mechanical Behaviour of Materials			Subject code	5.20
2.2 Course responsible/lecturer	*Assoc. Prof. Dr.Eng. Emilia Sabău - emilia.sabau@tcm.utcluj.ro*				
2.3 Teacher in charge of seminars/labs/projects	*Assoc. Prof. Dr.Eng. Emilia Sabău - emilia.sabau@tcm.utcluj.ro*				
2.4 Year of study	I	2.5 Semester	I	2.6 Assessment	E
2.7 Subject category	Formative category				DS
	Optional				DO

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	-	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study of textbooks, course materials, bibliography, and lecture notes	28
(c) Additional research in the library, on specialized electronic platforms, and in the field	14
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(e) Tutoring	0
(f) Other activities	0
3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	Attending the following courses: Applied Mathematics for Engineering, Strength of Materials, and Materials Science
4.2 Competence	Knowledge of the MS Windows operating system (basic level)

5. Requirements (if applicable)

5.1. for the course	Multimedia projector

5.2. for the seminar/lab/project	Materials testing laboratory + computers

6. Subject-specific learning outcomes

Professional competencies	Description of the fundamental theories and methods in the field of computer programming and applied informatics specific to manufacturing engineering technology. Use of fundamental knowledge associated with software programs and digital technologies to explain and interpret problems arising in computer-aided design and engineering of products, processes, and technologies, in theoretical-experimental investigation and computerized data processing, specific to industrial engineering in general, and manufacturing engineering technology in particular. Application of basic principles and methods from software programs and digital technologies for programming, database development, computer graphics, modeling, computer-aided design of products, processes, and technologies, as well as investigation and computerized data processing specific to industrial engineering in general, and manufacturing engineering technology in particular. Appropriate use of standard evaluation criteria and methods to assess the quality, advantages, and limitations of software programs and digital technologies, with the purpose of employing them in carrying out tasks specific to industrial engineering in general, and manufacturing engineering technology in particular. Development of professional projects specific to industrial engineering in general, and manufacturing engineering technology in particular, based on the selection, combination, and use of established principles, methods, digital technologies, information systems, and software tools in the field.
Transversal competencies	Application of the values and ethics of the engineering profession and responsible execution of professional tasks under conditions of limited autonomy and qualified supervision. Promotion of logical, convergent, and divergent reasoning, practical applicability, evaluation, and self-evaluation in decision-making. Objective self-assessment of the need for continuous professional training in order to integrate into the labor market, adapt to its dynamic requirements, and support personal and professional development. Efficient use of language skills and knowledge of information and communication technologies.

7. Expected learning outcomes

Knowledge	C1. The student/graduate demonstrates knowledge of mathematical theories applied in engineering, the principles of Finite Element Method (FEM) modelling and Computer-Aided Design (CAD) methods. C4. The student/graduate is familiar with theoretical and experimental scientific research methodology, academic ethics standards, and the structure of scientific reports.
Skills	A1.2 The student/graduate is using analytical mathematical calculations and implements them in CAE systems to simulate the behaviour of materials and subassemblies. A1.3 The student/graduate analyses virtual test data and interprets complex technical requirements for the topological optimization of products. A4.2 The student/graduate uses scientific research apparatus and equipment to collect experimental data relevant to industrial engineering. A4.3 The student/graduate analyses experimental data and formulates scientific conclusions using mathematical and statistical tools.

Responsibility and autonomy	R1.1 The student/graduate assumes responsibility for testing mathematical models and virtual simulations that form the basis for designing manufacturing technologies. R1.2 The student/graduate manages the iterative design process, integrating feedback from simulations. R1.3 The student/graduate demonstrates the capacity for innovation in component design, using databases and scientific libraries. R4.1 The student/graduate assumes responsibility for the integrity of collected data and for the adherence to academic ethics and integrity. R4.2 The student/graduate demonstrates autonomy in defining research hypotheses and in choosing appropriate experimental methods. R4.3 The student/graduate demonstrates the capacity to manage a complex research project over an extended duration.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	• Acquiring the fundamental notions referring to the mechanical behaviour of the materials used in industry • Knowledge of the laboratory tests used for determining the mechanical parameters of the materials used in industry • Knowledge of the mathematical methods devised for identifying the models that describe the mechanical behaviour of the materials used in industry
8.2 Specific objectives	• Exploiting the laboratory equipment used for materials testing • Calibrating models that describe the mechanical behaviour of the materials used in industry

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
1. General considerations referring to the materials testing. Terminology. Standardization of mechanical tests	2 hours	Multimedia projector, discussions and examples	
2. Mechanical metallurgy – Part 1 (structure of metallic materials, mechanics of the metal forming processes)	2 hours		
3. Mechanical metallurgy – Part 2 (theory of dislocations)	2 hours		
4. Mechanical metallurgy – Part 3 (plastic deformation mechanisms)	2 hours		
5. Mechanical metallurgy – Part 4 (hardening mechanisms)	2 hours		
6. Mechanical metallurgy – Part 5 (fracture mechanisms)	2 hours		
7. Tensile testing – Part 1. Terminology. Standardization. Mechanical parameters that can be determined by tensile testing	2 hours		
8. Tensile testing – Part 2. Geometry of the specimens. Strain measurement devices (extensometres)	2 hours		
9. Tensile testing – Part 3. Stress-strain curve	2 hours		
10. Hardening of metallic materials. Empirical hardening laws and their calibration	2 hours		

9.1 Course	No. of hours	Teaching methods	Notes
11. Anisotropy of metallic sheets. Coefficients of plastic anisotropy. Anisotropic plasticity models	2 hours		
12. Visco-plastic behaviour of metallic materials. Superplasticity	2 hours		
13. Other types of laboratory tests used for determining the mechanical parameters of metallic materials – Part 1 (compression test, shearing test, and hydraulic bulge test for metallic sheets)	2 hours		
14. Other types of laboratory tests used for determining the mechanical parameters of metallic materials – Part 2 (torsion test and bending test)	2 hours		

Bibliography

[1] Banabic, D., Bunge, H.-J., Pöhlandt, K., Tekkaya, A.E. Formability of Metallic Materials. Plastic Anisotropy, Formability Testing, Forming Limits. Berlin: Springer, 2000.
[2] Dieter, G. Metalurgie Mecanică. București: Editura Tehnică, 1970.
[3] Hosford, W.F. Mechanical Behavior of Materials. New York: Cambridge University Press, 2005.
[4] Poehlandt, K. Materials Testing for the Metal Forming Industry. Berlin: Springer, 1989.

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. Determination of the hardening curve by tensile testing. Calibration of an empirical hardening law	2 hours	Computer applications and discussions	
2. Determination of the hardening curve by hydraulic bulging. Calibration of an empirical hardening law	2 hours		
3. Determination of the plastic anisotropy coefficients by tensile testing	2 hours		
4. Determination of the balanced biaxial yield stress by hydraulic bulging	2 hours		
5. Experimental determination of a yield locus	2 hours		
6. Determination of the strain-rate exponent by tensile testing	2 hours		
7. Use of experimentally determined mechanical parameters for the numerical simulation of a deep-drawing process with the eta/DYNAFORM computer program	2 hours		

Bibliography

[1] Banabic, D., Bunge, H.-J., Pöhlandt, K., Tekkaya, A.E. Formability of Metallic Materials. Plastic Anisotropy, Formability Testing, Forming Limits. Berlin: Springer, 2000.
[2] Poehlandt, K. Materials Testing for the Metal Forming Industry. Berlin: Springer, 1989.
[3] *** eta/Dynaform User's Manual. Version 5.6.1. Troy: Engineering Technology Associates, 2008.
[4] *** eta/Dynaform Application Manual. Version 5.6. Troy: Engineering Technology Associates, 2007.
[5] *** eta/Post User's Manual. Version 1.7.9. Troy: Engineering Technology Associates, 2008.

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The acquired knowledge will allow the students to use modern materials testing techniques and constitutive models that describe the mechanical behaviour of these materials.

11. Evaluation

Type of activity	**11.1 Assessment criteria**	**11.2 Assessment methods** (and type of assessment: continuous/summative)	**11.3 Weight in the final grade**
11.4 Course	Presentation of a theoretical topic and solution of a problem	Assignment report	75 %
11.5 Seminar/Laboratory /Project / Practical training	Evaluation of the laboratory activity	Assignment report	25 %
11.6 Minimum performance standard Mark 5 (five) in both parts of the evaluation (course and applications)			

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
18.05.2026	Course	Assoc. Prof. Dr.Eng. Emilia SABĂU	
	Practical activities	Assoc. Prof. Dr.Eng. Emilia SABĂU	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department IF Assoc. Prof. Dr.Eng. Glad CONŢIU

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc. Prof. Dr.Eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof. Dr.Eng. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Accuracy of manufacturing systems			Subject code	7.00
2.2 Course responsible/lecturer	*Prof. Dr. Ing. Popa Marcel marcel.popa@tcm.utcluj.ro*				
2.3 Teacher in charge of seminars/labs/projects	*Prof. Dr. Ing. Popa Marcel marcel.popa@tcm.utcluj.ro*				
2.4 Year of study	2	2.5 Semester	I	2.6 Assessment	E
2.7 Subject category	Formative category				DA
	Optional				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	-	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study of textbooks, course materials, bibliography, and lecture notes	18
(c) Additional research in the library, on specialized electronic platforms, and in the field	12
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
(e) Tutoring	6
(f) Other activities	-
3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	
4.2 Competence	

5. Requirements (if applicable)

5.1. for the course	Laptop and video projector
5.2. for the seminar/lab/project	Laboratory equipped with computers

6. Subject-specific learning outcomes

Professional competencies	14 Inspects industrial equipment 20 Supervises production 23 Performs quality control 26 Calculates design costs 29 Monitors manufacturing quality standards
Transversal competencies	1 Demonstrates creativity and initiative 2 Assumes responsibility 3 Applies scientific and technological knowledge

7. Expected learning outcomes

Knowledge	C3. The student/graduate synthesizes Total Quality Management (TQM) concepts, logistics principles for manufacturing systems, and economic calculation methods in design.
Skills	A3.1 The student/graduate performs quality control and monitors compliance with manufacturing quality standards by applying advanced statistical methods. A3.2 The student/graduate calculates design costs and estimates the budget for launching new products into manufacturing. A3.3 The student/graduate prioritizes information, objects, and logistical resources to optimize material flow within manufacturing systems. A3.4 The student/graduate controls production using performance indicators and identifies bottlenecks in the logistics chain. A3.5 The student/graduate inspects industrial equipment and proposes maintenance or replacement plans based on life-cycle analysis
Responsibility and autonomy	R3.1 The student/graduate manages the material and financial resources of a manufacturing project. R3.2 The student/graduate performs process audits and proposes measures to ensure quality. R3.3 The student/graduate makes decisions regarding the optimization of the logistics chain to ensure timely delivery.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Knowing the competitive manufacturing methods and technologies
8.2 Specific objectives	Knowing the mathematical methods applied in engineering

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
1. Accuracy of competitive manufacturing systems.	2	Presentation, discussions	Video projector
2. Specific aspects of ensuring the accuracy of manufacturing systems	2		
3. Manufacturing accuracy in the case of conventional processing. The main factors that influence it.	2		
4. Manufacturing accuracy in the case of conventional processing.	2		

9.1 Course	No. of hours	Teaching methods	Notes
The main factors that influence it.			
5. Manufacturing accuracy in the case of conventional processing. The main factors that influence it.	2		
6. The accuracy of the fabrication in the case of unconventional processing and the main factors influencing it.	2		
7. The accuracy of the fabrication in the case of unconventional processing and the main factors influencing it.	2		
8. The accuracy of the fabrication in the case of unconventional processing and the main factors influencing it.	2		
9. Analysis of manufacturing accuracy by methods of mathematical statistics.	2		
10. Reliability and connection with the precision of manufacturing systems	2		
11. Statistical analysis of the stability of manufacturing systems	2		
12. Precision, technology and economy. Correlation in the case of conventional processing	2		
13. Precision, technology and economy. Correlation in the case of unconventional processing	2		
14. Modern methods of ensuring and controlling the precision of competitive manufacturing systems	2		

Bibliography

1. Popa, M.- Manufacturing accuracy in modern production. Academy of Technical Sciences of Romania, Bucharest 2007.
2. Berce, P., Balc, N.,- Fast manufacture of prototypes. E. T. Bucharest, 2000.
3. Popa, M.- Unkonventionelle Technologien und Fertigungseinrichten fuer Feinmechanik und Mikrotechnik (Technologies and Machines, Unconventional for Fine Mechanics and Microtechnics) UT Press, 2005, Bilingual Edition.
4. Gyenge, Cs., Ros, O., Popa, M.,- Machine tool construction technology, IPCN, ClujNapoca, 1989.
5. Dubbel-Manual of Mechanical Engineer, Technnica Publishing House, Bucharest 1998.
6. Westkaemper, E., Warnecke, H-J.,-Einfuehrung in die Fertigungstechnik, Teubner Verlag, Stuttgart, 2002.
7. Pfeifer, T., - Qualitaetsmanagement, Carl Hanser Verlag, Muenchen Wien, 1993.
8. Koenig, W., Klocke, F.,- Fertigungsverfahren, Springer Verlag, Heidelberg; New York, 6 Vol, 1997
9. Warnecke, H-J.,- Einfuehrung in die Fertigungstechnik, Teubner Verlag, stuttgart, 1993.
10. Nichici, Al., s.a. - Erosion processing in machine construction, Ed. Facla, Timisoara, 1993.
11. Gavrilas, I., Marinescu, N. I.,- Unconventional processing in the construction of machines, E.T. Bucharest, 2 vol, 1993.
12. Warnecke, H-J., Pritschow, G.,- Flexible Fertigungssystem, VCH Verlag, Basel, 1998.

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. Analysis of the precision of manufacturing systems by methods of mathematical statistics.	2		
2. Use of laser interferometry to determine the accuracy of manufacturing systems.	2		
3. Analysis of manufacturing accuracy, electrical erosion with massive electrode	2		
4. Analysis of manufacturing accuracy, electric erosion with filiform electrode	2		

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
5. Analysis of manufacturing accuracy, laser welding	2		
6. Accuracy analysis of water jet processing	2		
7. Determining the accuracy of the electrodes used in	2		

Bibliography

1. L. Slătineanu, et.al. "Innovative Manufacturing Engineering and Energy", MATEC Web of Conferences – EDP Sciences, France, Vol. 178, 2018, eISSN: 2261-236X, DOI: https:// doi.org/10.1051/matecconf/201817800001

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The skills acquired will be necessary for engineers to design manufacturing and assembly technologies within companies that produce parts and tooling for the automotive industry and companies that perform the assembly of automotive subassemblies and assemblies.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	Examination consistsof checking knowledge in writing.	Written test	75 %
11.5 Seminar/Laboratory /Project / Practical training	Evaluation of the students' activity during project hours / preparation of documentation for the laboratory.	Presentation of the applications	25 %
11.6 Minimum performance standard Condition for obtaining credits: E>5			

Completion date:	Faculty members	academic rank, title, First Name SURNAME	Signature
10.09.2025	Course	Prof. Dr. Ing. Popa Marcel	
	Practical activities	Prof. Dr. Ing. Popa Marcel	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Project Management			Subject code	8.00
2.2 Course responsible/lecturer	*Assoc.prof.dr.eng. Alina Popan – Alina.Luca@tcm.utcluj.ro*				
2.3 Teacher in charge of seminars/labs/projects	*As. dr.eng. Mircea Rusu – Mircea.Rusu@tcm.utcluj.ro*				
2.4 Year of study	I	2.5 Semester	II	2.6 Assessment	E
2.7 Subject category	Formative category				DA
	Optional				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	-	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study of textbooks, course materials, bibliography, and lecture notes	18
(c) Additional research in the library, on specialized electronic platforms, and in the field	12
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
(e) Tutoring	6
(f) Other activities	0

3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	
4.2 Competence	

5. Requirements (if applicable)

5.1. for the course	Laptop and video projector
5.2. for the seminar/lab/project	Laboratory equipped with computers

6. Subject-specific learning outcomes

Professional competencies	4 Applies technical principles 5 Selects technical documentation 6 Demonstrates technical communication skills 12 Specifies technical requirements 14 Inspects industrial equipment 17 Manages engineering projects 18 Evaluates technical requirements 20 Supervises production 23 Performs quality control 24 Provides project management 26 Calculates design costs 27 Monitors technology trends 29 Monitors manufacturing quality standards
Transversal competencies	1 Demonstrates creativity and initiative 2 Assumes responsibility 3 Applies scientific and technological knowledge

7. Expected learning outcomes

Knowledge	C3. The student/graduate synthesizes Total Quality Management (TQM) concepts, logistics principles for manufacturing systems, and economic calculation methods in design. C5. The student/graduate understands project management principles, technical English terminology and professional communication strategies within multidisciplinary teams.
Skills	A3.1 The student/graduate performs quality control and monitors compliance with manufacturing quality standards by applying advanced statistical methods. A3.2 The student/graduate calculates design costs and estimates the budget for launching new products into manufacturing. A3.3 The student/graduate prioritizes information, objects, and logistical resources to optimize material flow within manufacturing systems. A3.4 The student/graduate controls production using performance indicators and identifies bottlenecks in the logistics chain. A3.5 The student/graduate inspects industrial equipment and proposes maintenance or replacement plans based on life-cycle analysis A5.1 The student/graduate manages engineering projects and ensures project management by planning stages, resources and deadlines. A5.2 The student/graduate applies technical communication skills, using the English language for documentation and international collaboration. A5.3 The student/graduate monitors global technology trends and updates their innovation methods according to market requirements. A5.4 The student/graduate demonstrates initiative in mitigating risks and resolving unexpected issues during project execution. A5.5 The student/graduate interprets technical requirements received from international partners or clients and translates them into clear work tasks.
Responsibility and autonomy	R3.1 The student/graduate manages the material and financial resources of a manufacturing project. R3.2 The student/graduate performs process audits and proposes measures to ensure quality. R3.3 The student/graduate makes decisions regarding the optimization of the logistics chain to ensure timely delivery. R5.1 The student/graduate coordinates project teams and assumes responsibility for achieving the objectives. R5.2 The student/graduate self-evaluates the need for continuous training and identifies professional development opportunities. R5.3 The student/graduate exhibits ethical and responsible behaviour in relationships with team members and external partners.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	To develop students' skills in planning, organizing, implementing and evaluating projects, by using modern project management methods and tools and integrating them into the context of product lifecycle management.
8.2 Specific objectives	Understanding project management concepts and stages, including goal setting, task planning, and resource management. Develop skills to use specific tools and techniques for project planning and monitoring. Understanding and applying product lifecycle management principles in correlation with project management, for development and innovation processes optimization.

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
1. Introduction to project management. Defining fundamental concepts	2	Presentation, discussions	Video projector
2. Processes and stages of the project lifecycle	2		
3. Project initiation and planning. Setting the objectives	2		
4. Activity planning and specific tools	2		
5. Resource management. Optimization of the use of resources (human, material, financial)	2		
6. Project team management. Roles and responsibilities	2		
7. Risk management. Identifying and reducing risks	2		
8. Project monitoring and control. Performance indicators (KPIs)	2		
9. Evaluating project performance and success	2		
10. Case studies in project management	2		
11. Introduction to Product Lifecycle Management (PLM). Role in industry and research	2		
12. Implementing PLM in Industry	2		
13. Integration of product data. Technical documentation and process management	2		
14. Components, product lifecycle stages, and PLM software systems	2		
Bibliography 1. Antti Saaksvuori, Anselmi Immonen – Product Lifecycle Management, Second edition, Springer, 2005; 2. Hanneke Raap – SAP Product Lifecycle Management, Galileo Press, Boston, 2013.			

9.2 Seminar / laboratory / project / practical training	**No. of hours**	**Teaching methods**	**Notes**
1. Project analysis and project subject definition	2		
2. Setting objectives and developing the project structure	2		
3. Tasks planning (Gantt chart)	2		
4. Resource management and cost estimation	2		
5. Risk analysis and diminishing strategies	2		
6. Project monitoring (KPI) and planning optimization	2		
7. Elaboration and presentation of the final documentation of the project	2		
Bibliography 1. Antti Saaksvuori, Anselmi Immonen – Product Lifecycle Management, Second edition, Springer, 2005; 2. Hanneke Raap – SAP Product Lifecycle Management, Galileo Press, Boston, 2013.			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The content of the discipline is correlated with the requirements of the economic environment and with the recommendations of the academic and professional community, aiming at the formation of the skills necessary for the management of research and development projects. The discipline responds to the requirements of employers by developing the skills of planning, organizing, monitoring and evaluating projects, as well as by using modern management tools and integrating the concept of product lifecycle management.

11. Evaluation

Type of activity	**11.1 Assessment criteria**	**11.2 Assessment methods** (and type of assessment: continuous/summative)	**11.3 Weight in the final grade**
11.4 Course	The examination consists of the verification of knowledge (understanding, explanation and interpretation)	Written test	50%
11.5 Seminar/Laboratory /Project / Practical training	Preparing a project proposal	Evaluation and presentation of the project proposal	50%
11.6 Minimum performance standard Condition for obtaining credits: E>5			

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
10.09.2025	Course	Assoc.prof.dr.eng. Alina POPAN	
	Practical activities	As. dr.eng. Mircea Rusu	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Virtual Manufacturing			Subject code	9.00	
2.2 Course responsible/lecturer	Ș.l. dr. ing. Flaviu Horea Chezan – horea.chezan@tcm.utcluj.ro					
2.3 Teacher in charge of seminars/labs/projects	Ș.l. dr. ing. Flaviu Horea Chezan – horea.chezan@tcm.utcluj.ro					
2.4 Year of study	I	2.5 Semester	2nd	2.6 Assessment	Exam	
2.7 Subject category	Formative category				DS/DI	
	Optional					

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	-	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	14	3.6 Seminar	-	3.6 Laboratory	28	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	4
(b) Study of textbooks, course materials, bibliography, and lecture notes	15
(c) Additional research in the library, on specialized electronic platforms, and in the field	15
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(e) Tutoring	10
(f) Other activities	
3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	Descriptive geometry and technical drawing, Tolerances, Computer Aided Design (SolidWorks), Computer aided Manufacturing (SolidCAM)
4.2 Competence	

5. Requirements (if applicable)

5.1. for the course	Multi-media projector

5.2. for the seminar/lab/project	Laboratory with minimum 12 high-performance computers for CATIA V5

6. Subject-specific learning outcomes

Professional competencies	• To define the technical requirements of a product or a process • To use CAD and CAM software for development of different kind of applications • To interpret technical requirements, to control production and to analyse production processes for their improvement • To determine production feasibility
Transversal competencies	• To apply knowledge of science, technology and engineering • To organise information, objects and resources • To use equipment, tools or technology with precision • To show initiative

7. Expected learning outcomes

Knowledge	The student must demonstrate knowledge of mathematical theories applied in engineering and Computer-Aided Design (CAD) methods.
Skills	- The student could use advanced CAD software and specialized methods for the computer-aided design of different kind of products and/or technological device components. - The student could apply technical principles and use virtual manufacturing to anticipate process errors and reduce time-to-market. - The student could use design software to generate the technical documentation necessary for series production.
Responsibility and autonomy	- The student must assume responsibility for testing the virtual simulations that form the basis for designing manufacturing technologies. - The student could manage the iterative design process, integrating feedback from simulations. - The student could demonstrate the capacity for innovation in component design, using databases and scientific libraries.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Assisted manufacturing of parts bounded by complex surfaces and assemblies using Catia V5
8.2 Specific objectives	After completing the discipline students will be able to: - use an application for assisted manufacturing, for the development of part processing programs for complex parts - apply the procedures for adjusting a technological system such a turning or milling machining center - to process complex parts on machining centers by turning or milling

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
General presentation. Presentation of the manufacturing module.	2	Presentation of computer modeling	Laptop, Video projector
Presentation of manufacturing processes by removing material.	2		

9.1 Course	No. of hours	Teaching methods	Notes
Design and simulation of milling manufacturing processes (I). Semi-finished design, adjustments, machining in 21/2 roughing axes	2	stages of some case studies (complex geometric landmarks, assemblies etc.)	
Design and simulation of milling manufacturing processes (II). Semi-finished design, adjustments, processing in 21/2 finishing axes	2		
Design and simulation of turning manufacturing processes (I). Adjustments, semi-finished design, roughing	2		
Design and simulation of turning manufacturing processes (II). Finishing processing	2		
Case Study	2		
Bibliography 1. Damian, M. Proiectare asistată de calculator. Suport de curs. 2. Damian, M. Carean A., Roş, O., Revnic I., Caizar C. Fabricaţie asistată de calculator. Casa cărţii de ştiinţă, 2003.			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
Design in CATIA V5 of the semi-finished product for the manufacture of a milling part. Adjustment of basic parameters (machine, origin, axles, semi-finished product, part)	4	Individual use of CATIA v5 program by each student, in order to practice some modeling commands, necessary to finalize the project theme	Individual solving of project topics, under the supervision of the teacher.
Strategies for rough milling integrated in CATIA V5	4		
Assisted fabrication of a part on the Hass machining center. CNC program.	4		
Design in CATIA V5 of the semi-finished product for the manufacture of a turning part. Defining the basic parameters: machine, origin, axes, semi-finished product and part.	4		
Strategies for roughing turning integrated in CATIA V5. Strategies for finishing turning integrated in CATIA V5	4		
Assisted fabrication of a complex part on the turning machining center. CNC program.	4		
Final project presentation	4		
Bibliography 1. *** Catia V5 R21. Part Design in a Nutshell. Dassault Systems, 2012			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The knowledge assimilated by the students will allow the use of the CATIA V5 program (widely used in the industrial field) for manufacturing and assembly, in order to increase the competitiveness of industrial products.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	The exam consists of verifying knowledge by solving concrete	Examination - modeling a complex part	70%

	problems (modeling some benchmarks - case studies)		
11.5 Seminar/Laboratory /Project / Practical training	Presentation of the project made by each student	Presentation of the project	30%
11.6 Minimum performance standard			

Completion date:	Faculty members	academic rank, title, First Name SURNAME	Signature
10.09.2025	Course	S.l. dr. Ing. Flaviu Horea CHEZAN	
	Practical activities	S.l. dr. Ing. Flaviu Horea CHEZAN	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Computer Aided Design for Competitive Manufacturing				Subject code	10.10
2.2 Course responsible/lecturer	*Prof.dr.eng. Nicolae Bâlc – nicolae.balc@tcm.utcluj.ro*					
2.3 Teacher in charge of seminars/labs/projects	*Assoc. Prof. Dr.Eng. Dan Leordean – dan.leordean@tcm.utcluj.ro*					
2.4 Year of study	I	2.5 Semester	II	2.6 Assessment		E
2.7 Subject category	Formative category					DA
	Optional					DO

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	-	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study of textbooks, course materials, bibliography, and lecture notes	16
(c) Additional research in the library, on specialized electronic platforms, and in the field	15
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	12
(e) Tutoring	13
(f) Other activities	0

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

4. Pre-requisites (if applicable)

4.1 Curriculum	Attending the following courses: Computer Aided Design, Fundamentals of Metal Forming, and Metal Forming Technology
4.2 Competence	Knowledge of the MS Windows operating system (basic level) and capability of using SolidWorks (average level)

5. Requirements (if applicable)

5.1. for the course	-
5.2. for the seminar/lab/project	Computers + CAD program (SolidWorks)

6. Subject-specific learning outcomes

Professional competencies	1 Uses CAD software 2 Uses CAE systems 4 Applies technical principles 5 Selects technical documentation 8 Performs analytical calculations and utilizes mathematical models 14 Inspects industrial equipment 15 Uses dedicated design software 18 Evaluates technical requirements 20 Supervises production 21 Evaluates experimental data 23 Performs quality control 26 Calculates design costs 29 Monitors manufacturing quality standards
Transversal competencies	1 Demonstrates creativity and initiative 2 Assumes responsibility 3 Applies scientific and technological knowledge 4 Manages documentation and production organization

7. Expected learning outcomes

Knowledge	C1. The student/graduate demonstrates knowledge of mathematical theories applied in engineering, the principles of Finite Element Method (FEM) modelling and Computer-Aided Design (CAD) methods. C3. The student/graduate synthesizes Total Quality Management (TQM) concepts, logistics principles for manufacturing systems, and economic calculation methods in design.
Skills	A1.1 The student/graduate is using advanced CAD software and specialized methods for the computer-aided design of molds and automotive components. A1.2 The student/graduate is using analytical mathematical calculations and implements them in CAE systems to simulate the behaviour of materials and subassemblies. A1.3 The student/graduate analyses virtual test data and interprets complex technical requirements for the topological optimization of products. A1.4 The student/graduate applies technical principles and uses virtual manufacturing to anticipate process errors and reduce time-to-market. A1.5 The student/graduate is using design software to generate the technical documentation necessary for series production. A3.1 The student/graduate performs quality control and monitors compliance with manufacturing quality standards by applying advanced statistical methods. A3.2 The student/graduate calculates design costs and estimates the budget for launching new products into manufacturing. A3.3 The student/graduate prioritizes information, objects, and logistical resources to optimize material flow within manufacturing systems. A3.4 The student/graduate controls production using performance indicators and identifies bottlenecks in the logistics chain. A3.5 The student/graduate inspects industrial equipment and proposes maintenance or replacement plans based on life-cycle analysis.

Responsibility and autonomy	R1.1 The student/graduate assumes responsibility for testing mathematical models and virtual simulations that form the basis for designing manufacturing technologies. R1.2 The student/graduate manages the iterative design process, integrating feedback from simulations. R1.3 The student/graduate demonstrates the capacity for innovation in component design, using databases and scientific libraries. R3.1 The student/graduate manages the material and financial resources of a manufacturing project. R3.2 The student/graduate performs process audits and proposes measures to ensure quality. R3.3 The student/graduate makes decisions regarding the optimization of the logistics chain to ensure timely delivery.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	• Obtaining the skills to design for competitive manufacturing
8.2 Specific objectives	• Learning new and modern methods of designing products and using software tools; • Value analysis of a product; • Redesign to reduce parts processing and product assembly costs.

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
1. Concurrent Engineering (CE) – a new strategy and method for Rapid Product Development (RPD). Comparison between the classical method for RPD and CE.	4	Discussions and examples	
2. DFMA product analysis (Design for Manufacture and Assembly). Methods and criteria for computer aided analysis of product assembly.	4		
3. Designing the structure of the products and the shape of the component parts, for robotic and automated assembly.	4		
4. How to reduce the number of components and how to optimize the symmetry of the product's components. Redesign the industrial products, in order to be more competive.	4		
5. Design the shape of the parts for turning and drilling.	4		
6. Design the shape of the parts for milling and grinding.	4		
7. Design the shape of the parts for injection moulding, investment casting, sintering, etc.	4		

Bibliography :
1. Bâlc, N., Gyenge, Cs., Berce, P., Proiectare pentru Fabricaţia Competitivă, Cluj-Napoca, Editura Alma Mater, 2006, 310 pagini;
2. Leordan Dan, Balc Nicolae," Proiectare Industrială. Aplicaţii PTC Creo Parametric", Editura Alma Mater, 2013, Cluj-Napoca, ISBN: 978-606-504-152-3;
3. Bâlc, N. Tehnologia Neconvenţionale, Cluj-Napoca, Editura Dacia, 2001, 228 pagini;
4. Marcu, V., Gyenge, Cs., Gligor, E., Bâlc, N., Proiectarea cu DFA, Editura Transilvania Press, Cluj Napoca, 1995;
5. Ivan, N.V., Berce, P., Bâlc, N., ş.a. Sisteme CAD/CAPP/CAM – Teorie şi practică, Editura Tehnică,

9.1 Course	No. of hours	Teaching methods	Notes
Bucureşti, 2004; 6. Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight, Product design for manufacture and assembly, Editura Boca Raton, FL: CRC Press, 2011.			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. Analysis of the functional requirements and design variants of an industrial product.	2		
2. Analysis of the exploded assembly drawing of the studied product. Preparation of the manual assembly chart of the analysed product.	2		
3. Estimate the assembly time and costs. DFA - Design for Assembly analysis (using the DFMA software).	2		
4. Estimate the manufacturing time and costs for the components. DFM - Design for manufacture analysis (using DFMA software).	2		
5. Redesigning the structure of the analyzed product and the shape of the components, to decrease the manufacturing and assembly costs.	2		
6. Comparative analysis between redesigned product and initial version of the same product.	2		
7. Methods and criteria to select the appropriate assembly method (manual, robotic or high-speed assembly) of the analysed product.	2		
Bibliography : 1. Bâlc, N., Gyenge, Cs., Berce, P., Proiectare pentru Fabricaţia Competitivă, Cluj-Napoca, Editura Alma Mater, 2006, 310 pagini; 2. Leordan Dan, Balc Nicolae," Proiectare Industrială. Aplicaţii PTC Creo Parametric", Editura Alma Mater, 2013, Cluj-Napoca, ISBN: 978-606-504-152-3; 3. Marcu, V., Gyenge, Cs., Gligor, E., Bâlc, N., Proiectarea cu DFA, Editura Transilvania Press, Cluj Napoca, 1995.			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

Case studies - analysis and redesign will be done using products from companies with which Manufacturing Engineering Dept. collaborates.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	The exam consists of a written paper, followed by an oral presentation. Exam topics include synthesis questions (20%), low difficulty applications	Written test – 2 theoretical subjects and 1 application	60% (20% for each subject S1, S2 andS3);

	(20%), medium difficulty applications (40%) and high difficulty applications (20%).		
11.5 Seminar/Laboratory /Project / Practical training	Evaluation individual project	Evaluation of individual project and DFMA analysis	P=40%
11.6 Minimum performance standard Final mark: N=0.20*S1+0.20*S2+0.20*S3+0.4*P. The condition of obtaining the credits: E>5			

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
10.09.2025	Course	*Prof. Eng. Nicolae BÂLC, PhD.*	
	Practical activities	*Assoc.Prof.Eng. Dan LEORDEAN, PhD.*	

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Design of experiments				Subject code	10.20
2.2 Course responsible/lecturer	*Bocăneț Vlad – vlad.bocanet@tcm.utcluj.ro*					
2.3 Teacher in charge of seminars/labs/projects	*Bocăneț Vlad – vlad.bocanet@tcm.utcluj.ro*					
2.4 Year of study	1	2.5 Semester	2	2.6 Assessment		E
2.7 Subject category	Formative category					DA
	Optional					DO

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		3.3 Practical training	
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar		3.6 Laboratory	14	3.6 Project		3.3 Practical training	

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	4
(b) Study of textbooks, course materials, bibliography, and lecture notes	20
(c) Additional research in the library, on specialized electronic platforms, and in the field	16
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(e) Tutoring	4
(f) Other activities	
3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	Knowledge of probability, mathematical statistics and data processing.
4.2 Competence	Quantitative analysis skills, familiarity with the computing environment and basic mathematical modelling.

5. Requirements (if applicable)

5.1. for the course	Classroom equipped with projection equipment.

5.2. for the seminar/lab/project	Computer lab equipped with workstations and dedicated software for statistical analysis (e.g. Minitab, R, Python, DoE modules).

6. Subject-specific learning outcomes

Professional competencies	C3. Optimizing manufacturing processes using statistical analysis algorithms to reduce process variation, cycle times and costs. C5. Modeling and simulation of processes using virtual engineering and Design of Experiments techniques to validate competitive technology flows.
Transversal competencies	CT1. Application of scientific and engineering knowledge for the rigorous interpretation of experimental data. CT3. Drafting and documenting technical reports for production decision-making.

7. Expected learning outcomes

Knowledge	The student/graduate knows the methodology of theoretical and experimental scientific research, the norms of academic ethics and the structure of scientific reports. The student/graduate knows the mathematical theories applied in engineering, the principles of finite element modeling (FEM) and the methods of assisted product design.
Skills	A4.3 The Student/Graduate analyzes the experimental data and formulates scientific conclusions, using mathematical and statistical tools. A3.1 The Student/Graduate performs quality control and monitors compliance with quality standards for manufacturing by applying advanced statistical methods. A1.2 The Student/Graduate uses analytical mathematical calculations and implements them in CAE systems to simulate the behavior of materials and subassemblies.
Responsibility and autonomy	R4.2 The Student/Graduate proves autonomy in defining research hypotheses and in choosing appropriate experimental methods. R1.1 The Student/Graduate assumes responsibility for testing the mathematical models and virtual simulations that underpin the design of manufacturing technologies.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Acquisition of Experiment Design (DoE) techniques for the analysis, development and optimization of processes and products, aiming at excellence in competitive manufacturing.
8.2 Specific objectives	Use of advanced statistical methods to minimize the number of physical/virtual attempts required to achieve optimal parameters and integrate these methods into the digital engineering flow.

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
The Role of Experiment Design (DoE) in Virtual Engineering and Competitive Manufacturing	2	Discussions following the individual study of the materials.	The materials will be available online in
Descriptive Statistics Concepts, Probability Distributions, and Hypothesis Testing	4		
Unifactorial and multifactorial dispersion analysis (ANOVA)	4		

9.1 Course	No. of hours	Teaching methods	Notes
Complete Factorial Experiments (2^k): Principles, Main Effects, and Interactions	4	Solving concrete examples and cases in the industry.	multimedia and text format.
Fractional Factorial Experiments: Screening of Essential Variables in Complex Processes	4		
Response Surface Methodology (RSM) and Mathematical Optimization Models	4		
Taguchi Methodology: Robust Process Design and Variability Reduction	4		
Experimental validation of results obtained by numerical simulations (FEA, CFD) using DoE	2		
Bibliography Juran's Quality Handbook, Seventh Ed., Joseph A. De Feo, ISBN: 9781265821654			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
Presentation of software platforms for DoE (Minitab/R/Python) and definition of project themes	2	Practical training, dialogue, project activity	
Analysis of historical manufacturing data and application of normality/hypothesis tests	2		
Development and interpretation of an ANOVA model for process capability	2		
Structuring a Fractional Factorial Experiment for a Virtual Engineering Component	2		
Conducting the experiment in the virtual environment (simulation) and collecting the answers	2		
Application of the Response Surface Methodology (MSR) to identify the optimal point	2		
Bibliography Juran's Quality Handbook, Seventh Ed., Joseph A. De Feo, ISBN: 9781265821654			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The structure and content of the discipline are based on the applied engineering needs of the technological business environment, where data-driven decision-making and numerical simulation optimization through Design of Experiments are key competencies required for the positions of manufacturing process engineer, quality expert and research and development (R&D) engineer.

11. Evaluation

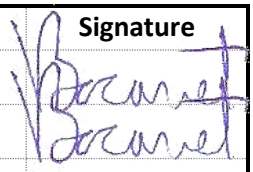
Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	Knowledge of the mathematical-statistical apparatus and of the methodology specific to the experimental designs.	Written Exam (Summative Assessment)	50%
11.5 Seminar/Laboratory /Project / Practical training	The quality of the data analysis, the relevance of the chosen	Practical project and oral defense (Continuous	50%

	model and the accuracy of the results regarding the optimization of the studied process.	evaluation)	

11.6 Minimum performance standard

The condition for entering the exam is to solve the practical applications and obtain an average of at least 5 out of 10.

The condition for passing the course is to obtain a grade of 5 in the written test.

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
15.09.2025	Course	Assoc. Prof. dr. ing. Vlad Bocăneț	
	Practical activities	Assoc. Prof. dr. ing. Vlad Bocăneț	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	English			Subject code	11.10
2.2 Course responsible/lecturer					
2.3 Teacher in charge of seminars/labs/projects	*Lect.dr. Maria Augusta Szasz, auguszta.szasz@lang.utcluj.ro*				
2.4 Year of study	I	2.5 Semester	II	2.6 Assessment	Col.
2.7 Subject category	Formative category				DC
	Optional				DO

3. Estimated total time

3.1 Number of hours per week	2	of which:	3.2 Course	-	3.3 Seminar	2	3.3 Laboratory	-	3.3 Project	-	3.3 Practical training	-
3.4 Number of hours per semester	28	of which:	3.5 Course	-	3.6 Seminar	28	3.6 Laboratory	-	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	4
(b) Study of textbooks, course materials, bibliography, and lecture notes	20
(c) Additional research in the library, on specialized electronic platforms, and in the field	26
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	22
(e) Tutoring	
(f) Other activities	
3.8 Total hours for individual study and evaluation (sum (3.7(a)…3.7(f))	72
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (if applicable)

4.1 Curriculum	
4.2 Competence	Min. B2 (according to CEFR)

5. Requirements (if applicable)

5.1. for the course	
5.2. for the seminar/lab/project	Attendance at classes, individual study and homework.

6. Subject-specific learning outcomes

Professional competencies	4 Applies technical principles 5 Selects technical documentation 6 Demonstrates technical communication skills 12 Specifies technical requirements 17 Manages engineering projects 18 Evaluates technical requirements 24 Provides project management 27 Monitors technology trends
Transversal competencies	1 Demonstrates creativity and initiative 2 Assumes responsibility 3 Applies scientific and technological knowledge

7. Expected learning outcomes

Knowledge	C5. The student/graduate understands project management principles, technical English terminology and professional communication strategies within multidisciplinary teams.
Skills	A5.1 The student/graduate manages engineering projects and ensures project management by planning stages, resources and deadlines. A5.2 The student/graduate applies technical communication skills, using the English language for documentation and international collaboration. A5.3 The student/graduate monitors global technology trends and updates their innovation methods according to market requirements. A5.4 The student/graduate demonstrates initiative in mitigating risks and resolving unexpected issues during project execution. A5.5 The student/graduate interprets technical requirements received from international partners or clients and translates them into clear work tasks.
Responsibility and autonomy	R5.1 The student/graduate coordinates project teams and assumes responsibility for achieving the objectives. R5.2 The student/graduate self-evaluates the need for continuous training and identifies professional development opportunities. R5.3 The student/graduate exhibits ethical and responsible behaviour in relationships with team members and external partners.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Students will obtain knowledge and skills to communicate in English in professional contexts (technical and engineering).
8.2 Specific objectives	At the end of the semester, students will be able to: - participate and express their opinion, evaluation and recommendations during meetings/events/activities related to their professional activity; - take notes on specialized topics in their field of specialization; - read and extract specific and general information from a wide range of technical texts; - to write short technical reports based on information extracted from different sources.

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**

9.1 Course	No. of hours	Teaching methods	Notes
Bibliography			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
Asking and answering questions in a professional meeting. Notes and formulation of text summaries.	2		
Extracting, summarizing and transmitting information extracted from specialized written texts (technical article, product specifications, brochures, product reviews, reports and proposals) in writing and orally to an experienced and non-specialist audience	6		
Expressing different degrees of certainty, evaluating situations, events and objects. Expressing the results and conditions. Providing information to support/reject an argument.	2		
Description of the steps of an industrial process, their sequences and duration	2		
Grammar of technical texts – revision – passive verbs, word formation, compound technical terms; Connectors	4		
Predicting the course of events, highlighting main trends and secondary directions or less important details. Ways of expression: necessity, obligation, recommendation on work-related topics.	4		
Preparation and writing of technical and evaluation reports	4		
Final Evaluation	4		
Bibliography 1. Biber, D & al. (2009) Longman grammar of spoken and written English, Longman. 2. Nigel A. Caplan (2012). Grammar Choicesfor Graduate and Professional Writers. Ann Arbour. 3. Marinela Grănescu, Ema Adam (2009) Effective Academic and Technical Writing, U.T.Press, Cluj-Napoca 4. Sonia C. Munteanu (2002) Academic Writing for Engineering Students, GenesisTipo, Cluj-Napoca.			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

Mastering a foreign language will support students in a more flexible integration into the labor market and improve personal development. Introduction to language for specific purposes and academic discourse will make it easier to read and write multiple documents in the field of study, make informed decisions about various types of information, and keep up to date with students' state-of-the-art professional knowledge.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course			
11.5 Seminar/Laboratory /Project / Practical training	Intermediate and final evaluations, solving homework or individual study, attendance at the seminar 80%	Evaluation during the semester Final test	50% 50%

11.6 Minimum performance standard Condition for obtaining credits: E>5 - 60% correct resolution of the subject.

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
10.09.2025			
	Seminar	Lect.dr. Maria Augusta SZASZ	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

DISZIPLINARBLATT

1. Programmdaten

1.1 Hochschuleinrichtung	Technische Universität Cluj-Napoca
1.2 Fakultät	Maschinenbau
1.3 Abteilung	Fertigungstechnik
1.4 Fachgebiet	Wirtschaftsingenieurwesen
1.5 Studienzyklus	Masterabschluss
1.6 Studiengang / Qualifikation	Procese de producție inovative și management tehnologic/ Innovative Produktionsprozesse und Technologiemanagement
1.7 Bildungsform	IF – Vollzeitbildung

2. Daten über die Disziplin

2.1 Name der Disziplin				Technisches Deutsch	Disziplinarkodex	10.00
2.2 Kursleiter				**Leutdr. Mona Tripon – *Mona.Tripon@lang.utcluj.ro***		
2.3 Inhabervon Seminar-/Labor-/Projektaktivitäten				**Leutdr. Mona Tripon – *Mona.Tripon@lang.utcluj.ro***		
2.4 Studienjahr	I	2.5 Semester	2	2.6 Art der Bewertung		C
2.7 Disziplinarregime	Bildungskategorie					DC
	Optionalität					VON

3. Gesamtgeschätzte Zeit

3.1 Anzahl der Stunden pro Woche	3	von diesem:	3.2 Verlauf	1	3.3 Seminar	2	3.3 Labor		3.3 Projekt	
3.4 Anzahl der Stunden pro Semester	100	von diesem:	3.5 Verlauf	14	3.6 Seminar	28	3.6 Labor		3.6 Projekt	

3.7 Verteilung des Zeitfonds (Stunden pro Semester) für:	
(a) Studium nach Lehrbuch, Kursmaterial, Bibliografie und Notizen	11
(b) Zusätzliche Dokumentation in der Bibliothek, auf spezialisierten elektronischen Plattformen und vor Ort	4
(c) Vorbereitung von Seminaren/Laboren, Aufgaben, Arbeiten, Portfolios und Aufsätzen	40
(d) Nachhilfe	
(e) Prüfungen	3
(f) Weitere Aktivitäten:	

3,8 Gesamtstunden des individuellen Lernens (Summe (3,7(a)... 3.7(f)))	58
3,9 Gesamtstunden pro Semester (3,4+3,8)	100
3.10 Anzahl der Credits	4

4. Vorhersagen (sofern zutreffend)

4.1 Lehrplan	
4.2 Kompetenzen	Fremdsprachen-Niveau B1 (laut CEFR)

5. Bedingungen (sofernzutreffend)

5.1. Kursentwicklung	Für das Online-Szenario muss der Schüler Zugang zu einem mit dem Internet verbundenen Gerät haben, das ein funktionierendes Mikrofon und eine Webcam bietet.

5.2. Durchführungdes Seminars / Labors / Projekts	Die Teilnahme am Seminar ist verpflichtend (vor Ort/online). Für das Online-Szenario muss der Schüler Zugang zu einem mit dem Internet verbundenen Gerät haben, das ein funktionierendes Mikrofon und eine Webcam bietet.

6. Spezifische erworbene Kompetenzen

Berufliche Fähigkeiten	
Transversale Kompetenze	CT2 Identifikation von Rollen und Verantwortlichkeiten in einem multispezialisierten Team, Entscheidungsfindung und Aufgabenverteilung mit Anwendung von Netzwerktechniken und effizienter Arbeit im Team.

7. Erwartete Lernergebnisse

Wissen	C3. Der Studierende/Absolvent synthetisiert die fortgeschrittenen Konzepte des Gesamtqualitätsmanagements, der Zuverlässigkeit und moderner Strategien zur präventiven und prädiktiven Wartung industrieller Geräte
Fähigkeiten	A3.1 Der Student/Absolvent führt die Qualitätskontrolle mit statistischen Methoden und spezifischen Werkzeugen durch, um die Einhaltung der Fertigungsstandards sicherzustellen. A3.2 Der Studierende/Graduierte überwacht Qualitätsstandards für die Fertigung und identifiziert Abweichungen in technologischen Prozessen. A3.3 Der Student/Absolvent inspiziert industrielle Anlagen, um den technischen Zustand zu diagnostizieren und dessen Ausfall zu verhindern. A3.4. Der Student/Graduierte analysiert die Daten der Qualitätstests, um Lösungen für kontinuierliche Prozessverbesserungen vorzuschlagen (Kaizen, Six Sigma). A3.5 Der Studierende/Absolvent verwendet spezielle technische Dokumentation zur Entwicklung von Wartungsplänen und Kontrollprozessen.
Verantwortung und Autonomie	R3.1 Der Student/Absolvent organisiert eigenständig die Qualitätsprüfungen und Interventionspläne an der Ausrüstung. R3.2 Der Studierende/Absolvent übernimmt die Verantwortung für Entscheidungen bezüglich der Einstellung oder Änderung nicht konformer Produktionsflüsse. R3.3 Der Studierende/Absolvent setzt verantwortungsvoll Sicherheitsnormen und ethische Standards im Betrieb industrieller Systeme um.

8. Ziele der Disziplin (zusammengefasstaus dem Raster der angesammelten spezifischen Kompetenzen)

8.1 Allgemeines Ziel der Disziplin	Entwicklung der kommunikativen Kompetenz im technischen, professionellen Kontext.
8.2 Spezifische Ziele	- Identifikation und angemessene Verwendung linguistischer Mittel, die spezifisch für technische Sprache sind - Formulierung von Meinungen, Bewertungen und Empfehlungen schriftlich oder mündlich in Fachsprache

	- Extraktion, Verarbeitung und Darstellung spezifischer und allgemeiner Informationen aus verschiedenen Texttypen im technischen Bereich - schriftliche und mündliche Ausdrucksformen über berufliche Fähigkeiten und Fertigkeiten

9. Inhalt

9.1 Verlauf	Keine Stunden.	Lehrmethoden	Beobachten Sie
Die Bedeutung des Deutschen im technischen Bereich	1		
Hervorhebung der Unterschiede zwischen allgemeiner und spezialisierter Sprache (Morphologie, Syntax, Sprache)	1		
Lexikalische Verfahren, die spezifisch für technische Sprache sind	1		
Linguistische Eingriffe in der technischen Sprache	1		
Lexikalische Strukturen, die spezifisch für technische Sprache sind	1		
Syntaktische Strukturen, die spezifisch für technische Sprache sind	1		
Verbalisierung nicht-linguistischer Elemente. Verwendung von Logos, Symbolen und Abkürzungen	1		
Analoge/digitale Sprache. Beschreibung der Bilder	1		
Die Struktur des spezialisierten Textes. Zusammenfassung. Identifizierung von Haupt- und Sekundärthemen	1		
Definition, Klassifikation und Bewertung in Fachsprache	1		
Ausarbeitung eines spezialisierten Textes	1		
Elemente der Interkulturalität im Berufsfeld	1		
Möglichkeiten in der technischen Hochschulbildung in Deutschland. Bachelor- und postgraduale Ausbildungsprogramme in der Europäischen Union	1		
Abschlussbewertung (Präsentationen)	1		

Bibliographie

1. Fearns, A./Buhlmann R.: Technisches Deutsch für Ausbildung und Beruf. Lehr- und Arbeitsbuch. Verlag Europa-Lehrmittel, 2013.
2. Steinmetz, M./Dintera, H.: Deutsch für Ingenieure. Ein DaF – Lehrwerk für Studierende ingenieurwissenschaftlicher Fächer. Springer View, 2018.
3. Tripon, Mona: Faszination Technik. Sprachtrainer Deutsch für Studenten technischer Universitäten. Napoca Star Verlag, Cluj-Napoca, 2012.

9.2 Seminar / Labor / Projekt	Keine Stunden.	Lehrmethoden	Beobachtungen
Grundlagen der Materialwissenschaft und Fertigungstechnik	2		
Merkmale der technischen Sprache (Präzision, Genauigkeit, Objektivität, Neutralität, logische Kohärenz)	2		
Bildung technischer Begriffe durch Komposition, Herleitung, Umwandlung.	2		
Neue Wörter mit lexikalischen Lehnwörtern bilden.	2		

Neologismen und Anglizismen im deutschen Fachvokabular			
Verbale und nominale Strukturen, die spezifisch für die Fachsprache sind	2		
Syntaktische Beziehungen konzentrierten sich auf den Prozess. Er drückt die Beziehungen von Kausalität, Widrigkeit, zeitlicher und modaler Beziehung aus. Unpersönliche Ausdrucksformen	2		
Ausdruck mathematischer Gleichungen, chemischer Formeln, geometrischer Formen, Maßeinheiten.	2		
Ausdruck von Symbolen und Figuren. Diagramme interpretieren. Bild/Konzept-Verhältnis	2		
Strukturierung der Informationen im Absatz. Allgemein-spezifische Beziehung.	2		
Verständnis und Formulierung von Definitionen Begriffe von der Gemeinsprache in eine spezialisierte Sprache zu wechseln und umgekehrt.	2		
Ausarbeitung von Formen, informativen Texten, Grafiken	2		
Gemeinsame Strukturen in der deutschen Berufssprache.	2		
Die Schlüsselelemente einer Präsentation. Organisation und Präsentation des Materials.	2		
Präsentationen	2		

Bibliographie

1. Fearns, A./Buhlmann R.: Technisches Deutsch für Ausbildung und Beruf. Lehr- und Arbeitsbuch. Verlag Europa-Lehrmittel, 2013.
2. Murdcheva, S./Mandcheva, K.: Allgemeiner Maschinenbau für die Hochschule, Level B1-B2, https://idial4p-center.eu/ro/module/viewdownload/31-maschinenbau1/79-daf-allgemeiner-maschinenbau-fuer-die-hochschule
3. Steinmetz, M./Dintera, H.: Deutsch für Ingenieure. Ein DaF – Lehrwerk für Studierende ingenieurwissenschaftlicher Fächer. Springer View, 2018.
4. Tripon, Mona: Faszination Technik. Sprachtrainer Deutsch für Studenten technischer Universitäten. Napoca Star Verlag, Cluj-Napoca, 2012.

10. Bestätigungder Inhalte der Disziplin mit den Erwartungen der Vertreter der epistemischen Gemeinschaft, Berufsverbände und Arbeitgebervertreter im Programmbezogenen Bereich

Verbesserung der Fähigkeit, spezialisierte Fachsprache zu verstehen und zu kommunizieren. Förderung des Zugangs zu kontinuierlicher beruflicher Weiterbildung. Steigerung des Beschäftigungspotenzials in deutschsprachigen Unternehmen.

11. Bewertung

Art der Tätigkeit	11.1 Bewertungskriterien	11.2 Bewertungsmethoden	11.3 Gewichtung der Endnote
11.4 Verlauf	Die Fähigkeit, Inhalte zu spezialisierten technischen Themen	Mündliche Bewertung (Präsentation) +	Individuelles Studienportfolio –

	zu erkennen, zu verstehen und weiterzuentwickeln.	individuelles Lernportfolio	50%
11.5 Seminar/Labor/Projekt	Fähigkeit, fachkundige technische Informationen in Ihrem gewählten Fachgebiet zu präsentieren.	(Die Bewertung erfolgt vor Ort/online, abhängig davon, wie der Kurs durchgeführt wird). Für Bewertungen in Online-Kursen ist die Audio- und Videopräsenz der Studierenden verpflichtend.	Präsentationen – 50%
11.6 Mindestleistungsstandard Mindestleistungsstandard: Die Endnote wird berechnet, wenn jede Komponente der Abschlussbewertung Löst sich korrekt in einem Verhältnis von mindestens 60 %.			

Fertigstellungsdatum:	**Titelverteidiger**	**Titel Vorname NACHNAME**	**Signatur**
23.06.2026	Verlauf	Lektor Dr. Tripon Mona	
	Anwendungen		

Die Meinung des Direktors der Abteilung, die die Disziplin koordiniert, gilt nur, wenn sie sich von der Abteilung unterscheidet, die das Studienprogramm organisiert	Direktor der LMA-Abteilung Assoc. Prof. Dr. Ruxanda Literat

Datum der Genehmigung im Rat der IF-Abteilung 23.06.2026	Direktor der IF-Abteilung Conf.dr.ing. Glad Contiu
Datum der Genehmigung im IIRMP Fakultätsrat 23 .06.2026	Dean Prof. dr.ing. Stelian Brad

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Innovative Manufacturing for Product Development				Subject code	13.00
2.2 Course responsible/lecturer	*Prof.dr.eng. Nicolae Bâlc – nicolae.balc@tcm.utcluj.ro*					
2.3 Teacher in charge of seminars/labs/projects	*Lect.dr.ing. Cosmin Cosma – cosmin.cosma@tcm.utcluj.ro*					
2.4 Year of study	II	2.5 Semester	I	2.6 Assessment		E
2.7 Subject category	Formative category					DS
	Optional					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	-	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study of textbooks, course materials, bibliography, and lecture notes	16
(c) Additional research in the library, on specialized electronic platforms, and in the field	15
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	12
(e) Tutoring	13
(f) Other activities	0
3.8 Total hours for individual study and evaluation (sum (3.7(a)…3.7(f))	100
3.9 Total hours per semester (3.4+3.8)	58
3.10 Number of credit points	4

4. Pre-requisites (if applicable)

4.1 Curriculum	
4.2 Competence	Disciplines: Physics, Chemistry, Materials science and engineering, Industrial Engineering Basics, Quality Engineering and management, Manufacturing Engineering, Non-conventional Technologies.

5. Requirements (if applicable)

5.1. for the course	Course room, equipped with video projector
5.2. for the seminar/lab/project	Laboratories equipped with 3D printing machines, selective laser melting/sintering, water jet cutting, silicone rubber molds, investment casting, etc.

6. Subject-specific learning outcomes

Professional competencies	3 Analyses production process feasibility 9 Reviews engineering principles 11 Manufactures prototypes for functional testing 12 Specifies technical requirements 16 Designs prototypes 19 Optimizes production processes 25 Operates high-performance measurement equipment 28 Designs automation components
Transversal competencies	1 Demonstrates creativity and initiative 2 Assumes responsibility 3 Applies scientific and technological knowledge 4 Manages documentation and production organization

7. Expected learning outcomes

Knowledge	C2. The student/graduate has knowledge of innovative manufacturing technologies, rapid prototyping workflows, and the specifics of producing components and sub-assemblies.
Skills	A2.1 The student/graduate manufactures prototypes using rapid prototyping technologies necessary for the functional and aesthetic verification of new products. A2.2 The student/graduate designs automation components and configures manufacturing equipment specific to automotive subassemblies. A2.3 The student/graduate analyses the feasibility of the production process, the precision of manufacturing systems and technological constraints. A2.4 The student/graduate operates precision measurement equipment to evaluate the compliance of parts with required tolerances. A2.5 The student/graduate analyses production processes to improve efficiency, reduce waste and increase competitiveness.
Responsibility and autonomy	R2.1 The student/graduate makes decisions regarding the design of optimal manufacturing technology. R2.2 The student/graduate coordinates the stages of prototype manufacturing and their integration into the manufacturing flow. R2.3 The student/graduate assumes responsibility for compliance with technical standards in the design of industrial equipment and manufacturing technologies.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	• Obtaining the skills to use innovative technologies, for rapid development of new products
8.2 Specific objectives	• Learning innovative manufacturing technologies through 3D printing and their performance;

	• Analysis of practical solutions, through which innovative technologies can be used efficiently in the rapid development of new products; • Evaluating the possibilities of reducing the time and costs of rapid development of new products.

9. Contents

9.1 Course	No. of hours	Teaching methods	Notes
1. Innovative Manufacturing methods for rapid development of new products (RPD - Rapid Product Development). CAD - CAM - 3DP - Transfer of virtual CAD models to AM equipment.	4	Discussions and examples	
2. Innovative manufacturing of complex metal parts, by selective laser melting. SLM - Selective Laser Melting: working principle and technological parameters. Innovative manufacturing by selective laser sintering. SLS - Selective Laser Sintering: working principle and technological parameters.	4		
3. Innovative manufacturing methods for complex steel parts, in small series: EBM (Electron Beam Melting - Arcam), EOS and Concept Laser. Comparison between SLS-SinterStation method for rapid manufacturing of steel parts and EOS direct sintering method - DMLS (Direct Metal Laser Sintering).	4		
4. Comparison between the SLS-Sinterstation method and conventional method of manufacturing sintered parts (Sinterom SA from Cluj-N), for obtaining sintered steel parts. Innovative manufacturing of plastic parts, using rapid prototyping technologies: SLS (from Duraform PA), fused deposition modelling (FDM) and stereolithography (SLA).	4		
5. Innovative manufacture of plastic parts in small series production, using vacuum casting in silicone rubber moulds. Rapid casting of metal parts, in small series production (Investment Casting).	4		
6. Innovative manufacturing using EDM - electrical discharge machining. EDM applications. Innovative manufacturing by water jet cutting (WJC) and milling (WJM).	4		
7. How to choose the appropriate innovative manufacturing method, to be efficient for a specific application, depending on material type, shape complexity, manufacturing series, etc. Medical applications of the 3D printing technologies.	4		

Bibliography :

1. Nicolae Balc, Dan Leordean, Editors: “Research and Applications in Manufacturing Engineering”, MATEC Web of Conferences – EDP Sciences, France, Volume 299, 2019, ISBN- ISBN: 978-2-7598 9083-5, https://www.matecconferences.org/articles/matecconf/abs/2019/48/contents/contents.html
2. Nicolae Balc, Editor: “Modern Technologies in Manufacturing”, MATEC Web of Conferences – EDP Sciences, France, Volume 137, 2017, ISBN- ISBN: 978-2-7598-9083-5, https://www.matec conferences.org/articles/matecconf/abs/2017/51/contents/contents.html
3. Nicolae Balc, Editor: “Modern Technologies in Manufacturing”, Trans Tech Publications - Applied Mechanics and Materials, Switzerland, Vol. 808, 394 pagini, 2015, ISBN-13: 978-3-03835-653-0, http://www.scientific.net/AMM.808/book;
4. Petru Berce, Nicolae Balc, ş.a., “Aplicatiile medicale ale tehnologiilor de fabricatie prin adaugare de

9.1 Course	No. of hours	Teaching methods	Notes
material", Editura Academiei Române, Bucuresti, 2015; 5. Berce, P., Bâlc, N., ş.a. "Tehnologii de fabricaţie prin adaugare de material şi aplicaţiile lor", Editura Academiei Romane, Bucureşti, 2014, (387 pag.), ISBN 978-973-27-2396-8; 6. Bâlc, N., Berce, P., Editors, „Actualităţi şi Perspective ale Cercetării Universitare în Inginerie Industrială", Editura Alma Mater, 2010, Cluj-Napoca, 89 pages, ISBN 978-606-504-104-22010.			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. Innovative manufacturing of plastic parts made by 3D printing	2		
2. Innovative manufacturing of metal parts made by SLM / SLS.	2		
3. Vacuum casting (VC), using silicone rubber molds.	2		
4. Investment casting (IC) of metal parts, in small series production.	2		
5. Innovative manufacturing by EDM and EDM wire cutting.	2		
6. Innovative manufacturing by water jet cutting (WJC) and water jet milling (WJM).	2		
7. Innovative manufacturing of customized medical implants.	2		
Bibliography : 1. Nicolae Balc, Dan Leordean, Editors: "Research and Applications in Manufacturing Engineering", MATEC Web of Conferences – EDP Sciences, France, Volume 299, 2019, ISBN- ISBN: 978-2-7598 9083-5, https://www.matec conferences.org/articles/matecconf/abs/2019/48/contents/contents.html 2. Nicolae Balc, Editor: "Modern Technologies in Manufacturing", MATEC Web of Conferences – EDP Sciences, France, Volume 137, 2017, ISBN- ISBN: 978-2-7598-9083-5, https://www.matec conferences.org/articles/matecconf/abs/2017/51/contents/contents.html 3. Nicolae Balc, Alina Popan, ş.a. "Tehnologii Neconventionale - Lucrări practice de laborator", ISBN 978-606-504-202-5, Editura Alma Mater, Cluj-Napoca, 2016; 4. Nicolae Balc, Editor: "Modern Technologies in Manufacturing", Trans Tech Publications - Applied Mechanics and Materials, Switzerland, Vol. 808, 394 pagini, 2015, ISBN-13: 978-3-03835-653-0, http://www.scientific.net/AMM.808/book; 5. Petru Berce, Nicolae Balc, ş.a., "Aplicatiile medicale ale tehnologiilor de fabricatie prin adaugare de material", Editura Academiei Române, Bucuresti, 2015; 6. Berce, P., Bâlc, N., ş.a. "Tehnologii de fabricaţie prin adaugare de material şi aplicaţiile lor", Editura Academiei Romane, Bucureşti, 2014, (387 pag.), ISBN 978-973-27-2396-8; 7. Bâlc, N., Berce, P., Editors, „Actualităţi şi Perspective ale Cercetării Universitare în Inginerie Industrială", Editura Alma Mater, 2010, Cluj-Napoca, 89 pages, ISBN 978-606-504-104-22010.			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The case studies, regarding the specific solutions for using the innovative manufacturing technologies, will be applied for products from the companies with which the Manufacturing Engineering Dept. collaborates.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	The exam consists of a written paper, followed by an oral presentation. Exam topics include synthesis questions (20%), low difficulty applications (20%), medium difficulty applications (40%) and high difficulty applications (20%).	Written test – 2 theoretical subjects and 1 application	60% (20% for each subject S1, S2 andS3);
11.5 Seminar/Laboratory /Project / Practical training	Evaluation of case studies from laboratory work.	Evaluation of individual case studies.	L=40%
11.6 Minimum performance standard Final mark: N=0.20*S1+0.20*S2+0.20*S3+0.4*P. The condition of obtaining the credits: E>5			

Completion date:	Faculty members	academic rank, title, First Name SURNAME	Signature
10.09.2025	Course	*Prof.dr.eng. Nicolae BÂLC*	
	Practical activities	*Lect.dr.eng. Cosmin COSMA*	

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Manufacturing technologies for car components			Subject code	14.00
2.2 Course responsible/lecturer	*Assoc. Prof. Ph.D. Eng. Alexandru Cărean; alexandru.carean@tcm.utcluj.ro*				
2.3 Teacher in charge of seminars/labs/projects	*Assoc. Prof. Ph.D. Eng. Ioan Alexandru Popan; ioan.popan@tcm.utcluj.ro*				
2.4 Year of study	II	2.5 Semester	1st	2.6 Assessment	Exam
2.7 Subject category	Formative category				DA
	Optional				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	-	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study of textbooks, course materials, bibliography, and lecture notes	36
(c) Additional research in the library, on specialized electronic platforms, and in the field	6
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
(e) Tutoring	2
(f) Other activities	
3.8 Total hours for individual study and evaluation (sum (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 (if applicable)

4.1 Curriculum	Cutting processing technologies, Cutting tools, CNC Programming.
4.2 Competence	

5. Requirements (if applicable)

5.1. for the course	Video projector, screen and board.
5.2. for the seminar/lab/project	CNC equipment in the laboratory.

6. Subject-specific learning outcomes

Professional competencies	Identifying the design methods of the product structure and the shape of the component parts, in order to reduce the manufacturing and assembly costs in the automotive industry. Use of specialized knowledge for the design of manufacturing systems specific to the automotive Industry. Evaluation and establishment of optimal design options for manufacturing systems, logistics and management of automotive component manufacturing processes . Use of modern computer aided manufacturing equipment for industrial applications.
Transversal competencies	CT1. Responsible execution of complex tasks regarding the use of computing technology in interdisciplinary virtual manufacturing projects, in conditions of autonomy and independence, respecting professional ethics CT3. Lifelong learning for professional career development, self-adaptation to the requirements of the international labor market, as a result of the globalization of the world economy. Ability to communicate effectively in English as well

7. Expected learning outcomes

Knowledge	C2. The student/graduate has knowledge of innovative manufacturing technologies, rapid prototyping workflows, and the specifics of producing components and sub-assemblies.
Skills	A2.1 The student/graduate manufactures prototypes using rapid prototyping technologies necessary for the functional and aesthetic verification of new products. A2.2 The student/graduate designs automation components and configures manufacturing equipment specific to automotive subassemblies. A2.3 The student/graduate analyses the feasibility of the production process, the precision of manufacturing systems and technological constraints. A2.4 The student/graduate operates precision measurement equipment to evaluate the compliance of parts with required tolerances. A2.5 The student/graduate analyses production processes to improve efficiency, reduce waste and increase competitiveness.
Responsibility and autonomy	R2.1 The student/graduate makes decisions regarding the design of optimal manufacturing technology. R2.2 The student/graduate coordinates the stages of prototype manufacturing and their integration into the manufacturing flow. R2.3 The student/graduate assumes responsibility for compliance with technical standards in the design of industrial equipment and manufacturing technologies.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Development of skills in the field of CNC manufacturing technologies for automotive components
8.2 Specific objectives	Assimilation of theoretical knowledge and specific manufacturing features of automotive components. Knowledge of CNC programming techniques in the case of manufacturing technologies on milling and turning machines. Assimilation of the necessary knowledge regarding the compensation of tool wear in order to maintain the precision of machining parts. Development of skills regarding the optimization of automotive component manufacturing technologies.

9. Contents

9.1 Course	No. of hours	Teaching methods	Notes
1. The assemblies, subassemblies and basic functions of a car. Description and operation.	2	Presentation and discussions; Video projector and board.	
2. The basic components of a car and the functional role.	2		
3. The characteristics of the technological manufacturing system in the automotive industry. The architecture of CNC machine tools specific to the automotive field.	2		
4. Specific aspects regarding the CNC manufacturing of automotive components.	2		
5. CNC programming and CNC operation on milling and turning machines.	2		
6. Compensation for tool wear during machining and turning in mass production of automotive components.	2		
7. Advanced CNC programming functions. CNC subprograms, milling cycles, turning cycles and drilling cycles.	2		
8. Development of CNC programs using advanced programming functions of CNC equipment. Parametric programming.	2		
9. Designing the manufacturing process of the Formula 1 racing car. The process of manual manufacturing, CNC manufacturing and assembly.	2		
10. Elaboration of the CNC program for the manufacture of the Front Wheel 1 from the Formula 1 racing car.	2		
11. Elaboration of the CNC program for the manufacture of the Front Wheel 2 from the Formula 1 racing car.	2		
12. CNC manufacturing of gearbox shafts.	2		
13. CNC manufacturing of gearbox gears.	2		
14. CNC manufacturing of the engine block.	2		

Basic Bibliography

1. Cărean, A., Popan, A. – Programarea și operarea centrelor de prelucrare CNC, Editura U.T. Press, Cluj-Napoca, 2015.
2. Cărean, A. – Tehnologii de prelucrare cu CNC, Editura Dacia, Cluj-Napoca, 2002.
3. Smid, P. – CNC Programming Handbook, Industrial Press, ediția actualizată.
4. Machining and CNC Technology, Cengage Learning.
5. Computer Numerical Control: Operation and Programming, Pearson.

Bibliography for Automotive Components Manufacturing

1. Automotive Manufacturing Systems and Processes, Springer.
2. Automotive Technology: Principles, Diagnosis and Service, Pearson.
3. Manufacturing Engineering and Technology și Steven R. Schmid, Pearson.
4. Fundamentals of Modern Manufacturing, Wiley.
5. Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson.
6. References for Advanced CNC Technologies and Industry 4.0
7. CNC Control Setup for Milling and Turning, Industrial Press.
8. Smart Manufacturing, Elsevier.
9. Industry 4.0: Managing the Digital Transformation, Apress.
10. Digital Manufacturing, McGraw-Hill.
11. Industrial Manuals and Technical Documentation

9.1 Course	No. of hours	Teaching methods	Notes
12. HAAS Automation – Operator's Manuals 13. FANUC CNC Manual Library 14. Sandvik Coromant – Metal Cutting Knowledge 15. Kennametal Engineering Resources 16. Seco Tools – Technical Guides			

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. Evaluation of safety measures specific to CNC operation on milling and turning machines.	2	Operation of the HAAS simulator for milling and turning; CNC machine setting and parts processing.	Interactive discussions.
2. Basic CNC programming and operation on HAAS simulators for milling and turning	2		
3. Setting and CNC operation of the HAAS VF-2SS milling machine. Tool wear compensation.	2		
4.Setting and CNC operation of the CNC lathe LYNX 220 FANUC Oi-TB. Tool wear compensation.	2		
5. Front Wheel 2 processing (Operation 1) on the HAAS VF 2SS milling machine.	2		
6. Front Wheel 2 processing (Operation 2) on the HAAS VF 2SS milling machine.	2		
7. Machining of the Front Wheel 2 (Operation 1) on the LYNX 220 FANUC Oi-TB CNC lathe.	2		
Bibliography 1. Cărean, A., Popan, A. – *Programarea și operarea centrelor de prelucrare CNC*, Editura U.T. Press, Cluj-Napoca, 2015. 2. Cărean, A. – *Fabricație pe echipamente CNC. Suport de curs pentru studii de master*, UTCN, 2020. 3. CNC Programming Handbook, Industrial Press, New York. 4. HAAS Machining Center Operator's Manual. 5. Doosan Lynx CNC Lathe Programming and Operation Manual. 6. FANUC Control System Technical Documentation for CNC Programming, Setup, and Tool Wear Compensation.			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The professional skills acquired in the discipline are in line with the expectations of employers in the field of automotive component manufacturing technologies.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	Level of knowledge of CNC programming techniques of milling and turning machine	Written test with automatic and manual evaluation (C)	80%

11.5 Seminar/Laboratory /Project / Practical training	Solving laboratory applications for each work performed	Verification of laboratory work (L)	20%
11.6 Minimum performance standard: N=C+L The examination is considered allowed only if each of the two components is met:: N≥5; C≥5; L≥5			

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
10.09.2025	Course	Assoc. Prof. Ph.D. Eng. Alexandru Cărean	
	Practical activities	*Assoc. Prof. Ph.D. Eng. Ioan Alexandru Popan*	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... academic rank, title, First Name SURNAME

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc. Prof. Ph.D. Eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof. Ph.D. Eng. Ph.D. ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Computer Aided Design of Forming Tools			Subject code	15.00
2.2 Course responsible/lecturer	*Assoc. Prof. Dr.Eng. Vasile CECLAN – vasile.ceclan@tcm.utcluj.ro*				
2.3 Teacher in charge of seminars/labs/projects	*Assoc. Prof. Dr.Eng. Vasile CECLAN – vasile.ceclan@tcm.utcluj.ro*				
2.4 Year of study	II	2.5 Semester	!	2.6 Assessment	E
2.7 Subject category	Formative category				DA
	Optional				DI

3. Estimated total time

3.1 Number of hours per week	3	of which:	3.2 Course	1	3.3 Seminar	-	3.3 Laboratory	-	3.3 Project	2	3.3 Practical training	-
3.4 Number of hours per semester	42	of which:	3.5 Course	14	3.6 Seminar	-	3.6 Laboratory	-	3.6 Project	28	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study of textbooks, course materials, bibliography, and lecture notes	14
(c) Additional research in the library, on specialized electronic platforms, and in the field	28
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(e) Tutoring	-
(f) Other activities	-
3.8 Total hours for individual study and evaluation (sum (3.7(a)…3.7(f))	100
3.9 Total hours per semester (3.4+3.8)	58
3.10 Number of credit points	4

4. Pre-requisites (if applicable)

4.1 Curriculum	Attending the following courses: Computer Aided Design, Fundamentals of Metal Forming, and Metal Forming Technology
4.2 Competence	Knowledge of the MS Windows operating system (basic level) and capability of using SolidWorks (average level)

5. Requirements (if applicable)

5.1. for the course	-
5.2. for the seminar/lab/project	Computers + CAD program (SolidWorks)

6. Subject-specific learning outcomes

Professional competencies	1 Uses CAD software 2 Uses CAE systems 4 Applies technical principles 5 Selects technical documentation 8 Performs analytical calculations and utilizes mathematical models 15 Uses dedicated design software 18 Evaluates technical requirements 21 Evaluates experimental data
Transversal competencies	1 Demonstrates creativity and initiative 2 Assumes responsibility 3 Applies scientific and technological knowledge 4 Manages documentation and production organization

7. Expected learning outcomes

Knowledge	C1. The student/graduate demonstrates knowledge of mathematical theories applied in engineering, the principles of Finite Element Method (FEM) modelling and Computer-Aided Design (CAD) methods.
Skills	A1.1 The student/graduate is using advanced CAD software and specialized methods for the computer-aided design of molds and automotive components. A1.2 The student/graduate is using analytical mathematical calculations and implements them in CAE systems to simulate the behaviour of materials and subassemblies. A1.3 The student/graduate analyses virtual test data and interprets complex technical requirements for the topological optimization of products. A1.4 The student/graduate applies technical principles and uses virtual manufacturing to anticipate process errors and reduce time-to-market. A1.5 The student/graduate is using design software to generate the technical documentation necessary for series production.
Responsibility and autonomy	R1.1 The student/graduate assumes responsibility for testing mathematical models and virtual simulations that form the basis for designing manufacturing technologies. R1.2 The student/graduate manages the iterative design process, integrating feedback from simulations. R1.3 The student/graduate demonstrates the capacity for innovation in component design, using databases and scientific libraries.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	• Development of capabilities useful in the field of computer aided design of metal forming tools (knowledge of the methodology used for designing metal forming tools; efficient utilization of a CAD program)

8.2 Specific objectives	• Acquiring a sound knowledge of the methodology used for designing metal forming tools • Understanding the strategy of designing in the assembly context • Efficient utilization of a CAD program.

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
1. Methodology used for designing cold metal forming tools. Part I: Technological analysis of the finished product; establishing the type and sequence of forming procedures	2	Discussions and examples	
2. Methodology used for designing cold metal forming tools. Part II: Principles of grouping the blanking/forming procedures; elaboration of the strip layout	2		
3. Computer aided design of cold metal forming tools. Part I: 3D modelling of the strip layout; designing the forming tool in the assembly context	2		
4. Computer aided design of cold metal forming tools. Part II: Using the parametric modelling facilities provided by modern CAD programs	2		
5. Computer aided design of a progressive die for blanking and piercing (case study). Part I: Technological analysis of the finished product; establishing the type and sequence of blanking/piercing procedures	2		
6. Computer aided design of a progressive die for blanking and piercing (case study). Part II: Grouping the blanking/piercing procedures in the die posts; elaboration of the strip layout; technological calculations	2		
7. Computer aided design of a progressive die for blanking and piercing (case study). Part III: Analysis of the die design	2		

Bibliography :

[1] Ciocârdia, C., Drăgănescu, Fl., Sindilă, Gh., Carp-Ciocârdia, Cr., Pîrvu, C. Tehnologia presării la rece. București: Editura Didactică și Pedagogică, 1991.
[2] Paquin, J.R., Crowley, R.E. Die Design Fundamentals. New York: Industrial Press, 1987.
[3] Romanovski, V.P. Ștanțarea și matrițarea la rece. București: Editura Tehnică, 1970.
[4] Rosinger, Șt. Procese și scule de presare la rece. Culegere de date pentru proiectare. Timișoara: Editura
Facla, 1987.
[5] Smith, D.A. (ed.) Die Design Handbook. Dearborn: Society of Manufacturing Engineers, 1990.
[6] Tăpălagă, I., Achimaș, Gh., Iancău, H. Tehnologia presării la rece, vol. I. Cluj-Napoca: Litografia Institutului Politehnic, 1980.
[7] Teodorescu, M., Ciocârdia, C., Zgură, Gh., Nicoară, D., Țâru, E., Roșca, A., Ciocan, O. Prelucrări prin deformare plastică la rece. Proiectarea tehnologiilor și echipamentelor de prelucrare prin deformare plastică la rece, vol. II. București: Editura Tehnică, 1988.
[8] Teodorescu, M., Zgură, Gh., Drăgănescu, Fl., Nicoară, D., Trandafir, M., Sindilă, Gh. Elemente de proiectare a ștanțelor și matrițelor. București: Editura Didactică și Pedagogică, 1983.

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. Computer aided design of a progressive die for blanking and piercing. Part I: Technological analysis of the finished product; establishing the type and sequence of blanking/piercing procedures	2		
2. Computer aided design of a progressive die for blanking and piercing. Part II: Grouping the blanking/piercing procedures in the die posts; elaboration of the strip layout	2		
3. Computer aided design of a progressive die for blanking and piercing. Part III: Technological calculations	6		
4. Computer aided design of a progressive die for blanking and piercing. Part IV: 3D modelling of the strip layout	4		
5. Computer aided design of a progressive die for blanking and piercing. Part V: Designing the lower components of the die	8		
6. Computer aided design of a progressive die for blanking and piercing. Part VI: Designing the upper components of the die	6		

Bibliography :

[1] Ciocârdia, C., Drăgănescu, Fl., Sindilă, Gh., Carp-Ciocârdia, Cr., Pîrvu, C. Tehnologia presării la rece. București: Editura Didactică și Pedagogică, 1991.
[2] Paquin, J.R., Crowley, R.E. Die Design Fundamentals. New York: Industrial Press, 1987.
[3] Romanovski, V.P. Ștanțarea și matrițarea la rece. București: Editura Tehnică, 1970.
[4] Rosinger, Șt. Procese și scule de presare la rece. Culegere de date pentru proiectare. Timișoara: Editura
Facla, 1987.
[5] Smith, D.A. (ed.) Die Design Handbook. Dearborn: Society of Manufacturing Engineers, 1990.
[6] Tăpălagă, I., Achimaș, Gh., Iancău, H. Tehnologia presării la rece, vol. I. Cluj-Napoca: Litografia Institutului Politehnic, 1980.
[7] Teodorescu, M., Ciocârdia, C., Zgură, Gh., Nicoară, D., Țâru, E., Roșca, A., Ciocan, O. Prelucrări prin deformare plastică la rece. Proiectarea tehnologiilor și echipamentelor de prelucrare prin deformare plastică la rece, vol. II. București: Editura Tehnică, 1988.
[8] Teodorescu, M., Zgură, Gh., Drăgănescu, Fl., Nicoară, D., Trandafir, M., Sindilă, Gh. Elemente de proiectare a ștanțelor și matrițelor. București: Editura Didactică și Pedagogică, 1983.

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The acquired knowledge will allow the students to use modern methods and computer programs for the design of metal forming tools.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	Presentation of a theoretical topic	Assignment report	50 %
11.5 Seminar/Laboratory /Project / Practical training	Computer aided design of a progressive die for	Assessing the die design	50 %

	blanking and piercing		

11.6 Minimum performance standard
Mark 5 (five) in both parts of the evaluation (course and applications)

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
10.09.2025	Course	*Assoc. Prof. Dr.Eng. Vasile CECLAN*	
	Practical activities	*Assoc. Prof. Dr.Eng. Vasile CECLAN*	

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE DESCRIPTION

1. Programme details

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Level of study	Master
1.6 Study programme / Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Mode of study	IF – full time attendance

2. Course details

2.1 Course title	Equipment for the manufacture, adjustment and control of automotive sub-assemblies			Course code	16.00
2.2 Course lecturer	*Assoc. Prof. Dr. Eng. Panc Nicolae – nicolae.panc@tcm.utcluj.ro*				
2.3 Laboratory coordinator	*Assoc. Prof. Dr. Eng. Moldovan Cătălin – catalin.moldovan@tcm.utcluj.ro*				
2.4 Year of study	2	2.5 Semester	1	2.6 Type of assessment	E
2.7 Course structure	Formative				DS
	Optional				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	3.3 Practical	0
3.4 Number of hours per semester	42	of which:	3.5 Lectures	28	3.6 Seminar	0	3.6 Laboratory	14	3.6 Project	0	3.3 Practical	0

3.7 Allocation of time (hours per semester) for self-study and assessment:	
(a) Assessment	2
(b) Study using the textbook, course materials, bibliography and notes	10
(c) Additional research in the library, on specialist online platforms and in the field	20
(d) Preparation for seminars/laboratories, assignments, presentations, portfolios and essays	20
(e) Tutoring	2
(f) Other activities	4

3.8 Total hours of independent study and assessment (sum of (3.7(a)…3.7(f))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credits	4

4. Prerequisites (where applicable)

4.1 Curriculum	Not applicable
4.2 Skills	Not applicable

5. Conditions (where applicable)

5.1. Course delivery	Availability of logistical support for lectures (projector, whiteboard)
5.2. for conducting the laboratory	Access to computers (desktop systems, laptops)

6. Specific skills acquired

Professional skills	11 Prepares prototypes for production 12 Defines technical requirements 13 Consults technical resources 14 Inspects industrial equipment 15 Uses specialised design software 17 Manage engineering projects 19 Analyses production processes with a view to improvement 20 Oversee production 27 Monitors technology trends 28 Designs automation components
Transversal skills	1 Shows initiative 2 Takes responsibility 3 Applies scientific, technological and engineering knowledge 4 Organises information, objects and resources 5 Uses equipment, tools or technological devices accurately

7. Expected learning outcomes

Knowledge	C2. The student/graduate understands innovative manufacturing technologies, rapid prototyping processes and the specifics of component and sub-assembly production.
Skills	A2.2 The student/graduate designs automation components and configures manufacturing and adjustment equipment specific to automotive sub-assemblies. A2.3 The student/graduate determines the feasibility of the production process by analysing resources, the precision of manufacturing systems and technological constraints. A2.4 The student/graduate operates precision measuring equipment to inspect the conformity of parts with the required tolerances. A2.5 The student/graduate analyses production processes with a view to improving efficiency, reducing waste and increasing market competitiveness.
Responsibility and autonomy	R2.1 The student/graduate makes strategic decisions regarding the selection of the optimal manufacturing technology for a given project. R2.3 The student/graduate takes responsibility for compliance with technical standards when operating complex industrial equipment.

8. Course objectives (based on the grid of specific competences acquired)

8.1 General objective of the course	To develop theoretical and practical competences regarding the design, use and optimisation of manufacturing, adjustment and control equipment specific to the automotive industry.
8.2 Specific objectives	1. The design and optimisation of manufacturing equipment for automotive sub-assemblies through material redistribution, removal and deposition, adapted to precision and efficiency requirements. 2. Integration and use of industrial robots in manufacturing and assembly processes, with a focus on human-machine collaboration and workflow optimisation. 3. Automation of production lines using pneumatic and e , numerical control systems and integrated automation, to

	increase productivity and reduce errors. 4. Quality and precision control in the manufacturing process, using advanced measurement equipment and automatic adjustment techniques to ensure compliance with automotive industry standards. 5. Adjustment and calibration of sub-assemblies to ensure optimal functionality, using manual and automatic adjustment methods, including dynamic balancing of moving parts. 6. Design and implementation of tooling and end-effectors for gripping, assembly and inspection operations, ensuring compatibility and performance in manufacturing processes. 7. Integrating sustainability and digitalisation concepts into the design and operation of equipment and production lines, in line with current trends in the automotive industry (Industry 4.0/5.0).

9. Course Content

9.1 Course	No. of hours	Teaching methods	Comments
C1. Introductory concepts. Characteristics of the automotive industry Definition of the automotive industry, historical development, economic and social impact. Global trends: Industry 4.0/5.0, digitalisation, sustainability, electric mobility. Standards and regulations: ISO, VDA, IATF 16949, EU/UN directives. Current requirements: precision, repeatability, energy efficiency, emission reduction	2	Lecture, heuristic methods and open discussions based on the teaching material presented.	
C2. The car: idea and design. General structure of the car Stages of car development: concept, design, prototyping, validation. Car architecture: basic structure (chassis, bodywork, powertrain). Integrated systems: electronic control, safety systems, HMI interfaces.	2		
C3. The transition from Industry 3.0 to Industry 5.0 Industry 3.0: automation based on PLCs and numerical control systems. Industry 4.0: integration of IoT, Big Data, AI, cyber-physical systems. Industry 5.0: human-machine collaboration, mass customisation, sustainability.	2		
C4. Structure of a technological processing system Components: machine-tool, devices, tools, control system ( ). Technological flows: processing, assembly, control, logistics. Integration into automated lines: the concept of the 'smart factory'	2		
C5. Manufacturing by material redistribution (1/2) Die casting: machines, applications (engine blocks, gearbox housings). Moulding with easily fusible patterns: machines, applications (complex parts).	2		

9.1 Course	No. of hours	Teaching methods	Comments
Centrifugal casting: machines, applications (cylindrical components			
C6. Manufacturing by material redistribution (2/2) Sintering: presses, furnaces, applications (porous metal parts). Additive manufacturing (AM): laser sintering, layering, applications (prototypes, customised parts). Challenges and prospects: quality, costs, integration	2		
C7. Subtractive manufacturing Machining: CNC lathes, milling machines, 5-axis machining centres. CNC machine tools: vertical/horizontal machining centres, automatic tool change systems. Palletised machining centres: automatic palletisers, internal transport systems	2		
C8. Industrial robots and specific devices Types of robots: anthropomorphic, SCARA, delta, collaborative (cobots). Applications: assembly, welding, painting, handling, inspection. Devices for machine tools: chucks, clamps, fixtures, positioning systems	2		
C9. The logistics subsystem in the automotive industry Handling: handling robots, AGV systems, automated conveyors. Transport and storage: standardised containers, RFID systems. Flow optimisation: reducing handling times, minimising errors	2		
C10. Manufacturing precision and quality control Precision parameters: dimensional tolerances, surface roughness, geometric deviations. Measurement methods: 3D measurement systems, coordinate measuring machines (CMM). Acceptance standards: ISO 2768, ANSI B4.2	2		
C11. Subassembly adjustment and part balancing Adjustment techniques: manual/automatic adjustment, calibration, error compensation. Balancing of moving parts: causes, methods, impact of on service life. Practical examples: suspension adjustment, wheel alignment.	2		
C12. Automation of assembly lines (1/2) Use of pneumatic drives: compressors, actuators, valves. Pneumatic diagrams: standardised symbols, circuit examples. Integration with electronic systems: PLCs, sensors, control interfaces.	2		
C13. Automation of assembly lines (2/2) Design of assembly lines: process flows, synchronisation, optimisation. Specific design standards: ISO 9001, ISO 3834, OEM specifications. Project examples: bodywork lines, electric vehicle chassis	2		
C14. Design of tooling and end-effectors	2		

9.1 Course	No. of hours	Teaching methods	Comments
Tooling design: clamping devices, control jigs, adjustment systems. Design of end-effectors with grippers: types, requirements, examples. Standards and best practices: rigidity, modularity, safety.			

Bibliography

1. Panc, N., Flexible Manufacturing Technologies and Systems, UTPress Publishing House, Cluj-Napoca, 2020;
2. Vuscan I., Panc N., Fundamentals of Mechanical Processing, Scoala Ardeleana Publishing House, Cluj-Napoca, 2014
3. David C Barton, John D. Fieldhouse, Automotive Chassis Engineering, 2nd ed., Springer, 2024
4. G. K. Awari, V. S. Kumbhar, R. B. Tirpude and S. W. Rajurkar, Automotive Manufacturing Processes – A Case Study Approach, CRC Press Taylor & Francis Group, 2023
5. Edited by David Crolla, Encyclopedia of Automotive Engineering, Wiley, 2015
6. Menachem Kimchi, David H. Phillips, Synthesis Lectures on Welding Engineering, 2nd ed., Springer, 2023
7. Jon M. Quigley, Roopa J. Shenoy, Project Management for Automotive Engineers: A Field Guide, SAE International, DOI: 10.4271/R-437, 2016
8. Don H. Wright, Testing automotive materials and components, Published by Society of Automotive Engineers Inc., U.S.A., 1993
9. James D. Halderman, Automotive Technology: Principles, Diagnosis and Service, 4th edition, Prentice Hall Pearson, 2012;

9.2 Seminar / laboratory / project / practical	No. of hours	Teaching methods	Comments
1. Fundamentals of industrial robot programming. Health and safety regulations;	2	Explanations of experimental laboratory work	
2. Application 1 on the Kuka KR180 industrial robot;	2		
3. Application 2 on the Kuka KR180 industrial robot;	2		
4. Application 3 on the Kuka KR180 industrial robot;	2		
5. Use of pneumatic actuators in manufacturing equipment for the automotive industry. Operation and adjustment of pneumatic actuators;	2		
6. Use of pneumatic actuators in manufacturing equipment for the automotive industry. Design of pneumatic diagrams using specialised software;	2		
7. The Industry 4.0 assembly line in the Bosch laboratory	2		

Bibliography:

1. User Guide for Festo FluidSim;
2. Kuka KR180 robot programming manual;
3. Bosch laboratory manual (internal documentation).

10. Aligning the course content with the expectations of representatives of the academic community, professional associations and key employers in the field relevant to the programme

The skills acquired will be required by engineers for the design of manufacturing and assembly technologies within companies producing components and tooling for the automotive industry and companies carrying out the assembly of automotive sub-assemblies and assemblies.

11. Assessment

Type of activity	11.1 Assessment criteria	11.2 Assessment methods	11.3 Weighting in

		(and form of assessment: continuous/summative)	the final mark
11.4 Course	Understanding and correct use of the information presented in the teaching materials provided.	Written examination	70%
11.5 Laboratory	Participation in solving the problems set during practical sessions	Written examination and assessment of involvement in laboratory activities	30%
11.6 Minimum performance standard *Course*: Achieving a score of at least 50% on each exam question. To achieve this score, the student must be able to describe the concepts presented in an intelligible manner and with logical coherence in their presentation. *Laboratory:* Completion of the applications and activities required during the laboratory session.			

Date of completion: 12.09.2025	**Staff**	**Academic rank, title First name SURNAME**	**Signature**
	Course	*Assoc. Prof. Dr. Eng. Nicolae PANC*	
	Laboratory	*Assoc. Prof. Dr. Eng. Cătălin MOLDOVAN*	

Approval of the Head of the department coordinating the module, only if this differs from the department organising the degree programme	Head of Department Assoc. Prof. Glad CONȚIU

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc. Prof. Ph.D. Eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof. Ph.D. Eng. Ph.D. ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Logistics of Manufacturing Systems				Subject code	17.10
2.2 Course responsible/lecturer	*Conf.dr.ing. Cristina Borzan* *Cristina.Borzan@tcm.utcluj.ro*					
2.3 Teacher in charge of seminars/labs/projects	*Conf.dr.ing. Cristina Borzan* *Cristina.Borzan@tcm.utcluj.ro*					
2.4 Year of study	2	2.5 Semester	1	2.6 Assessment		C
2.7 Subject category	Formative category					DS
	Optional					DO

3. Estimated total time

3.1 Number of hours per week	2	of which:	3.2 Course	1	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	-	3.3 Practical training	-
3.4 Number of hours per semester	28	of which:	3.5 Course	14	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	14
(b) Study of textbooks, course materials, bibliography, and lecture notes	14
(c) Additional research in the library, on specialized electronic platforms, and in the field	28
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(e) Tutoring	2
(f) Other activities	
3.8 Total hours for individual study and evaluation (sum (3.7(a)...3.7(f))	72
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (if applicable)

4.1 Curriculum	
4.2 Competence	

5. Requirements (if applicable)

5.1. for the course	
5.2. for the seminar/lab/project	

6. Subject-specific learning outcomes

Professional competencies	• Uses technical documentation • Conducting scientific research • Consulting technical resources • Monitoring technology trends
Transversal competencies	• Organizing information, objects, and resources • Applies scientific, technological, and engineering knowledge

7. Expected learning outcomes

Knowledge	C3. The student/graduate synthesizes the concepts of total quality management, industrial logistics principles and sustainable development strategies applicable in engineering C4. The student/graduate knows the methodology of scientific research, academic ethics and the way to structure research papers and reports in the field of industrial engineering
Skills	A3.2 The student/graduate applies quality standards for manufacturing and implements corrective measures in the logistics flow A3.3 The student/graduate organizes information, objects and resources within the supply and distribution chain A4.1 The student/graduate conducts independent scientific research, investigating phenomena related to manufacturing processes and technological management. A4.2 The student/graduate prepares scientific reports and technical articles based on experimental data collected during internships
Responsibility and autonomy	R3.3 The student/graduate makes managerial decisions regarding the optimization of logistical flows to increase economic efficiency R4.1 The student/graduate has autonomy in designing the research plan and interpreting the results. R4.3 The student/graduate assumes responsibility for respecting the norms of ethics and academic integrity

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Acquiring knowledge in the field of industrial logistics
8.2 Specific objectives	• To know all the organizational activities necessary to develop the logistics chain. • To understand the need to ensure a link between logistics and the company's strategy. • To evaluate the strategic management process of the acquisition, movement and storage of materials, semi-finished products / finished products and the information flows corresponding to these processes. • To summarize the conditions necessary for the efficient development of a distribution process

9. Contents

9.1 Course	No. of hours	Teaching methods	Notes
1. Purpose and logistical resources activity. Strategic Issues.	2	Exposure, discussion	Video projector, Microsoft Teams
2. The role and the principles of logistics. Connections logistics with marketing and production.	2		
3. Planning of logistical activities. The design of a logistical activity	2		
4. Distribution channels. Supply chains.	2		
5. Supply management activities. Forms and supply systems. Strategic decisions.	2		
6. Logistics of transport of goods and equipment.	2		
7. The human resources factor in logistics. Human resources management.	2		

Bibliography

1. [BOR'26] Borzan C.S.., *Logistica.* Suport de curs, Microsoft Teams, Logistica sistemelor de fabricație_Master IVFC/Files/Materiale de curs, 2026.
2. [BOR'01] Borzan M., Borzan C., Mocean F., *Elemente de asigurarea şi managementul calităţii.* Editura Studium, ISBN 973-9422-91-6, Cluj-Napoca, 2001.
3. [BOR'08] Borzan M., *Elemente de logistică şi distribuţie.* Notiţe de curs pentru secţiile de studii aprofundate. UTCN, 2002-2008.
4. [GAT'01] Gattorna J., *Managementul logisticii şi distribuţiei*. Editura Teora, Bucureşti, 2001.
5. [RIS'96] Ristea A.L., Purcarea T., *Distribuţia mărfurilor.* EDP, Bucureşti, 1996.
6. [BAL'06] Balan C., *Logistica*. Ed. URANUS, Editia a III-a. Bucuresti, 2006
7. [DAZ'96] Daganzo, Carlos F., Logistics systems analysis, 2nd revised and enlarged ed., New York; Berlin; Heidelberg: Springer, 1996, ISBN 3-540-60639-4
8. [HAR 19] Alan Harrison, Remko van Hoek, Logistics Management and Strategy Competing through the supply chain, Pearson UK, 2019

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
1. Planning and simulation of distribution system	2	Exposure, discussion, applications	Win QSB Software
2. Planning and optimizing the flow of raw materials and materials	2		
3. The Planning Partnership. Types of cooperation	2		
4. Optimizing systems for transport and storage of goods	2		
5. Reverse Logistics Systems	2		
6. Improving logistics function based on human resource management	2		
7. Evaluation of accumulated knowledge and granting qualification	2		

Bibliography

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

Adrian Trif, Marian Borzan, Cristina Miron-Borzan, Logistica, Aplicatii WinQSB, Editura UTPRESS, Cluj-Napoca, 2019, format electronic, ISBN 978-606-737-381-3
Borzan C. S. WinQSB Software for Operations Research**,** Master IVFC/Files/Materiale de curs, 2025.

11. Evaluation

Type of activity	**11.1 Assessment criteria**	**11.2 Assessment methods** (and type of assessment: continuous/summative)	**11.3 Weight in the final grade**
11.4 Course	Test (T)	Examination (E)	60%
11.5 Seminar/Laboratory /Project / Practical training	Case studies are checked and noted with S, if the deadline is respected	Verification (c)	40%
11.6 Minimum performance standard			

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
10.09.2025	Course	Conf.dr.ing. Cristina Borzan	
	Practical activities	Conf.dr.ing. Cristina Borzan	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department ..... Conf.dr.ing. Glad CONȚIU

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Databases and Manufacturing Expert Systems				Subject code	17.20
2.2 Course responsible/lecturer	*Assoc.prof.dr.eng. Adrian Trif; adrian.trif@tcm.utcluj.ro*					
2.3 Teacher in charge of seminars/labs/projects	*Assoc.prof.dr.eng. Adrian Trif; adrian.trif@tcm.utcluj.ro*					
2.4 Year of study	2	2.5 Semester	1	2.6 Assessment		C
2.7 Subject category	Formative category					DS
	Optional					DO

3. Estimated total time

3.1 Number of hours per week	2	of which:	3.2 Course	1	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	-	3.3 Practical training	-
3.4 Number of hours per semester	28	of which:	3.5 Course	14	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study of textbooks, course materials, bibliography, and lecture notes	28
(c) Additional research in the library, on specialized electronic platforms, and in the field	28
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	8
(e) Tutoring	4
(f) Other activities	2
3.8 Total hours for individual study and evaluation (sum (3.7(a)...3.7(f))	72
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (if applicable)

4.1 Curriculum	
4.2 Competence	

5. Requirements (if applicable)

5.1. for the course	PC workstations
5.2. for the seminar/lab/project	PC workstations

6. Subject-specific learning outcomes

Professional competencies	-Analyzes production processes for improvement -Uses software for computer-aided production -Is up to date with the digital transformation of industrial processes -Propose improvement strategies -Assesses financial viability -Drive process optimization -Recommend product improvement
Transversal competencies	-Show initiative -Apply scientific, technological and engineering knowledge -Organize information, objects and resources

7. Expected learning outcomes

Knowledge	C3. The student/graduate synthesizes the concepts of total quality management, industrial logistics principles and sustainable development strategies applicable in engineering
Skills	A3.1 The student/graduate performs quality control and monitors compliance with manufacturing quality standards by applying advanced statistical methods. A3.2 The student/graduate calculates design costs and estimates the budget for launching new products into manufacturing. A3.3 The student/graduate prioritizes information, objects, and logistical resources to optimize material flow within manufacturing systems. A3.4 The student/graduate controls production using performance indicators and identifies bottlenecks in the logistics chain. A3.5 The student/graduate inspects industrial equipment and proposes maintenance or replacement plans based on life-cycle analysis.
Responsibility and autonomy	R3.1 The student/graduate manages the material and financial resources of a manufacturing project. R3.2 The student/graduate performs process audits and proposes measures to ensure quality. R3.3 The student/graduate makes decisions regarding the optimization of the logistics chain to ensure timely delivery.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	Learning the basic knowledges regarding database theory, in the context of the database management system of the Microsoft ACCESS application
8.2 Specific objectives	- learning the terminology, specific to databases; - designing relational databases; - establishing the charts structure and their realization; - establishing the relations between charts; - making queries, forms and reports; - creation of databases in Microsoft Access.

9. Contents

9.1 Course	No. of hours	Teaching methods	Notes
Introduction to databases and their role in manufacturing and logistics -Types of databases -Industry examples	1	Lecturers, aplications	PC units, Video projector
Data modeling – relational model - Entities, attributes, relationships	1		
Transforming the ER model into a relational model - Primary and external keys	1		
Integrity and normalization constraints - Normal forms (1NF, 2NF, 3NF)	1		
SQL Language – SELECT - Filter, Sort	1		
Complex queries - JOIN, subqueries	1		
Data Manipulation - INSERT, UPDATE, DELETE	1		
VIEWS and indexes - Optimizing data access	1		
Information Systems in Production (ERP, MES) - Database Integration	1		
Product traceability - Batches, series, history	1		
Production Planning - Relationship with Databases	1		
Inventory management - Models and indicators	1		
Supply Chain - Information Flows	1		
Business Intelligence & Reporting - Dashboards, Aggregations	1		

Bibliography

1. Elmasri Ramez and Navathe Shamkant B. - Fundamentals of Database Systems, 7th Edition, Pearson, 2016.
2. Silberschatz Abraham, Korth Henry F., Sudarshan S. - Database System Concepts, 7th Edition, McGraw-Hill, 2019.
3. Connolly Thomas and Begg Carolyn - Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition, Pearson, 2015.
4. Ponniah Paulraj - Data Warehousing Fundamentals, Wiley, 2010.
5. Gunasekaran Angappa - Supply Chain Management: Theory and Applications, Springer, 2004.

van der Aalst Wil - Process Mining: Data Science in Action, 2nd Edition, Springer, 2016.

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
DBMS installation (e.g. MySQL / PostgreSQL) + interface Simple database creation	1		
ER modeling for an inventory management system	1		
Implementing the model in SQL (CREATE TABLE)	1		
Normalization of a logistics database	1		
Simple queries on production databases	1		
Analysis of relationships between products, orders and suppliers	1		
Logistics flow simulation (orders, deliveries)	1		
Create view for logistics reports	1		
Modeling a Manufacturing Process Database	1		
Implementation of the traceability system in SQL	1		
Queries for planning and optimization	1		
Inventory Management System (Full CRUD)	1		
Supply chain database simulation	1		
Creation of SQL reports + final project	1		

Bibliography

1. Beaulieu Alan - Learning SQL, 2nd Edition, O'Reilly Media, 2009.

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes
2. Forta Ben - SQL in 10 Minutes, Sams Teach Yourself, 5th Edition, Sams Publishing, 2019. 3. Molinaro Anthony - SQL Cookbook, 2nd Edition, O'Reilly Media, 2020. 4. MySQL Documentation, Oracle Corporation, disponibil online: https://dev.mysql.com/doc/ 5. PostgreSQL Documentation, PostgreSQL Global Development Group, disponibil online: https://www.postgresql.org/docs/ 6. Oracle Database SQL Language Reference, Oracle Corporation, disponibil online: https://docs.oracle.com/ 7. MySQL Workbench User Guide, Oracle Corporation. 8. pgAdmin Documentation, The pgAdmin Development Team. 9. DB Fiddle, platformă online pentru execuția interogărilor SQL, disponibilă la: https://www.db-fiddle.com/			

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The acquired skills will be necessary for all employees working with databases of any type.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight in the final grade
11.4 Course	-Answers to 10 theoretical questions	Written test (summative evaluation): duration of evaluation - 2 hours	50%
11.5 Seminar/Laboratory /Project / Practical training	-creating a database with all the tools learned	Practical test on computer (summative evaluation): 2 hours	50%
11.6 Minimum performance standard - answers to 5 questions in theory - creation of a table, a report form and a number of 3 queries			

Completion date:	Faculty members	academic rank, title, First Name SURNAME	Signature
10.09.2025	Course	Conf. dr.ing. Adrian Trif	
	Practical activities	Conf. dr.ing. Adrian Trif	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department .....

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD

COURSE SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Manufacturing Engineering
1.4 Field of study	Industrial Engineering
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Virtual Engineering and Competitive Manufacturing
1.7 Form of education	IF – full time attendance

2. Data about the subject

2.1 Subject name	Ethics and academic integrity				Subject code	18.00
2.2 Course responsible/lecturer	*Conf.univ.dr. Angelica CĂPRARU - Angela.Capraru@lang.utcluj.ro*					
2.3 Teacher in charge of seminars/labs/projects						
2.4 Year of study	2	2.5 Semester	1	2.6 Assessment		E
2.7 Subject category	Formative category					DC
	Optional					DI

3. Estimated total time

3.1 Number of hours per week	1	of which:	3.2 Course	1	3.3 Seminar	-	3.3 Laboratory	-	3.3 Project	-	3.3 Practical training	-
3.4 Number of hours per semester	14	of which:	3.5 Course	14	3.6 Seminar	-	3.6 Laboratory	-	3.6 Project	-	3.3 Practical training	-

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	0
(b) Study of textbooks, course materials, bibliography, and lecture notes	10
(c) Additional research in the library, on specialized electronic platforms, and in the field	10
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	16
(e) Tutoring	0
(f) Other activities	0
3.8 Total hours for individual study and evaluation (sum (3.7(a)...3.7(f))	36
3.9 Total hours per semester (3.4+3.8)	50
3.10 Number of credit points	2

4. Pre-requisites (if applicable)

4.1 Curriculum	
4.2 Competence	

5. Requirements (if applicable)

5.1. for the course	
5.2. for the seminar/lab/project	

6. Subject-specific learning outcomes

Professional competencies	4 Applies technical principles 5 Selects technical documentation 6 Demonstrates technical communication skills 7 Performs scientific research 10 Prepares scientific reports 12 Specifies technical requirements 13 Consults technical documentation 17 Manages engineering projects 18 Evaluates technical requirements 21 Evaluates experimental data 22 Operates laboratory research equipment 24 Provides project management 27 Monitors technology trends
Transversal competencies	1 Demonstrates creativity and initiative 2 Assumes responsibility 3 Applies scientific and technological knowledge 4 Manages documentation and production organization

7. Expected learning outcomes

Knowledge	C4. The student/graduate is familiar with theoretical and experimental scientific research methodology, academic ethics standards, and the structure of scientific reports. C5. The student/graduate understands project management principles, technical English terminology and professional communication strategies within multidisciplinary teams.
Skills	A4.1 The student/graduate conducts scientific research, utilizing databases, patents and international collaborations. A4.2 The student/graduate uses scientific research apparatus and equipment to collect experimental data relevant to industrial engineering. A4.3 The student/graduate analyses experimental data and formulates scientific conclusions using mathematical and statistical tools. A4.4 The student/graduate prepares technical reports and specialized scientific articles, demonstrating the capacity for synthesis and logical argumentation. A4.5 The student/graduate develops a dissertation thesis on a current topic, proposing original solutions to virtual engineering or manufacturing problems. A5.1 The student/graduate manages engineering projects and ensures project management by planning stages, resources and deadlines. A5.2 The student/graduate applies technical communication skills, using the English language for documentation and international collaboration. A5.3 The student/graduate monitors global technology trends and updates their innovation methods according to market requirements. A5.4 The student/graduate demonstrates initiative in mitigating risks and resolving unexpected issues during project execution. A5.5 The student/graduate interprets technical requirements received from international partners or clients and translates them into clear work tasks.

Responsibility and autonomy	R4.1 The student/graduate assumes responsibility for the integrity of collected data and for the adherence to academic ethics and integrity. R4.2 The student/graduate demonstrates autonomy in defining research hypotheses and in choosing appropriate experimental methods. R4.3 The student/graduate demonstrates the capacity to manage a complex research project over an extended duration. R5.1 The student/graduate coordinates project teams and assumes responsibility for achieving the objectives. R5.2 The student/graduate self-evaluates the need for continuous training and identifies professional development opportunities. R5.3 The student/graduate exhibits ethical and responsible behaviour in relationships with team members and external partners.

8. Discipline objectives (derived from the specific competencies grid)

8.1 General objective of the discipline	The course aims to analyse the fundamental problems, at the theoretical and applicative level, related to the academic ethics, in order to develop the ethical competence of the students, to form an upright behaviour from the academic point of view, which will be the basis of a responsible professional career.
8.2 Specific objectives	Development of skills needed to identify and solve ethical problems; Development and formation of scientific research skills in the field of engineering; Knowledge and assimilation of the legislation that regulates the academic conduct; Compliance and application of knowledge gained in the academic work.

9. Contents

9.1 Course	**No. of hours**	**Teaching methods**	**Notes**
1. The object and issues of ethics: conceptual delimitations Interdisciplinary approaches. Defining and interpreting the basic concepts of academic ethics. Glossary of terms	2	Interactive lecture	
2. Academic responsibilities and rights University code of the rights and obligations of the student from UTCN. Social effects of lack of academic honesty Case studies	2	Interactive lecture and discussions on real examples	
3. The ethics of scientific research. Principles, problems, solutions Standards and regulations of the academic environment regarding good conduct in scientific research Copyright and related rights	2	Lecture, discussions	
4. Good practice in writing a scientific paper Citation rules Corrections of fair conduct regarding the use of data Criteria for establishing originality in research	2	Lecture, heuristic conversation	
5. Plagiarism and self-plagiarism Types of plagiarism	2	Lecture, mini-case studies	

9.1 Course	No. of hours	Teaching methods	Notes
Plagiarism procedures. Electronic means of identifying plagiarism			
6. Other forms of academic dishonesty: consequences and sanctions Data forgery, ghostwriting, honorary authorship, etc. Counterproductive behaviors and attitudes	2	Lecture, presentation Heuristic conversation	
7. Case studies: dilemmas and problems Discussion topic: examples of "bad practices" in research	2	Lecture, case studies, discussions on good practices	

Bibliography

1. Eaton, S. E. (Ed.). (2024). *Second Handbook of Academic Integrity*. Springer Cham. https://link.springer.com/book/10.1007/978-3-031-54144-5
2. Glendinning, I., Eaton, S. E., Figueroa, B. A. M., & Sivasubramaniam, S. D. (2025). *Ethics and Integrity in Education (Research)*. Springer Cham. https://link.springer.com/book/9783031981562
3. King, A. E. (Ed.). (2025). *Artificial intelligence, pedagogy and academic integrity.* Springer. Disponibil la: https://link.springer.com/book/9783031925337
4. Macfarlane, B. (2009). *Researching with Integrity: The Ethics of Academic Enquiry.*
5. Ministerul Educației. (2024). *Codul-cadru de etică și deontologie universitară* (Hotărârea Guvernului nr. 305/2024). Disponibil la: https://www.edu.ro/sites/default/files/Anexa_Proiect_Cod_cadru_etica_deontologie_universitara.pdf
6. Ministerul Educației și Cercetării. (2023). *Ghid de integritate în cercetarea științifică*. [PDF]. Disponibil la: https://www.edu.ro/sites/default/files/fisiere%20articole/OMEC_3019-2025.pdf
7. Socaciu, E., Vică, C., Mihailov, E., Gibea, T., Mureșan, V., & Constantinescu, M. (2023). *Etică și integritate academică* (ediția a II-a). Editura Universității din București.
8. Sandu, A. (2025). *Arhitectura integrității. Dincolo de plagiat – curs de etică și integritate academică pentru studenți și cercetători*. Editura Lumen.
9. Springer, J. A. (2025). *ChatGPT in academia: University students' attitudes towards the use of ChatGPT and plagiarism. Journal of Academic Ethics.* Disponibil la: https://link.springer.com/article/10.1007/s10805-025-09603-5
10. Șercan, E., & Voicu, B. (2022). *Patterns of Academic Integrity Definitions among BA Romanian Students: The Impact of Rising Enrolments*. *Revista de Cercetare și Intervenție Socială*, 78, 87–106.
11. UNESCO. (2023). *Ghid pentru utilizarea inteligenței artificiale generative în educație și cercetare* [Raport oficial UNESCO, traducere în limba română]. JURIDICE.ro. Disponibil la: https://www.juridice.ro/704382/unesco-a-lansat-ghidul-pentru-ia-generativa-in-educatie-si-cercetare

9.2 Seminar / laboratory / project / practical training	No. of hours	Teaching methods	Notes

Bibliography

10. Corroborating the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The content of the discipline corresponds to the thematic areas in the field approached nationally and internationally at this level of studies.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/summative)	11.3 Weight

			in the final grade
11.4 Course	Understanding the fundamental concepts of academic ethics	Exam based on knowledge testing, •1/3 questions of principle (integrity, attributions, plagiarism, author) •1/3 on AI scenarios (what is allowed / what must be declared / what is risky); •1/3 on common academic situations (collaboration, citation, data, results).	70%
11.5 Seminar/Laboratory /Project / Practical training	The level of understanding of concepts and the ability to put oneself in context.	Academic report (check RL2 and RL3 and RL4).	30%

11.6 Minimum performance standard

In order to pass the discipline, the student must demonstrate that:

1. has basic knowledge of the fundamental concepts of ethics and academic integrity, as well as the rules and codes of ethics applicable to the academic environment;
2. recognises and correctly describes the main forms of deviation from academic ethics (plagiarism, self-plagiarism, fabrication and falsification of data, etc.);
3. correctly and consistently apply the principles of ethics and academic integrity in the completion of a written paper or academic project;
4. analyses, at a satisfactory level, a case study or problematic situation from the perspective of academic ethics;

Demonstrates responsible and honest behavior in teaching and assessment activities.

The passing standard is considered to have been achieved if the following conditions are cumulatively met:
the written exam has a grade of at least 5.00;
the report has a grade of at least 5.00;

Completion date:	**Faculty members**	**academic rank, title, First Name SURNAME**	**Signature**
10.09.2025	Course	Conf.univ.dr. Angelica Căpraru	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department .....

Date of approval by the IF Department Council 22.09.2025	Head of IF Department Assoc.prof.dr.eng. Glad CONȚIU
Date of approval by the IIRMP Faculty Council 26.09.2025	Dean of FIIRMP, Prof.dr.eng.dr.ec. Stelian BRAD