# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 54,00 |

## 2. Data about the subject

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Technological equipment's | | |
| 2.2 | Course responsible/lecturer | | | Conf.dr.ing.Dan Frunza Dan.Frunza@ipm.utcluj.ro | | |
| 2.3 | Teachers in charge of seminars | | | Lecturer Marius Tintelecan | | |
| 2.4 Year of study | II | 2.5 Semester | 2 | 2.6 Assessment | C | |
| 2.7 Subject category | Formative category | | | | | DS |
| | Optionality | | | | | DI |

## 3. Estimated total time

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

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 20 |
| (b) Supplementary study in the library, online and in the field | 10 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 10 |
| (d) Tutoring | 0 |
| (e) Exams and tests | 4 |
| (f) Other activities | 0 |

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

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | Material Resistance, Mechanics, Machine Organs and Mechanisms |
| 4.2 | Competence | |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | |
| 5.2 | For the applications seminar / lab / proj. | Presence at the laboratory is mandatory |

**1. Specific competences**

| | |
|---|---|
| Professional competences | Theoretical knowledge:<br>Types of machinery and machinery used in foundries and forging stations. Construction, operation and maintenance of foundry and plastic deformation machines and machines. Methods of choice of machines and equipment's.<br>Acquired skills:<br>Identification of components and subassemblies of equipment's and machinery. Analytical and experimental determination of the specific parameters of foundry and plastic deformation machines. Choosing suitable machinery/equipment for use in a manufacturing line.<br>Acquired skills:<br>Measurement of the parameters of machines of: cast, cored, poured into metal shapes, mechanical presses, hydraulic presses, hammers, etc. Adjustment and verification of the geometric precision and working precision of the machines, mechanical, hydraulic presses, hammers, etc.. |
| Cross competences | Promoting logical, convergent and divergent reasoning, the use of rigorous, efficient and responsible work strategies, under conditions of autonomy and professional independence, based on the principles, norms and values of the code of professional ethics.<br>Effective use of multilingual skills and knowledge of information and communication technology. |

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

| | | |
|---|---|---|
| 7.1 | General objective | Training of competences on the construction, operation and maintenance of machinery and technological machines |
| 7.2 | Specific objectives | Acquiring the necessary theoretical knowledge on the types of machinery, construction and exploitation of machines and equipment's.<br>Acquired skills and abilities:<br>- Identification of components and subassemblies of machinery and machinery. - Choosing suitable machinery/equipment for use in a manufacturing line.<br>- Adjustment and verification of the geometric precision and working precision of technological machines. |

**3. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Introduction. Classification of technological machinery for foundries.<br>Interoperation transport equipment and installations | 2 | Lecture, presentation slides, heuristic conversation | |
| 2. Machinery and installations for the preparation of training mixtures.<br>Prep stations of forming and core mixing. Plants for the regeneration of forming mixtures. | 2 | | |
| 3. Machinery for making temporary molds. Core making machines. | 2 | | |
| 4. Machines for debating molds and removing cores. | 2 | | |

| | | | |
|---|---|---|---|
| Mechanized and automated training-casting-debate lines | | | |
| 5. Machinery and installations for cleaning castings. Installations for continuous and semi-continuous casting of semi-manufactures. | 2 | | |
| 6. Machines for casting in permanent molds (under the action of gravity; low pressure casting) | | | |
| 7. Machines for casting in permanent molds (centrifugal field casting; pressure casting) | 2 | | |
| 8. Introduction: Advantages, disadvantages and classification of plastic deformation machines; actuators and mechanisms of plastic deformation machines; Hammers: classification, main functional parameters. | 2 | | |
| 9.Steam-air hammer: classification, principle of operation, universal control mechanism, assembly of the rod with piston and ram, causes of breakage of the rod. | 2 | | |
| 10.Pneumatic hammers: classification, operation of the pneumatic hammer with one cylinder, with two cylinders. | 2 | | |
| 11. Screw presses: scope of use, classification, main technical characteristics, operation, stress screw and materials. Mechanical presses: field of use, classification, operation of vertical close die forging presses and horizontal forging machines, rigidity of mechanical presses. | 2 | | |
| 12. Hydraulic presses: field of use, classification, main technical characteristics, operation of free forging, close die forging hydraulic presses. | 2 | | |
| 13.Rolling Mills classification, structure, working regime of the rolling mills, operation. Calculation of the rolling force. Rolling cylinders: classification, loads, materials. | 2 | | |
| 14.Auxiliary equipment for rolling sections (debiting, straightening machines, deploying, for transport and metal handling. Wire and rod drawing machines: classification, operation of simple and multiple drawing machines for bars and pipes. | 2 | | |

Bibliography

1. Micle, V., Zubac, V. – Procedee şi echipamente speciale în sectoarele de turnarea metalelor, Editura UT Pres, Cluj-Napooca, 2004.
2. Zubac, V. si Micle, V. - Masini si linii moderne în turnatorii, Editura UT Pres, Cluj-Napooca, 1996.
3. Zubac, V. si Micle, V.- Utilaje pentru turnatorie, Forme permanente, UT Pres, Cluj-Napoca, 1998.
4. Zubac, V. - Utilaje pentru turnatorie, E.D.P., Bucuresti, 1982.
5. Moldovan, V., Chiriţă,V. - Exploatarea raţională a maşinilor de forjat., Editura tehnică, Bucureşti, 1979
6. Moldovan, V., Maniu, A. - Utilaje pentru deformări plastice, Editura didactică şi pedagogică, Bucureşti, 1982
7. Moldovan, V., Dimitriu, S. - Modernizări în secţiile de forjare, Editura Transilvania Press, Cluj-Napoca, 1993

| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Laboratory presentation, labor protection measures. Determination of the specific parameters of the roller mixer. | 2 | Conversation working with | |

| | | | |
|---|---|---|---|
| Research of productivity parameters at a sand mixing preparation station. | | specialty books Practical work, use of specific equipment | |
| 2. Constructive-functional study of the machine by shaking and additional pressing MF 11. Construction of the indicator diagram, experimentally, of the shaking mechanism from the forming machine. | 2 | | |
| 3. Constructive-functional study of the making cores machine by shooting. Constructive-functional study and determination of the productivity of the core blower peel. | 2 | | |
| 4. Constructive-functional study and determination of the productivity of the casting machine in permanent forms. | 2 | | |
| 5. Constructive-functional study of the KCW low pressure casting machine. Visit at SC Armature SA Cluj-Napoca where the KCW machine operates. | 2 | | |
| 6. Research of the specific parameters of the centrifugal casting machine. | 2 | | |
| 7. The rational choice and operation of pressure casting machines. | 2 | | |
| 8. Presentation of works, laboratory and labor protection measures specific to plastic deformation plants. Study of kinematic and hydraulic schemes. | 2 | | |
| 9. Determination of impacting energy by the crusher method. | 2 | | |
| 10. Checking the working accuracy of pneumatic hammers. | 2 | | |
| 11. Measuring the stresses in the 0.4 MN hydraulic press frame, using strain gauges. | 2 | | |
| 12. Static rigidity of mechanical presses with a mount. | 2 | | |
| 13. The study of rigidity on the model of mechanical press frame with a mount. | 2 | | |
| 14. Measurement of rolling forces using strain gauges. | 2 | | |

Bibliography

1. Zubac, V., Sas, G., Nagy, E., Soporan, V. si Micle, V. - Utilaje metalurgice specifice -Turnatorie -Indrumator de laborator, Atelierul de multiplicare al IPC-N, 1986
2. Moldovan, V., Canta, T. - Îndrumător pentru lucrări de laborator la Utilaje pentru deformări plastice, Atelier de multiplicare al IPC-N, Cluj-Napoca, 1979
3. Rus, A.L. , Sas-Boca, M., Utilaje pentru deformări plastice – Îndrumător pentru lucrări de laborator, Editura Napoca Star, Cluj-Napoca, 2013

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

| |
|---|
| |

**5. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | - The ability to analyze | The exam consists of checking | 70% |

| | | | |
|---|---|---|---|
| | specific problems.<br>The synthesis power of information related to a specific subdomain. | theoretical knowledge (questions) in writing + oral (2hours). After course 7 a partial examination can be taken (written work -1 hour). | |
| 10.5 Seminars /Laboratory/Project | The ability to understand, interpret and solve specific problems in the field.<br>Presence, (inter)activity during laboratory hours. | Oral examination of the knowledge accumulated at the laboratory. | 30% |
| 10.6 Minimum standard of performance | | | |
| | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 12.04.2023 | Lecturer | Conf.dr.ing Dan Frunza | |
| | Teachers in charge of application | Lecturer.Marius Tintelecan | |
| | | | |

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

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## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 55.00 |

## 2. Data about the subject

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Metallic materials | | |
| 2.2 | Course responsible/lecturer | | | Lect. PhD. Eng. Violeta-Valentina Merie | | |
| 2.3 | Teachers in charge of laboratories / projects | | | Lect. PhD. Eng. Violeta-Valentina Merie / Lect. PhD. Eng. Călin-Virgiliu Pricã | | |
| 2.4 Year of study | IV | 2.5 Semester | I | 2.6 Assessment | Exam | |
| 2.7 Subject category | Formative category | | | | | DS |
| | Optionality | | | | | DI |

## 3. Estimated total time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | 4 | of which | 3.2 Course | 2 | 3.3 Seminar | 0 | 3.3 Laboratory | 1 | 3.3 Project | 1 |
| 3.4 Total hours in the curriculum | 56 | of which | 3.5 Course | 28 | 3.6 Seminar | 0 | 3.6 Laboratory | 14 | 3.6 Project | 14 |

| | |
|---|---|
| 3.7 Individual study: | |
| (a) Manual, lecture material and notes, bibliography | 36 |
| (b) Supplementary study in the library, online and in the field | 10 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 28 |
| (d) Tutoring | 0 |
| (e) Exams and tests | 3 |
| (f) Other activities | 0 |
| 3.8 Total hours of individual study (summ (3.7(a)...3.7(f))) | 74 |
| 3.9 Total hours per semester (3.4+3.8) | 130 |
| 3.10 Number of credit points | 4 |

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | Materials Science and Engineering knowledge |
| 4.2 | Competence | Methods for investigating the structure and properties of metallic materials |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | Online course - PowerPoint presentation; course support on the MS Teams |
| 5.2 | For the applications / projects | Practical applications in groups of maximum four students / individual study |

**6. Specific competences**

| | |
|---|---|
| Professional competences | PC1. Design and independent management of a semi - finished characterization program (optical microscopy, mechanical testing).<br>PC2. Critical analysis of metal parts.<br>PC3. Optimal choice of the type of semi-finished product for a metal alloy application.<br>PC.4 Optimal choice of alloy brand for a particular application.<br>PC.5 Use of image acquisition and processing systems.<br>PC.6 Use of modern metallographic sample processing systems from various alloys.<br>PC.7 Development of projects in which it is necessary to prescribe metallic materials and the state of their treatment. |
| Cross competences | CC1. Autonomous use of equipment in the metallography and testing laboratory.<br>CC2. Familiarization with teamwork in the laboratory.<br>CC3. Awareness of the need for continuous information in the field of metallic materials and al specific technologies for their processing. |

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

| | | |
|---|---|---|
| 7.1 | General objective | • Knowledge of alloys for industrial use in terms of composition-structure-properties correlation, heat treatments and specific processing methods, as well as standardization |
| 7.2 | Specific objectives | • Knowledge of the general properties of metallic materials.<br>• Deepening the correlation composition - structure - properties for metallic materials.<br>• Knowledge of the principles for the selection and processing of different alloys.<br>• Alloy / application selection, including using industry standards.<br>• Understanding the particularities of heat treatments for alloy classes.<br>• Detailed knowledge of laboratory equipment in the field.<br>• Operating with the aspects regarding the metallic materials to approach the situations from the industrial practice. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1.Generalities in the study of metallic materials | 2 | | |

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 2.Metal alloys. Constituents. Linking properties-equilibrium diagrams. Alloy structure. Classification of alloys | 2 | MS Teams online lecture | Course support on MS Teams |
| 3.Non-alloy steels: Phases and constituents. Influence of carbon content on mechanical properties. Accompanying elements. Degree of deoxidation | 2 | | |
| 4.Alloy steels: Alloy elements. The influence of alloying elements in steels. Classification. HSS, UHSS steels | 2 | | |
| 5.Standardization of non-alloy and alloy steels. Steels for bearings. Refractory steels | 2 | | |
| 6.Steels with special properties. Uses of steels | 2 | | |
| 7.Foundry pig iron | 2 | | |
| 8.Copper. Copper alloys: Brasses | 2 | | |
| 9.Copper alloys: Bronzes. Symbols | 2 | | |
| 10. Aluminium: Properties. Uses | 2 | | |
| 11. Aluminium alloys. Foundry alloys | 2 | | |
| 12. Deformable aluminium alloys | 2 | | |
| 13. Titanium and titanium alloys | 2 | | |
| 14. Magnesium and magnesium alloys. Zinc and zinc alloys. Nickel. Cobalt | 2 | | |
| Bibliography | | | |

| 8.2. Laboratory | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Analysis of structural constituents in steels | 2 | Working in the laboratory | 85 % on-site 15 % online |
| 2. Linking structure-mechanical properties of a steel | 2 | | |
| 3. Foundry pig iron structure | 2 | | |
| 4. Foundry aluminium alloys structure | 2 | | |
| 5. Deformable aluminium alloys structure | 2 | | |
| 6.Copper. Brasses. Bronzes: Structure, properties | 2 | | |
| 7. Titanium alloys structure | 2 | | |

Bibliography

1. W. D. Callister Jr., Materials Science and Engineering. An introduction (7th Ed.), John Wiley & Sons Inc., 2007

2. P. A. Schweitzer, Metallic materials. Physical, mechanical, and corrosion properties, Marcel Dekker, New York, 2003

3. ASM Handbook (vol.1, 2), ASM International, 1996

4. H. Colan, V. Cândea, D. M. Salomie – Materials science. Vol. 1, Cluj-Napoca, U.T.Press, 2013;

5. Cândea, C. Popa, T. Marcu - Atlas, metallographic structures, Cluj-Napoca, U.T.Press 2012;

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 6. V.Candea, C.Popa, N.Sechel, V.Buharu – Clasification and standardization of ferrous and non-ferrous alloys, UTPress, 2011;<br>7. C. Popa, V. Cândea, V. Şimon, D. Lucaciu, O. Rotaru – Biomaterials science. Metallic biomaterials, Cluj-Napoca, U.T.Press, 2008 | | | |

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

✓ Employers in the industrial environment expect engineers with this profile to know the metallic materials, their processing and treatment methods and to use the terminology correctly.

✓ Knowledge of metallography and macro fractography is highly valued in companies with a mechanical profile.

✓ The analytical program was adapted to the characteristics of the market in the field, both from the perspective of manufacturers, designers and service and maintenance companies.

✓ The structuring of knowledge within the discipline allows an easy adaptation of engineers to changes and improvements of alloys used, as well as their processing technologies.

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | Knowledge and understanding of the notions presented. Solving questions, problems | Online exam on MS Teams | 50 % |
| 10.5 Laboratory / Project | Project: content, presentation, how to answer questions | Public speech | 30 % |
| | Laboratory: how to work in the laboratory; solving tasks in laboratory work | MS Teams test | 20 % |
| 10.6 Minimum standard of performance | | | |
| Laboratory note greater than or equal to 5; Project note greater than or equal to 5 | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 9.04.2023 | Lecturer | Lect. PhD. Eng. Violeta-Valentina Merie | |
| | Teachers in charge of application | Lect. PhD. Eng. Violeta-Valentina Merie | |
| | | Lect. PhD. Eng. Călin-Virgiliu Pricâ | |
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| | |
|---|---|
| Date of approval in the department<br>26.06.2023 | Head of department<br>Ass.prof.dr.eng. Mariana Pop |
| Date of approval in the faculty<br>10.07.2023 | Dean<br>Prof.dr.eng. Cătălin Popa |

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## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 56,00 |

## 2. Data about the subject

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Sintered materials and products (modules) | | |
| 2.2 | Course responsible/lecturer | | | S.l.dr.ing. Thalmaier Gyorgy | | |
| 2.3 | Teachers in charge of seminars | | | S.l.dr.ing. Thalmaier Gyorgy | | |
| 2.4 Year of study | 4 | 2.5 Semester | 7 | 2.6 Assessment | Exam | |
| 2.7 Subject category | Formative category | | | | | DS |
| | Optionality | | | | | DOB |

## 3. Estimated total time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | 4 | of which | 3.2 Course | 2 | 3.3 Seminar | 0 | 3.3 Laboratory | 1 | 3.3 Project | 1 |
| 3.4 Total hours in the curriculum | 42 | of which | 3.5 Course | 28 | 3.6 Seminar | 0 | 3.6 Laboratory | 14 | 3.6 Project | 14 |

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 20 |
| (b) Supplementary study in the library, online and in the field | 8 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 28 |
| (d) Tutoring | 2 |
| (e) Exams and tests | 2 |
| (f) Other activities | |

| | |
|---|---|
| 3.8 Total hours of individual study (summ (3.7(a)...3.7(f))) | 60 |
| 3.9 Total hours per semester (3.4+3.8) | 116 |
| 3.10 Number of credit points | 4 |

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | N/A |
| 4.2 | Competence | Basic knowledge of Technical Drawing, Materials Science and Materials Technology, Powder Metallurgy |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | Lectures online MS Teams/onsite |
| 5.2 | For the applications | Applications online MS Teams /onsite |

**6. Specific competences**

| | |
|---|---|
| Professional competences | Evaluation and proposing an optimal solution of technical problems related to processing of parts by powder metallurgy by applying concepts, theories and experimental methods. |
| Cross competences | Carrying out activities and exercising the specific roles of teamwork, on different hierarchical levels.<br>Promoting the spirit of initiative, dialogue, cooperation, positive attitude, respect for others, diversity and multiculturalism and continuous improvement of one's activity.<br>The objective self-assessment of the need for continuous professional training, in order to be inserted on the labour market and to adapt to it's dynamics for personal and professional development. Effective use of multilingual skills and knowledge of information and communication technology |

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

| | | |
|---|---|---|
| 7.1 | General objective | The appropriate use of standard evaluation to appreciate the quality, merits and limitations of some processes, programs, projects, concepts, methods and theories. |
| 7.2 | Specific objectives | Appropriate use of standard evaluation criteria and methods, to appreciate the quality and the optimal solution of a technical problems related to materials processed in field of powder metallurgy. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Metal powders. Definitions, classification, specific properties. Manufacturing technologies. Recap. | 2 | Interactive methods using digital equipment, video materials, cases studies | Digital media content included |
| 2. The influence of alloying elements on the mechanical properties of PM parts | 2 | | |
| 3. Sintered structural parts. Design issues. Examples of technological itinerary | 10 | | |
| 4. Sintered anti-friction materials | 3 | | |
| 5. Sintered friction materials | 3 | | |
| 6. Porous materials | 4 | | |
| 7. Sintered materials for electrical contacts | 2 | | |
| 8. Special sintered materials | 2 | | |

Bibliography


1. Metals Handbook v. 7. Powder Metallurgy, Powder Metallurgy ASM,Ohio,USA, 1984.
2. Iron and Steel powders for sintered components, Höganäs Höganäs AB, Höganäs,

Sweeden, 2017
3. Material and Powder Properties; Handbook 1; Hoganas Handbook for Sintered Components; Hoganas AB; 2004.
4. Production of Sintered Components; Handbook 2; Hoganas Handbook for Sintered Components; Hoganas AB; 2004.
5. Design and Mechanical Properties; Handbook 3; Hoganas Handbook for Sintered Components; Hoganas AB; 2004.
6. German, R.M; Powder Metallurgy & Particulate Materials Processing; Metal Powder Industries Federation; Princeton, NJ; 2005.

| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| L. 1. Safety rules in the lab, presentation of the laboratory works. | 2 | Practical training | Prepare lab report for labs 2-4 |
| L. 2. Manufacturing and characterisation of a sintered structural part. | 4 | | |
| L. 3. Manufacturing and characterisation of a sintered porous bearing. | 4 | | |
| L. 4. Manufacturing and characterisation of a sintered porous part. Measuring the sintering degree | 4 | | |
| | | | Prepare a manufacturing project for the given part. |
| Project | | | |
| Design of the manufacturing technology of a specific PM part | 14 | | |

Bibliography:
1. German, R.M; Powder Metallurgy & Particulate Materials Processing; Metal Powder Industries Federation; Princeton, NJ; 2005
2. Iron and Steel powders for sintered components Handbook 0, Höganäs Höganäs AB, Höganäs, Sweeden, 2017
3. Production of Sintered Components; Handbook 2; Hoganas Handbook for Sintered Components; Hoganas AB; 2004

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

The acquired skills will be used in design, execution and control activities in the field of powder metallurgy and other industrial sectors where powders are used.

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | 5-10 questions | Written exam 2 h | 75% |
| 10.5 Seminars /Laboratory/Project | Overall activity + quiz | Oral/written exam 0.5 h | 25% |
| 10.6 Minimum standard of performance | | | |
| Minimum grade of 5 obtained at course exam and applications tests. | | | |

| Date of filling in: 05.05.2023 | | Title Surname Name | Signature |
|---|---|---|---|
| | Lecturer | sl.dr.ing Gyorgy Thalmaier | |
| | Teachers in charge of application | sl.dr.ing Gyorgy Thalmaier | |
| | | | |

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

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## 1. Data about the program of study

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|---|---|---|
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| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 57 |

## 2. Data about the subject

| | | |
|---|---|---|
| 2.1 | Subject name | Ceramic materials |
| 2.2 | Course responsible/lecturer | Associate professor Amalia Mesaros<br>Associate professor Traian Florin Marinca |
| 2.3 | Teachers in charge of seminars | Associate professor Amalia Mesaros<br>Associate professor Traian Florin Marinca |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.4 Year of study | 4 | 2.5 Semester | 1 | 2.6 Assessment | examination | |
| 2.7 Subject category | Formative category | | | | | DS |
| | Optionality | | | | | DI |

## 3. Estimated total time

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

| | |
|---|---|
| 3.7 Individual study: | |
| (a) Manual, lecture material and notes, bibliography | 24 |
| (b) Supplementary study in the library, online and in the field | 15 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 14 |
| (d) Tutoring | 2 |
| (e) Exams and tests | 3 |
| (f) Other activities | 0 |
| 3.8 Total hours of individual study (summ (3.7(a)…3.7(f))) | 58 |
| 3.9 Total hours per semester (3.4+3.8) | 100 |
| 3.10 Number of credit points | 4 |

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | It's not necessary |
| 4.2 | Competence | Basics of chemistry, physics and materials science |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | Presence at Technical University of Cluj-Napoca. Gadgets turned off |

| | | |
|---|---|---|
| | | during the course. |
| 5.2 | For the applications (laboratory) | Presence at laboratories is mandatory. Gadgets turned off during the laboratories. Homework is required. |

**6. Specific competences**

| | |
|---|---|
| Professional Competences | - Basic concepts on chemistry physics of silicates/oxides, non-oxidic, composites, glasses, vitroceramic and the technologies for their synthesis in various forms and shapes.<br>- Practical skill for elaboration and characterisation of ceramic materials.<br>- Capacity of determining characteristics and to interpret experimental data for ceramic materials.<br>- Knowledge in phase diagrams for oxides.<br>- Thermal treatments applied to ceramics.<br>- To correlate the characteristics of a ceramic material at a certain stage of processing with the technological flow of processing.<br>- Correlations between characteristics of ceramic materials and their industrial applications. |
| Cross competences | - Accomplishing the tasks in concordance with the imposed terms and requirements.<br>- Solving the tasks in accord with the general objectives.<br>- Permanent documentation and study. |

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

| | | |
|---|---|---|
| 7.1 | General objective | Development of competences in the field of ceramic materials. |
| 7.2 | Specific objectives | Obtaining skills for preparation and characterisation of ceramic materials. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. General aspects related to ceramic materials and technologies. | 2 | Lecture<br>PowerPoint presentation<br>Interactive teaching mode<br>Dialogue - conversation professor - student | Multimedia<br>Blackboard |
| 2. Crystalline, amorphous and vitrocrystalline ceramic structures. Structural defects. Nonstoichiometric. Solid solution. | 2 | | |
| 3. Glass structures. Vitroceramics | 2 | | |
| 4. Phase diagram in ceramics. Phase diagram of technological interests. | 2 | | |
| 5. Ceramic processing - fabrication method, calcination and sintering | 2 | | |
| 6. Transformation in ceramics. Phase transformation, diffusion. Solid state reactions. Sintering. | 2 | | |
| 7. Ceramic microstructures (sintered, porous, fibres, films). | 2 | | |
| 8. Mechanical behaviour of ceramics materials. Examples. | 2 | | |

| | | | |
|---|---|---|---|
| Applications. | | | |
| 9. Thermal behaviour of ceramic materials. Examples. Applications. | 2 | | |
| 10. Electric and electronic behaviour of ceramic materials. Examples. Applications. | 2 | | |
| 11. Magnetic behaviour of ceramic materials. Examples. Applications. | 2 | | |
| 12. Optical behaviour of ceramic materials. Examples. Applications. | 2 | | |
| 13. Chemical behaviour of ceramics. Examples. Applications. | 2 | | |
| 14. Ceramic materials selection and recycling. | 2 | | |
| Bibliography<br>[1]. W.D. Callister, Materials Science and Engineering-An Introduction, John Wiley&Sons, Inc. new York, 2000.<br>[2]. D.W. Richardson, Modern Ceramic Engineering, Marcel Dekker, Inc. New York, 1992. | | | |
| 8.2. Laboratory | Number of hours | Teaching methods | Notes |
| 1. General presentation of ceramic materials. Ceramic calculations. | 2 | Explication, conversation, Case Study. | Blackboard, computer. |
| 2. Ceramic structures. Phase diagram in ceramics. Defects. | 2 | | |
| 3. Synthesis of a glass. Density. Calculus of additive properties. | 2 | | |
| 4. Obtaining of a dense ceramic part. Calcination experiments. | 2 | | |
| 5. Porous ceramic synthesis by polyurethane foam template | 2 | | |
| 6. Temperature dependence of resistivity for ceramic materials. | 2 | | |
| 7. Optical microscopy investigation of ceramic structures. | 2 | | |
| Bibliography<br>[1]. W.D. Callister, Materials Science and Engineering-An Introduction, John Wiley&Sons, Inc. new York, 2000.<br>[2]. D.W. Richardson, Modern Ceramic Engineering, Marcel Dekker, Inc. New York, 1992.<br>[3]. www.mrs.org, www.acers.org | | | |

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

| |
|---|
| Competences will be necessary for the engineers which will work in the fields of ceramic materials including preparation, characterisation and applications. |

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | | | grade |
| 10.4 Course | Answers to the questions related to the subjects presented at courses (C). | Written test - 2 hours | 75% |
| 10.5 Laboratory | Laboratory test (L). | Written test – 1 hour | 25% |
| 10.6. Minimum standard of performance | | | |
| General examination mark $\geq 5$ (0.75C+0,25L) - L $\geq 5$ and C $\geq 5$. | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 14.03.2023 | Lecturer | Associate professor Amalia Mesaros<br>Associate professor Traian Florin Marinca | |
| | Teachers in charge of application | Associate professor Amalia Mesaros<br>Associate professor Traian Florin Marinca | |

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

# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 58,00 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Materials Selection and Design | | | |
| 2.2 | Course responsible/lecturer | | | S.l.dr.ing. Prica Virgiliu-Calin – calin.prica@stm.utcluj.ro | | | |
| 2.3 | Teachers in charge of seminars | | | S.l.dr.ing. Prica Virgiliu-Calin – calin.prica@stm.utcluj.ro | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 1 | 2.6 Assessment | Ex | | |
| 2.7 Subject category | Formative category | | | | | DS | |
| | | | | | | 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 | | 3.3 Project | 1 |
| 3.4 Total hours in the curriculum | 42 | of which | 3.5 Course | 28 | 3.6 Seminar | | 3.6 Laboratory | | 3.6 Project | 14 |

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 35 |
| (b) Supplementary study in the library, online and in the field | 13 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 7 |
| (d) Tutoring | 0 |
| (e) Exams and tests | 3 |
| (f) Other activities | |

| | |
|---|---|
| 3.8 Total hours of individual study (summ (3.7(a)...3.7(f))) | 58 |
| 3.9 Total hours per semester (3.4+3.8) | 100 |
| 3.10 Number of credit points | 4,00 |

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | |
| 4.2 | Competence | |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | Course - online to MS Teams platform |
| 5.2 | For the applications<br>- project | Works on groups of students, carried out by rotation - onsite |

**6. Specific competences**

| | |
|---|---|
| Professional competences | • Knowledge, understanding and use of terminology in the field of material selection and design;<br>• Using knowledge in the area of natural sciences to understand the relationship composition - structure - properties - use for materials;<br>• Knowledge of the basic principles regarding the design and selection of engineering materials;<br>• Knowledge of material properties;<br>• Knowledge of the main categories of materials for industrial use;<br>• Development of projects in which the design and selection of materials is necessary. |
| Cross competences | • Use of dedicated software;<br>• Awareness by students of the need for continuous information in the field of design and selection of materials. |

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

| | | |
|---|---|---|
| 7.1 | General objective | Familiarization with the terminology in the field, with the principles of design and selection of materials for engineering use. |
| 7.2 | Specific objectives | • Knowledge of the general properties of materials;<br>• Understanding the composition - structure - properties correlation for metallic, ceramic, polymeric and composite materials;<br>• Understanding the criteria underlying the design and selection of materials;<br>• Understanding the principles of material selection;<br>• Formation of an adequate technical language; |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Introduction to the design and selection of materials. The composition - structure - properties - uses correlation. The main classes of materials. | | | |
| 2. The influence of the structure on the materials properties. | | | |
| 3. Designing materials. Overview | | | |
| 4. Selection criteria of materials | | | |
| 5. Material property charts | | | |
| 7. Identification of the performance indices of the materials | | | |
| 8. Material selection charts | | | |

| | | | |
|---|---|---|---|
| 9. Selection of materials based on mechanical strength | | | |
| 10. Selection of materials based on machinability | | | |
| 11. Selection of materials based on hardening | | | |
| 12. Selection of tool materials | | | |
| 13. Eco design of materials. | | | |
| 14. Eco selection of materials. | | | |
| | | | |
| Bibliography<br>1. Domsa S., Selectia si proiectarea materialelor, UTPres, Cluj Napoca, 2006<br>2. Domsa S., Bodea M., Prica C, Baze de date – Studii de caz – Proiectarea Materialelor, Ed. Casa Cartii de Stiinta, Cluj-Napoca, 2005<br>3. Ashby M.F., Materials Selection in Mechanical Design, Elsevier, 2005<br>4. ASM Handbook, vol. 20, Materials Selection and Desing, 1997 | | | |
| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
| 1. Presentation of the CES Selector - selection software. | | | |
| 2. Case study: Selection of materials for pressure vessels | | | |
| 3. Case study: Selection of materials for fly-wheel | | | |
| 4. Case study: Selection of materials for making a connecting rod | | | |
| 5. Case study: Selection of materials for making the blades of a fan | | | |
| 6. Case study: Selection of materials for making a bicycle frame | | | |
| 7. Application of CES Selector software in the material selection process | | | |
| Bibliography<br>- Domsa S., Bodea M., Prica C, Baze de date – Studii de caz – Proiectarea Materialelor, Ed. Casa Cartii de Stiinta, Cluj-Napoca, 2005 | | | |

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

- Employers in the industrial environment expect engineers with this profile to know the materials, their design and selection methods and to use the correctly terminology;
- The structuring of the knowledge within the discipline allows an easy adaptation of the engineers to the changes that appear in the field of using new materials.

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | | | final grade |
| 10.4 Course | Knowledge and understanding of notions in the field of materials; | Final exam (14 questions) | 50 % |
| 10.5 Seminars /Laboratory/Project | Preliminary theoretical preparation; presentation of case studies; | note for the project activity | 50 % |
| 10.6 Minimum standard of performance | | | |
| • The minimum note to final exam = 5 | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 17.05.2023 | Lecturer | Lect.dr.ing. Prica Virgiliu-Calin | |
| | Teachers in charge of application | Lect.dr.ing. Prica Virgiliu-Calin | |
| | | | |

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

**SYLLABUS**

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 59,00 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Polymeric materials | | | |
| 2.2 | Course responsible/lecturer | | | PhD eng. Professor Violeta Popescu<br>violeta.popescu@chem.utcluj.ro<br>PhD eng. lecturer Gabriel Batin Gabriel.batin@stm.utcluj.ro | | | |
| 2.3 | Teachers in charge of seminars | | | PhD eng. Professor Violeta Popescu<br>violeta.popescu@chem.utcluj.ro<br>PhD eng. lecturer Gabriel Batin Gabriel.batin@stm.utcluj.ro | | | |
| 2.4 Year of study | IV | 2.5 Semester | 7 | 2.6 Assessment | C | | DS/DI |
| 2.7 Subject category | Formative category | | | | | | DS |
| | Optionality | | | | | | DI |

## 3. Estimated total time

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

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

| | |
|---|---|
| 3.8 Total hours of individual study (sum (3.7(a)…3.7(f))) | 33 |
| 3.9 Total hours per semester (3.4+3.8) | 75 |
| 3.10 Number of credit points | 4 |

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | |
| 4.2 | Competence | Chemistry, Materials Science, Materials Technology |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | |
| 5.2 | For the applications<br>Laboratory | Practical activities are mandatory. |

**6. Specific competences**

| | |
|---|---|
| Professional competences | • To acquire the main notions related to the classification, the structure, and the properties of plastic materials.<br>• To know the principles off chemical reactions, involve in the obtaining of polymers.<br>• To evaluate the impact of plastic materials on environment.<br>• To know the main fabrication processes for parts from plastic.<br>• To know to identify certain polymeric materials base on their properties.<br>• To be able to establish a fabrication technology.<br>• To be able to use the main tools used in plastic materials characterization. |
| Cross competences | • To know to establish the operation succession and technology phases.<br>• To know to design the technological process for fabrication of products from polymers.<br>• To be able to design the tools for fabrication of parts from polymers.<br>• To be able to choose the most appropriate material as a function of the characteristics of manufactured parts.<br>• Experimentally results interpretation of the main parts characteristics, and to draw appropriate conclusions. |

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

| | | |
|---|---|---|
| 7.1 | General objective | The development of competence related to polymeric materials obtaining, characterization and processing. |
| 7.2 | Specific objectives | 1. The understanding of the theoretical principles of the obtaining of polymeric materials by polymerization, polycondensation, polyaddition;<br>2. The understanding of the correlation between the structure of polymers, their properties and processing methods suitable for each type of polymeric material (thermoplastics, thermosets, and elastomers);<br>2. To know the equipment used in the manufacture of plastic parts;<br>2. Learning of the plastics processing processes;<br>3. Learning of the technical documentation on the design of technological processes for the manufacturing of plastic parts;<br>4. Environmental problems related to the processing of plastics. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Polymeric materials. Definitions and classification of | 2 | | |

| | | | |
|---|---|---|---|
| polymeric materials. | | | |
| 2. The obtaining reactions of polymers (chain polymerization, polycondensation, polyaddition). | 2 | | |
| 3. The structure and the properties of polymers. The reactivity of polymers. Polymers grafting and crosslinking. Thermoplasts, elastomers, duromers. | 2 | | |
| 4. Examples of polymers and their applications. Polyolefins, polyesters, polycarbonates, polyamides. | 2 | | |
| 5. Technologies and equipment for the preparation of plastics for processing. | 2 | | |
| 6. Technology of plastics processing by calendering. Equipment. | 2 | | |
| 7. Technology of processing plastics by extrusion. Equipment. The extrusion heads. | 2 | | |
| 8. Technology of processing plastics by injection. The principle of injection. Stages of the injection process. Injection machines. Component parts. Injection nozzles. Injection matrices. | 2 | | |
| 9. Technology processing by thermoforming and blowing of plastics. | 2 | | |
| 10. Optimization of plastics processing processes. | 2 | | |
| 11. The technology of assembling plastic parts. Mechanical assemblies, by welding and soldering. | 2 | | |
| 12. Polymers used in automotive industry. | 2 | | |
| 13. Polymers used in medicine. | 2 | | |
| 14. Recycling of polymer materials. | 2 | | |

Bibliografie


1. Popescu Violeta, Horovitz O., Damian Laura, Compozite cu matrice organică, Editura UTPRES, 2001.
2. Popescu Violeta, Horovitz O., Rusu Tiberiu, Materialele polimerice şi mediul. Editura Mediamira, Cluj-Napoca, 2005.
3. Horovitz O., Popescu Violeta, Moldovan Marioara, Prejmerean Cristina, Macromolecule şi compozite. Aplicaţii experimentale, Editura Mediamira, Cluj-Napoca, 2005.
4. Fetecău, C., Prelucrarea maselor plastice, Lit. Universităţii "Dunărea de jos" Galaţi, 1996.
5. Iclănzan, T., Plasturgie, Litografia Universităţii Tehnice Timişoara, Vol I-II, 1995.
6. Horum,S., ş.a., Memorator de materiale plastice, Seria Polimeri, Ed. T., Bucureşti, 1986.
7. Warson, H. (2001). Fundamentals of Polymer Chemistry. *Appl. Synth. Resin Latices*, 1-48.
8. Billmeyer, F. W. (1984). *Textbook of polymer science*. John Wiley & Sons.
9. Koltzenburg, S., Maskos, M., & Nuyken, O. (2017). *Polymer Chemistry* (pp. 477-491). Berlin, Germany: Springer.
10. Stevens, M. P. (1990). *Polymer chemistry* (Vol. 2). New York: Oxford university press.
11. Sun, S. F. (1994). Physical chemistry of macromolecules. *New York: John Willey and Sons Inc*.


| 8.2. Laboratory | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Polymers identification based on their properties. | 2 | Based on PowerPoint | |
| 2. The obtaining of polymer materials by radical | 2 | | |

| | | | |
|---|---|---|---|
| polymerization (bulk and emulsion polymerization). | | presentations | |
| 3. The study of behavior of plastics to mechanical tests (elongation, bending) | 2 | | |
| 4. The determination of hardness of plastic materials. | 2 | | |
| 5. The determination of viscosity of polymers. | 2 | | |
| 6. The determination of influence of temperature and pressure on the injection process. | 2 | | |
| 7. Polymers recycling. | 2 | | |

Bibliography


1. Ossi Horovitz, **Violeta Popescu,** Polymers and organic matrix composites. Laboratory works, pdf format.
2. Mihai, R., ş.a., Prelucrarea materialelor plastice, Editura Tehnică, Bucureşti, 1963.
3. Liana Hancu, Horatiu Iancau, Tehnologia materialelor nemetalice, Editura Alma Mater, Cluj-Napoca, 2003.
4. Ossi Horovitz, **Violeta Popescu,** Marioara Moldovan, Cristina Prejmerean, Macromolecule şi compozite. Aplicaţii experimentale, Editura Mediamira, (ISBN 973-713-053-7) **2005**, 207 pag.
5. Brânduşan L,. Pavel C., Mureşan R., Tehnologia Materialelor, Îndrumător pentru lucrări de laborator, Editura U.T. PRES 1999, Cluj-Napoca.
6. Mocanu D.R., Încercările materialelor, Vol I-II, Editura Tehnica Bucureşti, 1982.


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

Acquired competences will be required in design, execution and control activities in the field of processing non-metallic materials, production in SMEs and other industrial sectors involving processing processes of these types of materials.

## 10. Evaluation

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | The exam consists of a quiz with multiple answers and the development of topics related to polymer processing methods. | On-line or on-site as a function of the situation (2 hours) | 0.75 |
| 10.5 Laboratory | Solving a practical problem related to laboratory work. Synthesis material. | On-line or on-site as a function of the situation (2 hours) | 0.25 |
| 10.6 Minimum standard of performance | | | |
| Colloquium (grade C); Laborator y (grade L); Synthesis material (grade MS); N=0,5C+0,25L+0,25MS; | | | |

Condition for obtaining credits: N≥5; C≥5, L≥5; MS≥5

| **Date of filling in:** 20.04.2023 | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| | Lecturer | Prof PhD. Eng. Violeta Popescu | |
| | | Lecturer PhD. Eng. Gabriel Batin | |
| | Teachers in charge of application | Prof PhD. Eng. Violeta Popescu | |
| | | Lecturer PhD. Eng. Gabriel Batin | |
| | | | |

Date of approval in the department
26.06.2023

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

Date of approval in the faculty
10.07.2023

Dean
Prof.dr.eng. Cătălin Popa

# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 60,00 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Computer-aided Design and Manufacturing | | | |
| 2.2 | Course responsible/lecturer | | | Conf.dr.ing.Dan Frunza | | Dan.Frunza@ipm.utcluj.ro | |
| 2.3 | Teachers in charge of seminars | | | Conf.dr.ing.Dan Frunza | | Dan.Frunza@ipm.utcluj.ro | |
| 2.4 Year of study | IV | 2.5 Semester | 7 | 2.6 Assessment | C | | |
| 2.7 Subject category | Formative category | | | | | | DS |
| | Optionality | | | | | | DI |

## 3. Estimated total time

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

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 10 |
| (b) Supplementary study in the library, online and in the field | 0 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 20 |
| (d) Tutoring | 0 |
| (e) Exams and tests | 3 |
| (f) Other activities | 0 |

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

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | Technical Drawing, Material Resistance |
| 4.2 | Competence | |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | |
| 5.2 | For the applications<br>seminar / lab / proj. | 80% Teams<br>20% onsite |

**6. Specific competences**

| | |
|---|---|
| Professional competences | Design of high-performance technologies for the processing of materials based on the concept of sustainable development and under conditions of high quality of the products obtained. |
| Cross competences | 1. The use of expert knowledge for the design of high-performance technologies, under quality conditions of the products obtained<br>2. Integrated use of the conceptual and methodological apparatus and a minimum data set for the design of high-performance material processing technologies |

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

| | | |
|---|---|---|
| 7.1 | General objective | Development of high-performance technologies specific to materials engineering using an innovative spectrum of qualitative methods. |
| 7.2 | Specific objectives | Definition of techniques for designing high-performance materials engineering technologies, environmentally sustainable. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1.Finite element method basics. | 2 | | |
| 2 Static analysis (stresses, displacements, strains and factor of safety), using the finite elements method. Static Analysis for assemblies (contact). | 2 | | |
| 3.Frequency analysis. Analysis of thermal transfer processes. | 2 | | |
| 4.Buckling Analysis. Drop test Analysis. | 2 | | |
| 5.Design study. Optimizing the shape and size of an object, based on the loads and restrains to which it is subjected. | 2 | | |
| 6. Engineering methods in CAD-CAM (Manipulation of geometry, The Overlay Trial, 3D modeling), The Structure of a CNC | 2 | | |
| 7. Creating a CNC program (SolidCam program). | 2 | | |

Bibliography

1. Groover, M.P., Zimmers, E.W., “CAD/CAM: Computer Aided Design and Manufacturing”, Prentice-Hall International Editions, 1984
2. Tizzard, A., “An introduction to Computer-Aided Engineering”, McGraw-Hill Book Company, 1994

| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Stress and strain analysis of a plate. | 2 | Case study | |
| 2. Stress and strain analysis in a brachet. | 2 | | |
| 3.Stress and strain analysis in a rotating flywheel. | 2 | | |
| 4. Buckling and Frequency Analysis. | 2 | | |
| 5. Stress and strain analysis in a Shrink fit assembly. | 2 | | |
| 6. Analysis of the thermal gradient in the insulation of a pipe and in a wall of a metallic casting Mould (Steady state analysis). | 2 | | |
| 7.Analysis of thermal induced Stresses in a cylindrical part of martensitic stainless steel X20Cr13 (Transient analysis). | 2 | | |
| 8.Design of pressure vessels. | 2 | | |
| 9.Drop test analysis | 2 | | |
| 10.Creating a Design Study. Optimize the shape and mass of a part. | 2 | | |
| 11-12. The Structure of a CNC, setting up the tools, according to the machine coordinate system and the position of the part. | 4 | | |
| 13-14 Creating a CNC program (SolidCam program). | 4 | | |

Bibliography

1. Solidworks and Solidcam help and tutorials

2.. Groover, M.P., Zimmers, E.W., "CAD/CAM: Computer Aided Design and Manufacturing", Prentice-Hall International Editions, 1984

3.. Tizzard, A., "An introduction to Computer-Aided Engineering", McGraw-Hill Book Company, 1994

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

| |
|---|
| |

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | Solving a problem and answering 5 questions in theory | Written test – duration of evaluation 1.5-2 hours | 75% |
| 10.5 Seminars /Laboratory/Project | Solve an app on computer | Practical examination on computer | 25% |
| 10.6 Minimum standard of performance | | | |
| | | | |

| Date of filling in: 15.04.2023 | | Title Surname Name | Signature |
|---|---|---|---|
| | Lecturer | Conf.dr.ing Dan Frunza | |
| | Teachers in charge of application | Conf.dr.ing.Dan Frunza | |
| | | | |

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

**SYLLABUS**

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 61.10 |

## 2. Data about the subject

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Materials processing technologies | | |
| 2.2 | Course responsible/lecturer | | | Assoc. prof. Pop Mariana, | | |
| 2.3 | Teachers in charge of seminars | | | Lecturer Sas Boca Monica | | |
| 2.4 Year of study | IV | 2.5 Semester | 7 | 2.6 Assessment | | Exam |
| 2.7 Subject category | Formative category | | | | | DS |
| | Optionality | | | | | DI |

## 3. Estimated total time

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

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 28 |
| (b) Supplementary study in the library, online and in the field | 8 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 14 |
| (d) Tutoring | 4 |
| (e) Exams and tests | 4 |
| (f) Other activities | |

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

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | Materials science and engineering, Theory of Plastic deformation and fracture, Heat treatment, Computer graphics, Plastic deformation processing processes |
| 4.2 | Competence | Calculation notions: stresses, deformations, forces, energy, mechanical work. Notions of computer operation; Use of computer aided design software to make 2D and 3D geometric models. |

**5. Requirements (where appropriate)**

| | | |
|---|---|---|
| 5.1 | For the course | Theory of plasticity and materials fracture, Technological processes in materials engineering I, II (Hate treatments, Plastic deformation) |
| 5.2 | For the applications | |

**6. Specific competences**

| | |
|---|---|
| Professional competences | To apply the basic principles and methods for solving the problems appeared in the exploitation of the materials processing technologies; To use the standard criteria and methods for the analysis, evaluation of materials processing technologies and their implementation in accordance with the norms of quality, environment and labor protection; Calculate the deformation energy, pressure and deformation force corresponding to each technology; To measure process parameters; To perform in Excel the graphical processing of the results obtained at the experimental tests; To analyze and interpret the results obtained in the experimental tests. |
| Cross competences | Promoting logical, convergent and divergent reasoning, the use of rigorous, efficient and responsible work strategies, in conditions of professional autonomy and independence, based on the principles, norms and values of the code of professional ethics. Effective use of multilingual skills and knowledge of information and communication technology. |

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

| | | |
|---|---|---|
| 7.1 | General objective | Development of skills in the design of processing technologies by plastic deformation, in accordance with the norms of quality, environment and work safety, in support of professional training. |
| 7.2 | Specific objectives | 1. Assimilation of theoretical knowledge on the basic principles in the design of processing technologies by plastic deformation of materials on hammers and presses.<br>2. Development of skills for performing specific calculations in the elaboration of processing technologies by plastic deformation of materials and in the design of tools. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Forgeable and semi-finished materials used in plastic deformation processing. Processes for cutting semi-finished products. Choice of cutting procedure. Calculation of the cutting force and choice of the cutting machine. Heating of semi-finished products for plastic deformation. Establishing the optimal temperature range for plastic deformation (permissible temperature range, technological; determination of heating speed and | 2 | Exposure, conversation | Video-projector |

| | | | |
|---|---|---|---|
| duration, induction heating). | | | |
| 2. Upsetting: Discharge variants, execution modes and S.D.Vs. Technological elements at discharge. Choice of the initial semi-finished product and of the discharge equipment. | 2 | | |
| 3. Semi-finished products used for plastic deformation; cutting semi-finished products for plastic deformation; Thermal regime of plastic deformation; Advantages and disadvantages of plastic deformation processes compared to other manufacturing processes. | 2 | | |
| 4. Equipment used for plastic deformation. Constructive principles, technical characteristics. | 2 | | |
| 5 Forging processes; basic operations for open die forging: upsetting, stretching, drilling, bending, twisting (technological elements, materials); Applications. | 2 | | |
| 6. Close die forging of metals and alloys. Advantages disadvantages. Principles, deformation conditions, materials, deformation parameters. Applications. | 2 | | |
| 7. Extrusion of parts and semi-finished products. Methods, advantages disadvantages. Principles, deformation conditions, materials, deformation parameters. Applications. | 4 | | |
| 8. Drawing of wires, bars, tubes. Advantages disadvantages. Principles, deformation conditions, materials, deformation parameters. Applications. | 2 | | |
| 9. Semi-finished rolling processes, finished products; Principles, deformation conditions, materials, deformation parameters. Applications. | 2 | | |
| 10. Plastic sheet deformation processes. Deep-drawing and stamping; Principles, deformation conditions, materials. Applications. | 2 | | |
| 11. Operations after plastic deformation; Criteria for choosing the optimal technology for processing a piece. Applications. | 2 | | |
| 12. Non conventional plastic deformation processes. | 2 | | |
| 13. Aspects regarding the simulation of plastic deformation processes. Applications | 2 | | |
| Bibliography<br>Altan, T., s.a., Cold and hot forging, ASM International, 2005,<br>Dieter, G., Mechanical metallurgy, McGraw Hill, 1988,<br>Hosford, W.,F., Caddell, R.,M., Metal forming, mechanics and metallurgy, Prentice Hall, 1993.<br>Lange, K., Handbook of metal forming, Society of manufacturing engineers, 1985.<br>Laue, K., Stenger H., Extrusion, American Society for Metals, 1981,<br>Pop, M., Plastic deformatiom, Ed. Mega, 2014<br>Schey, J., A., Tribology in Metalworking, American Society for Metals, 1984. | | | |

| | | | |
|---|---|---|---|
| Metals Handbook, Vol.14, Forming and Forging, Ninth Edition | | | |
| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
| 1. Prezentarea lucrarilor | 2 | Exposition, discussions, experimental tests, simulations | Experimental installations, computers, software |
| 2.Gaurirea cu dorn plin si tubular | 2 | | |
| 3.Matritarea cu bavura, Matritarea fara bavura: stabilirea fortei de matritare | 2 | | |
| 4.Studiul influentei parametrilor geometrici ai zonei de deformare asupra fortei de extrudare | 2 | | |
| 5.Trefilarea sarmelor: stabilirea fortei de trefilare | 2 | | |
| 6.Stabilirea fortei de deformare la laminare | 2 | | |
| 7. Aplicarea softului Forge in analiza procedeelor de deforamre plastica. Compararea rezultatelor obtinute prin simulare cu cele experimentale. | 2 | | |
| Bibliography<br>Neag, A., Pop, M., Plastic Deformation, Aplication, UTPress, 2009. | | | |

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

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

**10. Evaluation**

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

| Date of filling in: 10.04.2023 | | Title Surname Name | Signature |
|---|---|---|---|
| | Lecturer | Assoc.prof.Pop Mariana | |
| | Teachers in charge of application | Assoc.prof.Pop Mariana | |
| | | | |

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

# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 61,20 |

## 2. Data about the subject

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Ecomaterials | | |
| 2.2 | Course responsible/lecturer | | | S.l.dr.ing. Thalmaier Gyorgy | | |
| 2.3 | Teachers in charge of seminars | | | S.l.dr.ing. Thalmaier Gyorgy | | |
| 2.4 Year of study | 4 | 2.5 Semester | 7 | 2.6 Assessment | Exam | |
| 2.7 Subject category | Formative category | | | | | DS |
| | Optionality | | | | | DOB |

## 3. Estimated total time

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

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 18 |
| (b) Supplementary study in the library, online and in the field | - |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 14 |
| (d) Tutoring | 2 |
| (e) Exams and tests | 2 |
| (f) Other activities | |

| | |
|---|---|
| 3.8 Total hours of individual study (summ (3.7(a)...3.7(f))) | 36 |
| 3.9 Total hours per semester (3.4+3.8) | 78 |
| 3.10 Number of credit points | 3 |

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | N/A |
| 4.2 | Competence | Basic knowledge of Technical Drawing, Materials Science and Materials Technology |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | Lectures online MS Teams/onsite |
| 5.2 | For the applications | Applications online MS Teams /onsite |

**6. Specific competences**

| | |
|---|---|
| Professional competences | Discuss the concept "sustainable development" and analyse environmental, social and economic perspectives on materials development.<br>Give an overview of toxicological effects on human and ecology from materials production and usage.<br>Discuss energy usage and energy-relevant materials from sustainability perspective. |
| Cross competences | Give an overview of the application of the legislation within the environmental area for material exploitation, production and usage.<br>Apply simplified life cycle assessment methodology.<br>Describe the structure of the environmental management system ISO 14001 and how to implement it. |

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

| | | |
|---|---|---|
| 7.1 | General objective | This course looks at where important materials in products we use every day come from and how these materials can be used more efficiently, longer, and in closed loops. |
| 7.2 | Specific objectives | In addition to providing many cases of managing materials for sustainability, the course also teaches skills and tools for analysing circular business models and promotes development of your own ideas to become more involved in the transition to a Circular Economy. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. General issues about ecology, pollutants and pollution | 4 | Interactive methods using digital equipment, video materials, cases studies | Digital media content included |
| 2. Recycled materials | 2 | | |
| 3. Renewable materials | 2 | | |
| 4. Materials for efficiency | 2 | | |
| 5. Materials for waste treatment | 4 | | |
| 6. Materials for reduction of environment load | 2 | | |
| 7. Materials for easy disposal or recycle | 2 | | |
| 8. Hazardous free materials | 2 | | |
| 9. Materials for reducing human health impact | 2 | | |
| 10. Materials for energy efficiency | 3 | | |
| 11. Materials for green energy | 3 | | |

Bibliography

1. Ashby, M. F., Materials and the environment : eco-informed material choice, Oxford: Butterworth-Heinemann, 2009

| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Safety rules in the lab, presentation of the laboratory works. | 2 | Practical training | Prepare lab report for labs 2-6 |
| 2. Materials recycling and upcycling | 2 | | |
| 3. Industrial waste valorisation | 2 | | |
| 4. Energy production, storage and reduction of energy use | 2 | | |
| 5. Eco building materials | 2 | | |
| 6. Functionally graded materials | 4 | | |

Bibliography:


1. German, R.M; Powder Metallurgy & Particulate Materials Processing; Metal Powder Industries Federation; Princeton, NJ; 2005
2. Ashby, M. F., Materials and the environment: eco-informed material choice, Oxford: Butterworth-Heinemann, 2009


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

The acquired skills will be used in design, execution and control activities in the field materials.
Up-to-date technical skills and state-of-the-art technological knowledge.
An entrepreneurial mindset, focused on the sustainability of industrial activities.

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | 5-10 questions | Written exam 2 h | 75% |
| 10.5 Seminars /Laboratory/Project | Overall activity + short quiz from lab reports | Oral/written exam 0.5 h | 25% |
| 10.6 Minimum standard of performance | | | |
| Minimum grade of 5 obtained at course exam and laboratory tests. | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 05.05.2023 | Lecturer | sl.dr.ing Gyorgy Thalmaier | |
| | Teachers in charge of application | sl.dr.ing Gyorgy Thalmaier | |
| | | | |

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

# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 62 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Composite Materials | | | |
| 2.2 | Course responsible/lecturer | | | Lect. dr.ing. Sechel Argentina-Niculina - Niculina.Sechel@stm.utcluj.ro | | | |
| 2.3 | Teachers in charge of seminars | | | Lect. dr.ing. Sechel Argentina-Niculina - Niculina.Sechel@stm.utcluj.ro | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 8 | 2.6 Assessment | Exam | | |
| 2.7 Subject category | Formative category | | | | | | DS |
| | Optionality | | | | | | DI |

## 3. Estimated total time

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

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 30 |
| (b) Supplementary study in the library, online and in the field | 10 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 13 |
| (d) Tutoring | 2 |
| (e) Exams and tests | 3 |
| (f) Other activities | - |

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

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | |
| 4.2 | Competence | Knowledge from Materials Technology, Metallic Materials, Polymeric Materials and Ceramic Materials fields. |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | |
| 5.2 | For the applications seminarului / laboratorului / proiectului | Attendance at the laboratory is mandatory according to UTCN regulations |

## 6. Specific competences

| | |
|---|---|
| Professional Competences | Knowledge about composite materials types, materials for matrices and materials for reinforcing elements.<br>Knowledge about the methods and technological procedures for elaboration and processing of composite materials<br>Knowledge about the methods for determining the specific characteristics of each class of composite materials<br>Knowing the selection criteria of a composite material type for a given application |
| Cross competences | Promoting the logical reasoning, efficiency and responsibility in the activities carried out<br>Awareness of the need for continuous training and professional development in order to enter the labor market<br>To promote the teamworking in practical laboratory activities |

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

| | | |
|---|---|---|
| 7.1 | General objective | • Development of skills in the field of composite materials in support of vocational training |
| 7.2 | Specific objectives | • Assimilation of the theoretical bases regarding the main types of composite materials and their specific elaboration procedures<br>• Understanding the reinforcement mechanism, knowledge of the factors that determine the properties of composite materials<br>• Obtaining the skills to use specific laboratory devices and equipment for the elaboration and characterization of composite materials |

## 8. Contents

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. General considerations on composite materials - history, definitions, constituent materials, classification criteria | 2 | Power Point Prezentation Interactive teaching mode university lecture | |
| 2. Materials for matrices. Matrix functions. Types of matrix materials (metallic, ceramic and polymeric materials) | 2 | | |
| 3. Reinforcement materials. Functions of reinforcements | 2 | | |
| 4. Fiber reinforcement materials (continuous and short fibers) – processing, forms, types, properties | 2 | | |
| 5. Discontinuous Reinforcements (whiskers and particles) – processing, types, properties | 2 | | |

| | | | |
|---|---|---|---|
| 6. Compatibility between the matrix and the reinforcement material | 2 | Teacher-student dialogue | |
| 7. Interface problems of composite materials. Methods for improving the adhesion between matrix and reinforcement materials | 2 | | |
| 8. Processing of metal matrix composites. Properties and applications of metal matrix composites. | 2 | | |
| 8. Processing of ceramic matrix composites. Properties and applications of ceramic matrix composites. | 2 | | |
| 9. Processing of polymer matrix composites. | 2 | | |
| 10. Properties and applications of the polymer matrix composites | 2 | | |
| 11. Behavior of composite materials at external loads. | 2 | | |
| 12. Methods of investigation of composite materials. | 2 | | |
| 13. Selection of the composite materials. Case studies | 2 | | |

Bibliography


1. V. Iancău, Materiale metalice compozite şi tratamentele lor termice, Ed. Dacia, 1999.
2. O. Gângu, Materiale compozite uşoare, Ed. Universităţii din Craiova, 2003.
3. F. Ştefănescu, ş.a., Materialele viitorului se fabrică azi - Materiale compozite, Ed. D.P., Bucureşti, 1986.
4. T. Dobra, ş.a., Materiale compozite cu matrice metalica: aliaje dure sinterizate, Cluj-Napoca, U.T.Press, 2003
5. C. Dumitras, C. Opran, Prelucrarea materialelor compozite, ceramice şi minerale, Ed. Tehnică, Bucuresti, 1994
6. P. Moldovan, Compozite cu matrice metalică, Ed. Printech, Bucuresti, 2008.
7. *** ASM Handbook, Composites, ASM Int., 1992, ASM Int., 1992
8. G. Neagu, F. Ştefănescu, Metallic Matrix Composites with Particles, Ed. Bren, Bucureşti, 2002.
9. Manoj Gupta, Nai Mui Ling Sharon, Magnesium, magnesium alloys, and magnesium composites, John Wiley and Sons, 2011


| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Presentation of the laboratory works, de manner of the lab work will be development and the norms of labor protection. Analysis of the morphology of composite reinforcements. | 2 | Exposure and applications | |
| 2. Determination of the reinforcement's volume fraction in the composite materials. | 2 | | |
| 3. Establishing the technological parameters for the elaboration of composite materials by liquid phase infiltration. | 2 | | |
| 4. Obtaining of the parts from composite materials through powder metallurgy processes. | 2 | | |
| 5. Obtaining of the polymer matrix composites by Hand lay-up technique. | 2 | | |
| 6. Study of the structure of composite materials by optical microscopy and scanning electron microscopy. | 2 | | |

| | | | |
|---|---|---|---|
| 7. Tensile properties of fiber reinforced polymer matrix composites. | 2 | | |
| Bibliography<br>1. Gy. Thalmaier, N.A. Sechel, I. Vida-Simiti, Metalurgia pulberilor - aplicaţii practice, Ed. UTPress, 2015<br>2. B. V. Neamţu, T. F. Marinca, F. Popa, Tehnici de analiză a materialelor: Aplicații practice, Ed. UTPRES, Cluj-Napoca, 2015<br>3. G. Hubca, M. Margareta, Materiale compozite, Ed. Tehnică, 1999. | | | |

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

| |
|---|
| The acquired competencies will be necessary for the employees who carry out their activity within a sector of design / processing / characterization of composite materials. |

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | Assessment of the knowledge taught, by solving tests that consist of topics / questions from the theoretical part and problems (E) | Written test - duration of assessment 2 hours | 75 % |
| 10.5 Seminars /Laboratory/Project | Students will be evaluated at each laboratory session with taking into account the degree of involvement and how to process and interpret the results in practical activities. The final grade in the laboratory (L) represents the arithmetic mean of the grades from each practical session | - continuous evaluation | 25 % |
| 10.6 Minimum standard of performance | | | |
| Examination grade (E) ≥ 5; Laboratory grade (L) ≥ 5, (Final grade = 0.75E + 0.25L) | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 04.05.2023 | Lecturer | Lect. dr.ing. Argentina-Niculina Sechel | |
| | Teachers in charge of application | Lect. dr.ing. Argentina-Niculina Sechel | |
| | | | |

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

**SYLLABUS**

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 63 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | Materials with special applications | | | | | |
| 2.2 | Course responsible/lecturer | Associate professor Traian Florin Marinca, marinca.traian@stm.utcluj.ro<br>Associate professor Florin Popa, florin.popa@stm.utcluj.ro | | | | | |
| 2.3 | Teachers in charge of seminars | Associate professor Traian Florin Marinca, marinca.traian@stm.utcluj.ro<br>Associate professor Florin Popa, florin.popa@stm.utcluj.ro | | | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 2 | 2.6 Assessment | examination | | |
| 2.7 Subject category | Formative category | | | | | | DS |
| | Optionality | | | | | | DI |

## 3. Estimated total time

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

| | |
|---|---|
| 3.7 Individual study: | |
| (a) Manual, lecture material and notes, bibliography | 22 |
| (b) Supplementary study in the library, online and in the field | 14 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 14 |
| (d) Tutoring | 4 |
| (e) Exams and tests | 4 |
| (f) Other activities | |

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

## 4. Pre-requisites (where appropriate)

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

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | Presence at Technical University of Cluj-Napoca at Materials Science and Engineering Department |
| 5.2 | For the applications (laboratory) | Presence at Technical University of Cluj-Napoca at Materials Science and Engineering Department laboratories |

**6. Specific competences**

| | |
|---|---|
| Professional competences | To know the ensemble of the physical, mechanical and technological properties of the materials, of their domains of variation on classes of materials and within the classes of materials<br>To understand the interdependence of material-structure-property-use.<br>To evaluate the engineering materials from the point of view of their properties |
| Cross competences | After completing the discipline students will be able to:<br>-To acquire an adequate scientific language, with specific engineering notions.<br>-Understand the difference between the different types of structures that appear in materials<br>-Understand the operation of complex research and investigation equipment<br>-To be able to correlate the microstructural properties with the physical-mechanical properties of a material<br>-Know how to use the material-structure-property correlation to modify the properties of the material.<br>-Know how to analyse material data, to be able to make correlations between the properties of the material and its use in practice<br>-Know how to intervene creatively in the production of new materials, new processing technologies and in finding solutions to guide the properties of materials in the direction of their rational use |

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

| | | |
|---|---|---|
| 7.1 | General objective | Development of competencies in the field of materials with special applications (magnetic materials, superconducting materials, smart materials etc). |
| 7.2 | Specific objectives | Understanding the physical, optical and structural properties of materials with special applications. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. High permeability magnetic materials | 3 | Lecture<br>PowerPoint presentation<br>Interactive | Multimedia |
| 2. Materials for magnetic recordings | 2 | | |
| 3. Superconducting materials at high temperatures | 2 | | |
| 4. Permanent magnets based on rare earths | 3 | | |
| 5. Magnetic ceramic materials | 2 | | |
| 6. Homogeneous semiconductor materials with | 2 | | |

| | | | |
|---|---|---|---|
| junctions. Oxidic and organic semiconductors. | | teaching mode<br><br>Dialogue - conversation professor - student | Blackboard |
| 7. Use of ceramic, plastic, liquid and gaseous insulating materials in electronics and microelectronics | 2 | | |
| 8. Materials used in the manufacture of accumulators, batteries and fuel cells. Technology. Applications | 2 | | |
| 9. Photoelectric cells. Technology. Applications | 2 | | |
| 10. Smart materials. Metallic and polymeric materials with shape memory. | 4 | | |
| 11. Materials for brushes and electrical contacts | 2 | | |
| 12. Thermoelectric materials | 2 | | |
| | | | |
| | | | |

Bibliography


[1]. Traian Florin Marinca – course notes
[2]. Florin Popa – course note
[3]. P.Y. Yu, M. Cardona, Fundamentals of Semiconductors Physics and Materials Properties Fourth Edition, Springer-Verlag Berlin Heidelberg 2010
[4]. D. Linden, T.B. Reddy, Handbook of Batteries Third Edition, McGraw-Hill, 2002
[5]. M. Schwartz, Encyclopedia of Smart Materials, John Wiley & Sons, Inc., 2002
[6]. Michael Coey, Magnetism and Magnetic Materials, 2009, ISBN-13: 978-0521816144, Cambridge University Press
[7]. J. Ping Liu, Eric Fullerton, Oliver Gutfleisch, D.J. Sellmyer, Nanoscale Magnetic Materials and Applications, Springer-Verlag US 2009, ISBN 978-0-387-85598-1


| 8.2. Laboratory | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Determining the optimal operating point of a permanent magnet | 2 | Explication, conversation, Case Study. | Blackboard, computer, specialized software |
| 2. The influence of thermomagnetic treatments on magnetic permeability | 2 | | |
| 3. Obtaining NdFeB bonded magnets. | 2 | | |
| 4. Determining the capacity and charging characteristics of lead and nickel batteries. | 2 | | |
| 5. Determining the conversion efficiency of photoelectric cells | 2 | | |
| 6. Temperature variation of the shape memory effect | 2 | | |
| 7. Study of electrical contact wear | 2 | | |

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[1]. Traian Florin Marinca – course notes
[2]. Florin Popa – course note
[3]. P.Y. Yu, M. Cardona, Fundamentals of Semiconductors Physics and Materials Properties Fourth Edition, Springer-Verlag Berlin Heidelberg 2010
[4]. D. Linden, T.B. Reddy, Handbook of Batteries Third Edition, McGraw-Hill, 2002
[5]. M. Schwartz, Encyclopedia of Smart Materials, John Wiley & Sons, Inc., 2002
[6]. Michael Coey, Magnetism and Magnetic Materials, 2009, ISBN-13: 978-0521816144,

Cambridge University Press
[7]. J. Ping Liu, Eric Fullerton, Oliver Gutfleisch, D.J. Sellmyer, Nanoscale Magnetic Materials and Applications, Springer-Verlag US 2009, ISBN 978-0-387-85598-1

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

Skills will be required for employees who will work as technological engineers. The acquired competencies will be used by those who will carry out their activity within departments whose activity is the innovation, development of new materials with special applications or elaboration, characterization and testing of materials, as well as within the departments that are authorized to certify the quality of a material.

**10. Evaluation**

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

| Date of filling in: | | Title Surname Name | Signature |
|---|---|---|---|
| 17.04.2023 | Lecturer | Associate professor Traian Florin Marinca<br>Associate professor Florin Popa | |
| | Teachers in charge of application | Associate professor Traian Florin Marinca<br>Associate professor Florin Popa | |

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

**SYLLABUS**

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 64 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Advanced materials and technologies | | | |
| 2.2 | Course responsible/lecturer | | | Assoc.Prof. Bogdan Viorel Neamtu<br>Assoc.Prof. Gavril Negrea | | | |
| 2.3 | Teachers in charge of seminars | | | Assoc.Prof. Bogdan Viorel Neamtu<br>Assoc.Prof. Gavril Negrea | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 2 | 2.6 Assessment | | | E |
| 2.7 Subject category | Formative category | | | | | | DS |
| | Optionality | | | | | | DI |

## 3. Estimated total time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | 3 | of which | 3.2 Course | 2 | 3.3 Seminar | 0 | 3.3 Laboratory | 1 | 3.3 Project | 0 |
| 3.4 Total hours in the curriculum | 100 | of which | 3.5 Course | 28 | 3.6 Seminar | 0 | 3.6 Laboratory | 14 | 3.6 Project | 0 |

| | |
|---|---|
| 3.7 Individual study: | |
| (a) Manual, lecture material and notes, bibliography | 16 |
| (b) Supplementary study in the library, online and in the field | 20 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 14 |
| (d) Tutoring | 4 |
| (e) Exams and tests | 4 |
| (f) Other activities | 0 |
| 3.8 Total hours of individual study (summ (3.7(a)…3.7(f))) | 58 |
| 3.9 Total hours per semester (3.4+3.8) | 100 |
| 3.10 Number of credit points | 4 |

## 4. Pre-requisites (where appropriate)

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

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | Venue: Room E114, Faculty of Materials Engineering and |

| | | |
|---|---|---|
| | | Environmental, Labor Blvd. 103-105 Cluj Napoca, |
| 5.2 | For the applications seminarului / laboratorului / proiectului | Venue: Rooms: C 409, E09-1, E05-3, E110, Faculty of Materials and Environmental Engineering, B-dul Muncii 103-105 Cluj Napoca, |

**6. Specific competences**

| | |
|---|---|
| Professional competences | To know technologies for producing advanced materials: sol-gel method, mechanosynthesis, SPS, PVD, CVD<br>• To know the advanced materials produced by advanced technologies • To understand the interdependence of material-structure-property-use.<br>• To evaluate engineering materials from the point of view of their properties<br>• To develop skills and the ability to operate with measurement data.<br>• Know how to process statistics and interpret measurement data<br>• Know how to analyze data provided by equipments<br>• Know how to interpret data obtained from devices that work on different principles, but measure the same parameters of the material<br>• To know how to use correctly the complex equipment in the laboratory<br>• To form skills and the ability to operate with: optical, electronic microscopes, structural investigation devices, etc. |
| Cross competences | • To acquire an adequate scientific language, with specific engineering notions.<br>• ability to distinguish relevant information from irrelevant information<br>• ability to recognize the essential features of the phenomena studied<br>• ability to work cooperatively and flexibly in a research / analysis group<br>• ability to develop and implement an analysis plan / project<br>• ability to promote initiative, dialogue, cooperation, positive attitude, respect for others, diversity / multiculturalism, continuous improvement of one's professional activities<br>• objective self-assessment of the need for continuous training<br>• ability to use multilingual skills effectively and knowledge of information technology. |

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

| | | |
|---|---|---|
| 7.1 | General objective | To be informed about special technologies for the production of advanced materials |
| 7.2 | Specific objectives | To know the methods of rapid and ultra-rapid quenching, mechanical alloying, reactive milling, spark plasma sintering, PVD, CVD, sol-gel, vacuum technique. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Introduction: variants of chemical methods for obtaining materials. | 2 | | |
| 2. Chemistry of the precursors used in the sol-gel process: oxides, metal salts, alkoxides, carboxylates, | 2 | | |

| | | | |
|---|---|---|---|
| acetylacetonates. Soil formation and stability. The hydrolysis-condensation | | Lecture<br><br>PowerPoint presentation<br><br>Interactive teaching mode<br><br>Teacher-student dialogue | Multimedia<br><br>Blackboard |
| 3. Gelling (sol-gel transition): phenomenology; classical theory and percolation theory; kinetic models. Aging and drying gels. | 2 | | |
| 4. Phenomenology and structural evolution 5. | 2 | | |
| 5. Sintering mechanisms | 2 | | |
| 6. Applications of the sol-gel process. Movies and covers. Monolithic block. Powders. Fiber. Composites | 2 | | |
| 7. Intelligent materials | 2 | | |
| 8. Methods of mechanosynthesis. Mechanical alloying | 2 | | |
| 9. Mechanical grinding, Reactive grinding. Applications | 2 | | |
| 10. Effects of rapid cooling. Methods for obtaining amorphous alloys by rapid cooling | 2 | | |
| 11. Spark Plasma sintering. Principles. Applications | 2 | | |
| 12. Vacuum technique | 2 | | |
| 13. Obtaining materials through PVD technique. Properties. Applications | 2 | | |
| 14. Obtaining materials by CVD technique. Properties. Applications | 2 | | |

Bibliography


1. Cavaliere Pasquale, Spark Plasma Sintering of Materials, 2019, Springer International Publishing, 2019.
2. M.A.Otooni-Elements of Rapid Solidification Springer-Verlag Berlin, 1998 9.
3. J.F.Shackelford- Introduction to Materials Science for Engineers, Macmillan P.C., 1998
4. Cury Suryanarayana, Mechanical alloying and milling, 1995, CRC Press.
5. David Levy, Marcos Zayat, The Sol-Gel Handbook, 2015, Wiley-VCH Verlag GmbH & Co. KGaA, ISBN:9783527334865
6. Donald M. Mattox, Handbook of Physical Vapor Deposition (PVD) Processing, 2010, Elsevier, ISBN 978-0-8155-2037-5.


| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Preparation by chemical methods of ZnO thin films | 2 | Practical measurements, data recording, spectrum interpretation, mathematical calculation. | Blackboard, computer, Specialized software and equipment |
| 2. Nanoscale zinc oxide synthesis | 2 | | |
| 3. Thermal, structural and morphological characterization of the obtained ZnO films and powders | 2 | | |
| 4. Obtaining the Ni3Fe compound by mechanical alloying and its characterization | 2 | | |
| 5. Establishing the thermodynamic conditions for obtaining amorphous alloys. Case Study. | 2 | | |
| 6. Obtaining by SPS a nanocrystalline compact from mechanically alloyed powders | 2 | | |
| 7. Obtinerea unuor straturi subţiri prin PVD | 2 | | |

Bibliography

1. Cavaliere Pasquale, Spark Plasma Sintering of Materials, 2019, Springer International Publishing, 2019.
2. M.A.Otooni-Elements of Rapid Solidification Springer-Verlag Berlin, 1998 9.
3. J.F.Shackelford- Introduction to Materials Science for Engineers, Macmillan P.C., 1998
4. Cury Suryanarayana, Mechanical alloying and milling, 1995, CRC Press.
5. David Levy, Marcos Zayat, The Sol-Gel Handbook, 2015, Wiley-VCH Verlag GmbH & Co. KGaA, ISBN:9783527334865
6. Donald M. Mattox, Handbook of Physical Vapor Deposition (PVD) Processing, 2010, Elsevier, ISBN 978-0-8155-2037-5.

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

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

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | Assessment of the knowledge taught - at the end of the semester (grade V), by solving some tests that consist of a theoretical part and problems | Written test / Oral test | 80% |
| 10.5 Seminars /Laboratory/Project | Students will be evaluated at each laboratory session taking into account the degree of involvement and how to process and interpret the results in practical activities. The final grade in the laboratory (L) represents the arithmetic mean of the grades from each practical session | Written test / Oral test | 20% |
| 10.6 Minimum standard of performance | | | |
| • Colloquium note ≥ 5; Laboratory grade ≥ 5, (Colloquium grade = 0.8 V + 0.2L) | | | |

| Date of filling in: | | Title Surname Name | Signature |
|---|---|---|---|
| 16.05.2023 | Lecturer | Assoc.Prof. Bogdan Viorel Neamtu<br>Assoc.Prof. Gavril Negrea | |
| | Teachers in charge of application | Assoc.Prof. Bogdan Viorel Neamtu | |
| | | Assoc.Prof. Gavril Negrea | |
| | | | |

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

# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 65.00 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Numerical control systems in materials processing | | | |
| 2.2 | Course responsible/lecturer | | | Assoc. Prof. Dan Frunza | | | |
| 2.3 | Teachers in charge of seminars | | | Lecturer Dan Noveanu | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 8 | 2.6 Assessment | | Exam | |
| 2.7 Subject category | Formative category | | | | | DS | |
| | Optionality | | | | | DI | |

## 3. Estimated total time

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

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 14 |
| (b) Supplementary study in the library, online and in the field | 7 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 14 |
| (d) Tutoring | 7 |
| (e) Exams and tests | 2 |
| (f) Other activities | |

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

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | |
| 4.2 | Competence | |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | |
| 5.2 | For the applications<br>Seminars /Laboratory/ | |

| | | |
|---|---|---|
| | Project | |

## 6. Specific competences

| | |
|---|---|
| Professional competences | To be able to analyse the functionality of a manufacturing system and to identify the elements of specific order<br>Know the components / equipment of digital control specific to the processing of materials<br>To be able to conceive and design a combinational circuit, respectively a sequential circuit of digital control |
| Cross competences | Carrying out activities and exercising the specific roles of teamwork, on different hierarchical levels, promoting the spirit of initiative, dialogue, cooperation, positive attitude, respect for others, diversity and multiculturalism and continuous improvement of one's activity.<br>The objective self-assessment of the need for professional training continues, in order to be inserted on the labour market and to adapt to the dynamics of its requirements and for personal and professional development. Effective use of multilingual skills and knowledge of information and communication technology. |

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

| | | |
|---|---|---|
| 7.1 | General objective | Development of skills in the field of digital order processing of materials in the context of permanent improvement of control equipment. |
| 7.2 | Specific objectives | Identification of different control systems and functional blocks composing them, based on the functional requirements of some equipment of materials processing.<br>Developing skills to understand how it works / definition / conception of an integrated manufacturing system, through the prism of the flow informational, respectively of the control system that coordinates it. |

## 8. Contents

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| Course 1. Fundamentals of ordering manufacturing systems. | 2 | Exposure, discussions | Video-projector |
| Course 2. Symbols. Component element. | 2 | | |
| Course 3. Basic concepts about processing systems. | 2 | | |
| Course 4. Digital control | 2 | | |
| Course 5. Combinational logic circuits. | 2 | | |
| Course 6. Sequential logic circuits | | | |
| Course 7. Sensors and transducers used in a manufacturing system. | 2 | | |
| Course 8. Microprocessor in control of manufacturing systems; microprocessor systems | 2 | | |
| Course 9. Microcontrollers; structure / block diagram of a microcontroller system; examples of control devices with microcontrollers. | 2 | | |

| | | | |
|---|---|---|---|
| Course 10. Programmable automata integrated in a manufacturing system | 2 | | |
| Course 11. Principles of designing the digital control scheme | 2 | | |
| Course 12. Digital control diagrams specific to the various components of a manufacturing system | 2 | | |
| Course 13. Examples of digital control for various cutting applications | 2 | | |
| Course 14. Machines, equipment, industrial robots and Artificial Intelligence | 2 | | |

Bibliography


1. Baiesu., A.-S. – Tehnica reglarii automate, Editura MatrixRom, Bucuresti, 2012, ISBN
2. Chircor, M., ş.a. – Elemente de cinematica, dinamica şi planificarea traiectoriilor roboţilor industriali, Editura Academiei Române, Bucureşti, 2001, ISBN .
5. Damian, M., Cărean, Al. – Fabricaţie asistată de calculator, Editura Casa Cărţii de Ştiinţă, Cluj-Napoca, 2003, ISBN .
6. Davidoviciu, A., ş.a. – Modelarea, simularea şi comanda manipulatoarelor şi roboţilor industriali, Editura Tehnică, Bucureşti, 1986, ISBN .
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8. Moise., - Automate programabile de tip industrial, Editura MatrixRom, Bucuresti, 2010, ISBN
9. Trandafir, M., ş.a. – Automatizarea proceselor de productie, Elemente tehnologice si constructive, Oficiu de informare documentara pentru industria constructiilor de masini, Bucuresti, 1992


| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| Laboratory presentation, norms regarding labor protection. Hardware components of computer systems. Signals; | 2 | Exposure, Applications | Video projector, Computers, Equipment |
| Elements of the control system of a manufacturing system (parameters, characteristics, etc.) | 4 | | |
| Digital circuits: combinational logic circuits; | 2 | | |
| Digital circuits: sequential logic circuits; pulse distributors | 2 | | |
| Sensors and transducers (characteristics, operation, measurement and testing, etc.).the various components of a microcontroller (ports, timers-counters, serial interface). | 2 | | |
| PLCs: configuration; testing; programming. Applications with PLCs. | 4 | | |
| Computer management of a manufacturing system (specific simulation and functional testing software). | 12 | | |

Bibliography


1. Bostan, E., ş.a. – Sisteme de reglare automata, Culegere de probleme, Editura MatrixRom, Bucuresti, 2011, ISBN
2. Bostan, E., ş.a. – Servomecanisme, Indrumar de laborator, Editura MatrixRom, Bucuresti, 2009, ISBN
3. Csipkes, G., ş.a. – Circuite integrate digitale, Culegere de probleme, Editura U.T.Pres, 2011, ISBN
4. Ciumbulea, G. –Sisteme digitale, Teorie si aplicatii industriale, Editura Electra, Bucuresti, 2005,

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5. Domsa, A., ş.a. – Elemente de reglare automata, Editura U.T.Pres, 2005, ISBN
6. Navrapesu, C., ş.a. – Utilizarea microcontrolerelor industriale, Editura ICPE, Bucuresti, 2000, ISBN
7. Petre, V.-C. – Introducere in microcontrolere si automate programabile, Editura MatrixRom, Bucuresti, 2010, ISBN
8. Spranceana, N. ş.a. – Automatizari discrete in industrie, Culegere de probleme, Editura Tehnica,
Bucuresti, 1978
9. Szasz Csaba – Sisteme numerice de comanda si control, Editura U.T.Pres, 2006,

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

The skills acquired are necessary for any engineer in the specialty of Materials Processing Engineering / Materials Science, who operates a manufacturing system.

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | Answers to 8 theory questions and solving 2 problems | Written exam, 2 hours | 60% |
| 10.5 Seminars /Laboratory/Project | Completion of the 14 laboratory works<br>Solving homework | Observation and analysis of practical activities carried out by students<br>Homework check | 40% |
| 10.6 Minimum standard of performance | | | |
| Promoting the laboratory activity with grade 5 and solving the homework; Correct answer to 4 questions and 1 problem solved at the written exam. | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 4.05.2023 | Assoc.Prof. | Dan Frunza | |
| | Lecturer | Dan Noveanu | |
| | | | |

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

# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 66,10 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Modelling and simulation in materials science | | | |
| 2.2 | Course responsible/lecturer | | | Lecturer Ph.D Eng. DAN NOVEANU | | | |
| 2.3 | Teachers in charge of seminars | | | Lecturer Ph.D Eng. DAN NOVEANU | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 2 | 2.6 Assessment | V | | |
| 2.7 Subject category | Formative category | | | | | | DS |
| | Optionality | | | | | | 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 | - |
| 3.4 Total hours in the curriculum | 28 | of which | 3.5 Course | 14 | 3.6 Seminar | - | 3.6 Laboratory | 14 | 3.6 Project | - |

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 10 |
| (b) Supplementary study in the library, online and in the field | 15 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 10 |
| (d) Tutoring | 10 |
| (e) Exams and tests | 2 |
| (f) Other activities | 0 |

| | |
|---|---|
| 3.8 Total hours of individual study (summ (3.7(a)...3.7(f))) | 47 |
| 3.9 Total hours per semester (3.4+3.8) | 75 |
| 3.10 Number of credit points | 3 |

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | Applied Informatics II |
| 4.2 | Competence | 3D Modelling of parts and assemblies |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | On-line |
| 5.2 | For the applications seminarului / laboratorului / proiectului | On-line |

## 6. Specific competences

| | |
|---|---|
| Professional competences | After completing the discipline students will be able to:<br>• To know aspects of the most advanced techniques and methods of geometric modeling of the solid and simulation of the mechanical interaction between objects.<br>• Know how to use the "Simulation" module integrated into the SolidWorks program.<br>• Use the computer to model and simulate material resistance problems, thermal transfer, etc. |
| Cross competences | Acquiring knowledge specific to the field of engineering for the purpose of vocational training and entry into the labor market. |

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

| | | |
|---|---|---|
| 7.1 | General objective | Development of competences in the field of modelling and simulation. |
| 7.2 | Specific objectives | Assimilation of theoretical knowledge on the use of Simulation module in SolidWorks.<br>Ability to make complex mechanical simulations. |

## 8. Contents

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| Introduction. (General principles of modeling and simulation, finite element method) | 2 | Lecture+case studies, discussions | On-line, TEAMS |
| Presentation of the "Simulation" module integrated into the SolidWorks program. | 2 | | |
| Static analysis with "Simulation" | 2 | | |
| Simulation of thermal transfer processes (stationary and transient) | 2 | | |
| Modal analysis and buckling with "Simulation" | 2 | | |
| Optimization studies using the "Simulation" module | 2 | | |
| Impact studies using the "Simulation" module | 2 | | |
| Bibliography<br>1. CosmosWorks User's Guide<br>2. Kurowski_Engineering_Analysis_with_CosmosWorks<br>3. Solidworks User's Guide | | | |
| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
| Analysis of the state of strain and deformation in a plate and a support. | 2 | Example practice | On-line, TEAMS |
| Analysis of the state of tension and deformation in a rotating flywheel | 2 | | |

| | | | |
|---|---|---|---|
| Modal analysis of a platform and performing a buckling analysis in the elastic domain. | 2 | | |
| Analysis of thermal transfer through the wall of a metal casting form (stationary regime) | 2 | | |
| Transient heat transfer problem | 2 | | |
| Optimize the shape of a part | 2 | | |
| Example of impact analysis | 2 | | |
| Bibliography<br>1.Mikell P. Groover, Emory W. Zimmers, CAD/CAM: Computer-Aided Design and Manufacturing, Prentice-Hall International, Inc.1984.<br>2. Andrew Tizzard, An Introduction to Computer Aided Engineering, McGraw-Hill Book Company, 1994.<br>3. CosmosWorks User's Guide<br>4. Kurowski_Engineering_Analysis_with_CosmosWorks | | | |

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

| |
|---|
| Acquired competencies will be required for employees working in design, manufacturing, manufacturing services. |

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | 20 Theory questions. | On-line<br>Grid Questionnaire – Duration of Evaluation 1/2 hours | 20% |
| 10.5 Seminars /Laboratory/Project | Solving an application with the help of a computer | On-line<br>Practical sample – duration 2 hours | 80% |
| 10.6 Minimum standard of performance | | | |
| Make at least 50% of the assessments. | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 18.04.2023 | Lecturer | Lecturer Ph.D Eng. DAN NOVEANU | |
| | Teachers in charge of application | Lecturer Ph.D Eng. DAN NOVEANU | |
| | | | |

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

**SYLLABUS**

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 66.20 |

## 2. Data about the subject

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1 | Subject name | Semiconductor Materials | | | | |
| 2.2 | Course responsible/lecturer | Associate professor Traian Florin Marinca, marinca.traian@stm.utcluj.ro | | | | |
| 2.3 | Teachers in charge of seminars | Associate professor Traian Florin Marinca, marinca.traian@stm.utcluj.ro | | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 2 | 2.6 Assessment | colloquium exam | |
| 2.7 Subject category | Formative category | | | | | DS |
| | Optionality | | | | | DO |

## 3. Estimated total time

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

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 16 |
| (b) Supplementary study in the library, online and in the field | 10 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 10 |
| (d) Tutoring | 3 |
| (e) Exams and tests | 3 |
| (f) Other activities | 5 |

| | |
|---|---|
| 3.8 Total hours of individual study (summ (3.7(a)…3.7(f))) | 47 |
| 3.9 Total hours per semester (3.4+3.8) | 75 |
| 3.10 Number of credit points | 3 |

## 4. Pre-requisites (where appropriate)

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

## 5. Requirements (where appropriate)

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

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

**6. Specific competences**

| | |
|---|---|
| Professional competences | The student, after attending the course and performing laboratory work will be able to:<br>- To know the general characteristics of semiconductors;<br>- To understand the role of semiconductors in applications and the general applications of semiconductors;<br>- To understand the Engineering of the electronic band structure and crystal structure of semiconductor<br>materials.<br>- To Interpret the bandgap.<br>- Be familiar with the optical and structural characterization techniques<br>- Be familiar with the processing techniques. |
| Cross competences | - To acquire a specific engineering scientific language.<br>- To improve their skills and abilities to operate with laboratory equipment.<br>- To know how to evaluate the data in relation to given references. |

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

| | | |
|---|---|---|
| 7.1 | General objective | Development of competencies in the field of semiconductor materials (critical to microelectronic devices) |
| 7.2 | Specific objectives | Understanding the physical, optical and structural properties of semiconductor materials. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Electrical conductivity. General notions about semiconductors. | 2 | Lecture<br>PowerPoint presentation<br>Interactive teaching mode<br>Dialogue - conversation professor - student | Multimedia<br>Blackboard |
| 2. Elementary semiconductors. Extrinsic and intrinsic semiconductors | 2 | | |
| 3. Amorphous semiconductors. Oxidic semiconductors. Nanostructured semiconductors | 2 | | |
| 4. Organic semiconductors. Applications of organic semiconductors (OLED etc). | 2 | | |
| 5. Junctions p-n. Diode. Diode applications (LED, photovoltaic cells, etc.) | 2 | | |
| 6. npn and pnp junctions. Transistor and transistor applications. | 2 | | |
| 7. Semiconductor technology. Methods for obtaining | 2 | | |

| | | | |
|---|---|---|---|
| semiconductors | | | |
| Bibliography<br>[1]. Traian Florin Marinca – course notes<br>[2]. P.Y. Yu, M. Cardona, Fundamentals of Semiconductors Physics and Materials Properties Fourth Edition, Springer-Verlag Berlin Heidelberg 2010.<br>[3]. Hwaiyu Geng, Semiconductor Manufacturing Handbook (McGraw-Hill Handbooks S) 1st Edition, McGraw-Hill Education; 1st edition, 2005, ISBN-13 : 978-0071445597<br>[4]. Yacobi, B.G., Semiconductor Materials, An Introduction to Basic Principles, Springer Science+Business Media New York, 2003, ISBN 978-0-306-47361-6<br>[5]. Lev I. Berger, Semiconductor Materials, 1996, CRC Press, ISBN 9780849389122 | | | |
| 8.2. Laboratory | Number of hours | Teaching methods | Notes |
| 1. Determination of the forbidden / activation energy zone for semiconductor materials. Bandgap. | 2 | Explication, conversation, Case Study. | Blackboard, computer, specialized software |
| 2. Determining the lifespan of overloaded carriers | 2 | | |
| 3. Determining the density of dislocations in semiconductor materials | 2 | | |
| 4. Electrical resistivity of semiconductors, its variation with temperature | 2 | | |
| 5. Analysis of a LED lighting bulb, dimmable lighting bulb. Control of tension and voltage waveform | 2 | | |
| 6. Diodes and transistors analysis | 2 | | |
| 7. Photovoltaic cells analysis | 2 | | |
| Bibliography<br>[1]. P.Y. Yu, M. Cardona, Fundamentals of Semiconductors Physics and Materials Properties Fourth Edition, Springer-Verlag Berlin Heidelberg 2010.<br>[2]. Hwaiyu Geng, Semiconductor Manufacturing Handbook (McGraw-Hill Handbooks S) 1st Edition, McGraw-Hill Education; 1st edition, 2005, ISBN-13 : 978-0071445597<br>[3]. Yacobi, B.G., Semiconductor Materials, An Introduction to Basic Principles, Springer Science+Business Media New York, 2003, ISBN 978-0-306-47361-6<br>[4]. Lev I. Berger, Semiconductor Materials, 1996, CRC Press, ISBN 9780849389122 | | | |

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

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

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | The exam consists of written test (C). The written test contains grid topics and broader topics that need to be developed. The written exam is carried out as follows: students enter the exam room after being | Written test (C) - 2 hours | 70% |

| | | | |
|---|---|---|---|
| | invited to the room by the teacher and occupy the place indicated by the teacher, having on them only writing instruments and paper support on which to write; the number of writing instruments, exam sheets and auxiliaries (ruler, eraser and the like) is announced at the beginning of the exam by the teacher. Failure to comply with the requirements will result in removal from the exam. The exam subjects are either dictated by the teacher or a printed copy is handed to each student. The presence of a mobile phone or other electronic devices on students during the exam is considered copied. | | |
| 10.5 Laboratory | At each laboratory the students receive a mark regarding their implication (I). The students receive notes on the laboratory tests (T) - $T=(T_1+\ldots T_n)/n$ (n - number of tests). The final laboratory mark (L) is $L=0,5I+0,5T$.<br>Each mark should be at least 5. | Oral test (I) - continuous assessment.<br><br>Tests (T) – 1 hour – theoretical and practical tests | 30% |
| 10.6. Minimum standard of performance | | | |
| $T \geq 5$, $I \geq 5$, $C \geq 5$, E (the general examination mark) = 0,7 C+0,3L with L=0,5I+0,5T | | | |

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

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

# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 67.1 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Building Materials | | | |
| 2.2 | Course responsible/lecturer | | | Associate Professor Ph.D. Eng. Claudiu ACIU<br>Claudiu.Aciu@ccm.utcluj.ro<br>Lecturer Ph.D. Eng. Elena JUMATE<br>Elena.Jumate@ccm.utcluj.ro | | | |
| 2.3 | Teachers in charge of seminars | | | Associate Professor Ph.D. Eng. Claudiu ACIU<br>Claudiu.Aciu@ccm.utcluj.ro<br>Lecturer Ph.D. Eng. Elena JUMATE<br>Elena.Jumate@ccm.utcluj.ro | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 2 | 2.6 Assessment | C | DS/DO | |
| 2.7 Subject category | Formative category | | | | | | |
| | Optionality | | | | | | |

## 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 | … |
| 3.4 Total hours in the curriculum | 28 | of which | 3.5 Course | 14 | 3.6 Seminar | … | 3.6 Laboratory | 14 | 3.6 Project | … |

| | |
|---|---|
| 3.7 Individual study: | |
| (a) Manual, lecture material and notes, bibliography | 25 |
| (b) Supplementary study in the library, online and in the field | 5 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 10 |
| (d) Tutoring | 5 |
| (e) Exams and tests | 2 |
| (f) Other activities | … |

| | |
|---|---|
| 3.8 Total hours of individual study (summ (3.7(a)…3.7(f))) | 47 |
| 3.9 Total hours per semester (3.4+3.8) | 75 |
| 3.10 Number of credit points | 3 |

**4. Pre-requisites (where appropriate)**

| | | |
|---|---|---|
| 4.1 | Curriculum | |
| 4.2 | Competence | Physics; Chemistry |

**5. Requirements (where appropriate)**

| | | |
|---|---|---|
| 5.1 | For the course | … |
| 5.2 | For the applications | … |

**6. Specific competences**

| | |
|---|---|
| Professional competences | After completing the discipline, students must have theoretical knowledge about:<br>- Mineral binders (hydraulic and non-hydraulic binders); Mortars with inorganic binders; Concretes with inorganic binders; Ceramic materials; Glass materials; Bitumen and bituminous binders; Insulation materials; Thermal insulation, sound and hydrofuge insulation; Polymer materials.<br>After completing the discipline, students will be able to:<br>- determine the properties of binders (plaster, lime, cement);<br>- determine the mortar composition. Determination of properties of mortar with mineral binders;<br>- determine of concrete composition. determination of properties of fresh concrete;<br>- determine the properties of ceramic products (wall and roofing materials);<br>- determine the properties of bitumen and bitumen impregnated materials;<br>- determine the mechanical strengths of plaster, cement, mortar, concrete and masonries. |
| Cross competences | 1. Application of effective and responsible work strategies, punctuality, responsibility and personal liability based on principles, norms and values of professional ethics.<br>2. Applying the techniques of effective team work on different hierarchical levels.<br>3. Documentation in Romanian and in a foreign language, for professional and personal development through continuous training and effective adaptation to new technical specifications. |

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

| | | |
|---|---|---|
| 7.1 | General objective | Developing expertise in control and quality assurance in support of training. |
| 7.2 | Specific objectives | Assimilating theoretical knowledge concerning the characteristics of the main building materials and methods for their determination. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Aggregates for mortars and concretes. | 2 | Power Point presentation | Video – projector |
| 2. Mineral binders: non-hydraulic binders. Mineral binders: hydraulic binders. Polymer materials. | 2 | | |
| 3. Mortars with inorganic binders. | 2 | | |

| | | | |
|---|---|---|---|
| 4. Concretes with inorganic binders. Polymer concretes. | 2 | | |
| 5. Ceramic materials. Glass materials. | 2 | | |
| 6. Bituminous binders. Bitumen. Insulation materials, thermal insulation, sound and hydrofuge insulation. | 2 | | |
| 7. Composite and associated materials. | 2 | | |

Bibliography

1. Daniela Lucia MANEA, Claudiu ACIU, Alexandru Gheorghe NETEA (2011). Materiale de construcţii. Ed. UTPRESS, Cluj-Napoca.
2. Manea Lucia Daniela, Netea Gheorghe Alexandru, Claudiu Aciu (2014). Materiale de construcţie si chimie aplicată. Teste grilă. Ed. UTPRESS, Cluj –Napoca.
3. Daniela Lucia MANEA, Claudiu ACIU (2015). Materiale de Construcţii şi Chimie Aplicată. Building Materials and Applied Chemistry. Ed. UTPRESS, Cluj-Napoca.
4. Manea Daniela Lucia (2012). Patologia și reabilitarea structurilor; Materiale speciale pentru construcţii. Ed. UTPRESS, Cluj-Napoca.
5. Neville A. M. (2003). Proprietăţile betonului, ediţia a IV –a. Editura Tehnică, Bucureşti.
6. Manea Daniela (2003). Materiale compozite. Ed. UTPRESS, Cluj-Napoca.
7. Stoian Valeriu și colectiv (2004). Materiale compozite pentru construcții. Ed. Politehnica, Timișoara.

| 8.2. Laboratory | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Work protection and safety technique norms. | 2 | Laboratory work presentation and applications | Laboratory works |
| 2. Determination of aggregate characteristics. | 2 | | |
| 3. Determination of properties of construction and molding plaster and cement. | 2 | | |
| 4. Determination of mortar composition. Determination of properties of mortar with mineral binders. | 2 | | |
| 5. Determination of concrete composition and properties of fresh concrete. | 2 | | |
| 6. Determination of properties of ceramic products (wall materials, roofing materials). Tests and determinations on bitumen and bitumen impregnated materials. | 2 | | |
| 7. Determination of mechanical strengths | 2 | | |

Bibliography

1. Daniela Lucia MANEA, Alexandru Gheorghe NETEA, Claudiu ACIU (2012). Materiale pentru construcţii. Ed. UTPRESS, Cluj-Napoca.
2. Netea Gheorghe Alexandru, Manea Lucia Daniela, Claudiu Aciu(2010). Materiale de construcţie și chimie aplicată, Vol III.Ed. UTPRESS, Cluj-Napoca.
3. Manea Lucia Daniela, Netea Gheorghe Alexandru, Claudiu Aciu (2014). Materiale de construcţie și chimie aplicată. Teste grilă. Ed. UTPRESS, Cluj –Napoca.
4. Netea Alex., Manea Daniela, Aciu Claudiu, Jumate Elena, Babota Florin, Pleșa Luminița, Iernuțan Răzvan. *Materiale de construcţie. Chimie.* Ed. UTPRESS, Cluj – Napoca, 2019.

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

Acquired skills will be necessary to the employees who work in the quality control of building materials, civil engineers as well as to the teachers in secondary education.

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | Multiple choice test | Written test | 60 % |
| 10.5 Laboratory | Problems | Written test | 40 % |
| 10.6 Minimum standard of performance | | | |
| Mark components: Problems (mark P); Multiple choice test (mark G).<br>Mark computation formula: N = 0,4P + 0.6G; is calculated only if: P ≥ 5 and G ≥ 5. | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 07.05.2023 | Lecturer | Associate Professor Ph.D. Eng. Claudiu ACIU | |
| | | Lecturer Ph.D. Eng. Elena JUMATE | |
| | Teachers in charge of application | Associate Professor Ph.D. Eng. Claudiu ACIU | |
| | | Lecturer Ph.D. Eng. Elena JUMATE | |
| | | | |

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

# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 67.20 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Nanomaterials and nanotechnologies | | | |
| 2.2 | Course responsible/lecturer | | | Assoc.Prof. Bogdan Viorel Neamtu | | | |
| 2.3 | Teachers in charge of seminars | | | Assoc.Prof. Bogdan Viorel Neamtu | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 2 | 2.6 Assessment | | C | |
| 2.7 Subject category | Formative category | | | | | DS | |
| | Optionality | | | | | DO | |

## 3. Estimated total time

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

| 3.7 Individual study: | |
|---|---|
| (a) Manual, lecture material and notes, bibliography | 10 |
| (b) Supplementary study in the library, online and in the field | 17 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 12 |
| (d) Tutoring | 4 |
| (e) Exams and tests | 4 |
| (f) Other activities | 0 |

| | |
|---|---|
| 3.8 Total hours of individual study (summ (3.7(a)…3.7(f))) | 47 |
| 3.9 Total hours per semester (3.4+3.8) | 75 |
| 3.10 Number of credit points | 3 |

## 4. Pre-requisites (where appropriate)

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

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | |

| | | |
|---|---|---|
| 5.2 | For the applications seminarului / laboratorului / proiectului | |

**6. Specific competences**

| | |
|---|---|
| Professional competences | To acquire an adequate scientific language, with specific engineering notions.<br>Understand the difference between the different types of structures that appear in materials<br>To know how to evaluate the composition and microstructure of a material through qualitative and quantitative instrumental analyzes<br>To know the preparation and manufacture of nanostructures<br>To know and understand the organization and behavior of matter at the nanometer level<br>To understand the operation of complex research and investigation equipment<br>Be able to correlate the properties of microstructure with the physical-mechanical properties of a material |
| Cross competences | -To develop skills and the ability to operate with measurement data.<br>-Know how to appreciate the nature and type of errors in specific laboratory measurements.<br>-Know how to process statistics and interpret measurement data<br>-Know elements of preparation and manufacture of nanostructures<br>-To know the applications of nanotechnology in technology, pharmacy, biology, medicine, etc. -<br>To know the application fields of amorphous and nanocrystalline materials |

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

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

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Notions of material structure. Properties of nanomaterials | 2 | | |
| 2. The organization and behavior of matter at the nanometer level. Phenomena of self-organization (self-assembly) and self-replication of atoms and molecules. Manipulation of atoms and molecules. | 2 | | |

| | | | |
|---|---|---|---|
| 3. Synthesis and properties of nanoparticles, nanoclusters, nanotubes, nanowires, etc. | 2 | Lecture<br><br>PowerPoint presentation<br><br>Interactive teaching mode<br><br>Teacher-student dialogue | Multimedia<br><br>Blackboard |
| 4. Thin films Physical deposition methods (Evaporation based methods; Ablation; DC and RF spraying) | 2 | | |
| 5. Thin films Chemical deposition methods | 2 | | |
| 6. Film formation and structure (nucleation thermodynamics; nucleation rate; nucleation rate. Nucleation dependence of substrate temperature; atomistic theory of nucleation; film coalescence, coalescence mechanisms) | 2 | | |
| 7. Epitaxial growth (Structural aspects of epitaxy; Reticular mismatch; NCSL theory; Epitaxial film deposition methods) | 2 | | |
| 8. Characterization of thin films (electrical, magnetic and optical properties; Determination of film thickness and roughness; Morphological characterization; Structural characterization; Characterization of multilayer structures; Chemical characterization.) | 2 | | |
| 9. Thermodynamics of the formation of amorphous and nanocrystalline structures. Kinetics of the formation of amorphous and nanocrystalline structures | 2 | | |
| 10. Massive amorphous metallic materials. Preparation and characterization. | 2 | | |
| 11. Methods for obtaining metastable materials by rapid cooling. Techniques for consolidating rapidly cooled materials into massive products | 2 | | |
| 12. Thermal stability and structural transformations when heating materials obtained by rapid cooling | 2 | | |
| 13. Mechanical, thermal, magnetic and electrical properties of amorphous and nanocrystalline materials | 2 | | |
| 14. Applications of nanotechnology in technology, pharmacy, biology, medicine, etc. Fields of application of amorphous and nanocrystalline materials | 2 | | |

Bibliography


1. Sharma Surender, Handbook of Materials Characterization, 2018, ISBN 978-3-319-92955-2, Springer International Publishing
2. Cavaliere Pasquale, Spark Plasma Sintering of Materials, 2019, Springer International Publishing, 2019.

3. M.A.Otooni-Elements of Rapid Solidification Springer-Verlag Berlin, 1998 9.
4. J.F.Shackelford- Introduction to Materials Science for Engineers, Macmillan P.C., 1998
5. David Levy, Marcos Zayat, The Sol-Gel Handbook, 2015, Wiley-VCH Verlag GmbH & Co. KGaA, ISBN:9783527334865
6. Donald M. Mattox, Handbook of Physical Vapor Deposition (PVD) Processing, 2010, Elsevier, ISBN 978-0-8155-2037-5.

| 8.2. Seminars /Laboratory/Project | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| 1. Evaporation deposition in the electron beam of a metal film (film deposition, determination of the film thickness by X-ray diffraction at small angles) | 2 | Practical measurements, data recording, spectrum interpretation, mathematical calculation. | Blackboard, computer, Specialized software and equipment |
| 2. Growth of an oxide film by CVD- (deposition and pyrolysis of the precursor film and heat treatment of crystallization, determination of the degree of crystallinity by X-ray diffraction) | 2 | | |
| 3. Obtaining massive amorphous metallic materials in the laboratory | 2 | | |
| 4. Heating behavior of metal bottles. (Determination of recrystallization temperature by thermal analysis) | 2 | | |
| 5. Determination of the magnetic properties of metal bottles in the Co-Ni-P system | 2 | | |
| 6. Mechanical properties of amorphous materials. Tensile test of amorphous bands | 2 | | |
| 7. Applications of atomic force microscopy to the study of nanomaterials. | 2 | | |

Bibliography

1. Sharma Surender, Handbook of Materials Characterization, 2018, ISBN 978-3-319-92955-2, Springer International Publishing
2. Cavaliere Pasquale, Spark Plasma Sintering of Materials, 2019, Springer International Publishing, 2019.
3. M.A.Otooni-Elements of Rapid Solidification Springer-Verlag Berlin, 1998 9.
4. J.F.Shackelford- Introduction to Materials Science for Engineers, Macmillan P.C., 1998
5. David Levy, Marcos Zayat, The Sol-Gel Handbook, 2015, Wiley-VCH Verlag GmbH & Co. KGaA, ISBN:9783527334865
6. Donald M. Mattox, Handbook of Physical Vapor Deposition (PVD) Processing, 2010, Elsevier, ISBN 978-0-8155-2037-5.

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

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

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| 10.4 Course | Assessment of the knowledge taught - at the end of the semester (grade V), by solving some tests that consist of a theoretical part and problems | Written test / Oral test | 80% |
| 10.5 Seminars /Laboratory/Project | Students will be evaluated at each laboratory session taking into account the degree of involvement and how to process and interpret the results in practical activities. The final grade in the laboratory (L) represents the arithmetic mean of the grades from each practical session | Written test / Oral test | 20% |
| 10.6 Minimum standard of performance | | | |
| • Colloquium note ≥ 5; Laboratory grade ≥ 5, (Colloquium grade = 0.8 V + 0.2L) | | | |

| **Date of filling in:** | | **Title Surname Name** | **Signature** |
|---|---|---|---|
| 16.04.2023 | Lecturer | Assoc.Prof. Bogdan Viorel Neamtu | |
| | Teachers in charge of application | Assoc.Prof. Bogdan Viorel Neamtu | |
| | | | |

Date of approval in the department
26.06.2023

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

Date of approval in the faculty
10.07.2023

Dean
Prof.dr.eng. Cătălin Popa

**SYLLABUS**

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Materials and Environmental Engineering |
| 1.3 | Department | Materials Science and Engineering |
| 1.4 | Field of study | Materials Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Materials Science |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 68 |

## 2. Data about the subject

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | Practical activity for graduation project | | | |
| 2.2 | Course responsible/lecturer | | | | | | |
| 2.3 | Teachers in charge of seminars | | | | | | |
| 2.4 Year of study | 4 | 2.5 Semester | 8 | 2.6 Assessment | Exam | | |
| 2.7 Subject category | Formative category | | | | | | DS |
| | Optionality | | | | | | DI |

## 3. Estimated total time

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | | of which | 3.2 Course | | 3.3 Seminar | | 3.3 Laboratory | | 3.3 Project | 5 |
| 3.4 Total hours in the curriculum | | of which | 3.5 Course | | 3.6 Seminar | | 3.6 Laboratory | | 3.6 Project | 5 |

| | |
|---|---|
| 3.7 Individual study: | |
| (a) Manual, lecture material and notes, bibliography | 10 |
| (b) Supplementary study in the library, online and in the field | 10 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 30 |
| (d) Tutoring | - |
| (e) Exams and tests | - |
| (f) Other activities | - |

| | |
|---|---|
| 3.8 Total hours of individual study (summ (3.7(a)…3.7(f))) | 30 |
| 3.9 Total hours per semester (3.4+3.8) | 100 |
| 3.10 Number of credit points | 4 |

## 4. Pre-requisites (where appropriate)

| | | |
|---|---|---|
| 4.1 | Curriculum | ---- |
| 4.2 | Competence | ---- |

## 5. Requirements (where appropriate)

| | | |
|---|---|---|
| 5.1 | For the course | |
| 5.2 | For the applications | Departments from UTCN or specialized companies |

**6. Specific competences**

| | |
|---|---|
| Professional Competences | Knowledge about materials and technologies. Methods and procedures, selection criteria. Management of the research activities. |
| Cross competences | Promoting the logical reasoning, efficiency and responsibility in the carried-out activities. Awareness of the need for continuous training and professional development in order to enter the labor market. |

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

| | | |
|---|---|---|
| 7.1 | General objective | • Development of skills in the field of composite materials in support of vocational training |
| 7.2 | Specific objectives | • Carrying out comparative documentation studies on the specifics of the topic of chosen project.<br>• Preparing students to know the specific types of materials and/or equipment.<br>• Training of future specialists in the direction preparation, characterization and tests of materials. |

**8. Contents**

| 8.1. Lecture (syllabus) | Number of hours | Teaching methods | Notes |
|---|---|---|---|
| Bibliographic documentation | 10 | | |
| Identification and description of materials and methods used for the completion of the bachelor's thesis | 15 | | |
| Visits to industrial units for the purpose of data collection if necessary | 10 | | |
| Experimental research in the proposed topic, their harmonization with the chosen research topic. | 25 | | |
| Modeling / optimization of the technological / ecological process | 5 | | |
| Interpretation of results and their relation to other results from the literature | 25 | | |

| | | | |
|---|---|---|---|
| Bibliography<br>• Specific thematic bibliography<br>• Regulations for drafting and supporting the draft license | 10 | | |
| If necessary the times allocated for each lecture can be adapted to specific conditions. | | | |

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

| |
|---|
| The acquired competencies will be necessary for the employees who carry out their activity within a sector of design / processing / characterization of materials. |

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| Practical activities | Knowledge assessment fundamental and specialized | | 100 % |
| 10.6 Minimum standard of performance | | | |
| • Preparation of a bibliographic study, correlated with the proposed topic, from the specialized literature;<br>• Technical description of the materials and equipment used and establishing the characteristics of the material/materials;<br>• Correlation of the obtained results with specialized literature; | | | |

| | | | |
|---|---|---|---|
| **Date of filling in:**<br>04.03.2023 | | | |
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| | |
|---|---|
| Date of approval in the department<br>26.06.2023 | Head of department<br>Ass.prof.dr.eng. Mariana Pop |
| Date of approval in the faculty<br>10.07.2023 | Dean<br>Prof.dr.eng. Cătălin Popa |