SUBJECT DESCRIPTION

1. Data related to the study program

1.1 Higher education institution	**UNIVERSITY OF ORADEA**
1.2 Faculty	**Faculty of Electrical Engineering and Information Technology**
1.3 Department	Department of Electrical Engineering
1.4 Field of study	Electrical engineering
1.5 Study cycle	Master (2nd cycle)
1.6 Study program/Qualification	Advanced Systems in Electrical Engineering / Master of Science in Engineering

2. Data related to the subject

2.1 Name of the subject		**Analysis and modeling of microwave systems for industrial applications**					
2.2 Holder of the subject		prof.PhD.eng.Hathazi Francisc – Ioan					
2.3 Holder of the academic seminar/laboratory/project		--- / associate prof.PhD eng.Șoproni Vasile – Darie / associate prof.PhD eng.Molnar Carmen – Otilia					
2.4 Year of study	I	2.5 Semester	I	2.6 Type of the evaluation	Ex.	2.7 Subject regime	Imposed / Deepening discipline (I/DAP)

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	5	of which: 3.2 course	2	3.3 academic seminar/laboratory/project	- / 2 / 1
3.4 Total of hours from the curriculum	70	Of which: 3.5 course	28	3.6 academic seminar/laboratory/project	- / 28/14
Distribution of time					55 hours
Study using the manual, course support, bibliography and handwritten notes					14
Supplementary documentation using the library, on field-related electronic platforms and in field-related places					14
Preparing academic seminaries/laboratories/ themes/ reports/ portfolios and essays					14
Tutorials					7
Examinations					6
Other activities.					---
3.7 Total of hours for individual study	**55**				
3.9 Total of hours per semester	**125**				
3.10 Number of credits	**5**				

4. Pre-requisites (where applicable)

4.1 related to the curriculum	Knowledge of Electrical Circuit Theory I and II, Electrotechnical Materials, Microwave Technology, Electrothermal
4.2 related to skills	Adequate selection of design methodology and characteristics of components and electrical systems

5. Conditions (where applicable)

5.1. for the development of the course	The course can be taken face-to-face or online. Laptop, video projector, magnetic board, free speech.
5.2.for the development of the academic seminary/laboratory/project	- / The laboratory can be carried out face to face or online. Smart board, computer network with workstation for each student, access to microwave equipment in the laboratory / The project can be carried out face to face or online. Smart board, computer network with workstation for each student, access to microwave equipment in the laboratory
6. Specific skills acquired	

Professional skills	• C2. Operating with fundamental concepts in computer science and information technology • C2.1. – Modeling and design of electrical systems in electrothermal applications, which refers to the processing of dielectric materials in the microwave field; • C2.3. – Uses of modeling and designing electrical systems in electrothermal applications. • C2.4. – Correct solution and understanding of the operation of different microwave technologies. • C2.5. – The acquired knowledge is useful in solving the problems faced by a specialist in electrical engineering.
Transversal skills	• CT1 – Identify the objectives to be achieved, the available resources, the conditions for their completion, the working stages, the working times, the deadlines and the related risks; • CT2 – Identify roles and responsibilities in a multidisciplinary team and apply effective relationship techniques and teamwork; • CT3 – Efficient use of information sources and resources of communication and assisted professional training (Internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in a language of international circulation.

7. The objectives of the discipline (resulting from the grid of the specific competences acquired)

7.1 The general objective of the subject	• The course is addressed to students from the Advanced Systems in Electrical Engineering specialization and aims to present the phenomena of production, transport and use of microwave energy in various industrial applications. Project applications are based on the premise that microwave material processing is a relatively new technology that provides new opportunities to improve the physical properties of materials; provides alternatives for processing materials that are difficult to process; reduces the harmful effects of material processing on the environment; provides economic benefits by saving energy, space and time; and offers the opportunity to produce new materials and microstructures that cannot be obtained by other methods.
7.2 Specific objectives	• Starting from the preconditions imposed by each product subject to industrial microwave processing, the student will be able to analyze the variations of the monitored parameters and to design a microwave oven adapted to the product to be processed.

8. Contents*

8.1 Course	Teaching methods	No. of hours/ Observations
Course 1 – 2 – Wave applicators with conveyor belt. Flat waves. Wave guides. Mutual impedance. Standing wave voltage ratio S. Examples of conveyor belt applicators	Laptop, video projector, IQ Board, free speech	4
Course 3 – 4 – Special applicator structures. Two-cavity TE10n applicator. Applicator: periodic, rectangular TEM, ridge, disc, dielectric, mobile resonant, spiral, radiant, ellipsoidal and spherical	Laptop, video projector, IQ Board, free speech	4
Course 5 – 6 – General aspects regarding the microwave heating circuit, the discharge phenomena in gaseous environment	Laptop, video projector, IQ Board, free speech	4
Course 7 – 8 – Pressure microwave processing of high temperature sensitive materials	Laptop, video projector, IQ Board, free speech	4
Course 9 – 10 – Automatic control, adjustment and adaptation of the drying process.	Laptop, video projector, IQ Board, free speech	4
Course 11 – 13 – Hybrid systems in industrial applications that use microwave technologies	Laptop, video projector, IQ Board, free speech	6

Course 14 – Safety rules adopted for microwave installations	Laptop, video projector, IQ Board, free speech	2
Bibliography 1. Soproni Vasile Darie, Hathazi Francisc Ioan, Molnar Carmen Otilia, Arion Mircea Nicolae - Analiza și modelarea sistemelor cu microunde pentru aplicații industriale (suport curs–format electronic), 2020, pp.143 2. Teodor Maghiar, Darie Şoproni – Tehnica încălzirii cu microunde, Editura Universităţii din Oradea, 2003 3. Rulea Gh. – Tehnica frecvenţelor foarte înalte, Ed. Tehnică, Bucureşti, 1966 4. Rulea Gh. – Tehnica microundelor, Ed. Didactică şi Pedagogică, Bucureşti, 1981 5. Drăgoi Gh. - Tehnica frecvenţelor foarte înalte, Ed. Militară, Bucureşti, 1979 6. Metaxas A. C. – Industrial Microwave Heating, Peter Peregrinus LTD., 1983 7. Manolescu P., ş. a. – Măsurări electrice şi electronice, Ed. Didactică şi Pedagogică, Bucureşti, 1980 8. Adrian Vârtosu – Măsurări cu microunde şi optoelectronice, Univ. Politehnica Timişoara, 1996 9. Tudor Palade – Tehnica microundelor, Univ. Politehnica Cluj, 1995 10. Carmen O. Molnar – Modelarea numerică a câmpului electromagnetic din instalaţiile electrotermice cu microunde, Editura Universităţii din Oradea, 2006, pg. 190, ISBN 973-613-969-7. 11. T. Leuca, Livia Bandici, Carmen O. Molnar - Aspecte privind încălzirea în câmp de microunde a materialelor dielectrice, Editura Mediamira, Cluj-Napoca 2006, pag.187, ISBN (13) 978-973-713-142-3. 12. Carmen O. Molnar - Teoria câmpului electromagnetic, Editura Universităţii din Oradea, 2005, pag.223, ISBN 973-613-833-X.		
8.2. Seminar	Teaching methods	No. of hours/ Observations

8.3. Laboratory	Teaching methods	No. of hours/ Observations
1. Laboratory protection rules specific to microwave installations	Free speech, use of computer network from the laboratory equipment	2
2 – 3 – Analysis of the components and the operation of the laboratory installation for drying or microwave treatment of dielectric materials	Free speech, use of computer network from the laboratory equipment	4
4. Analysis of the component parts and the mode of operation of the laboratory installation for soil decontamination. Measurement and interpretation of results	Free speech, use of computer network from the laboratory equipment	2
5. Analysis of the component parts and of the operation of the laboratory installation for the extraction of oils from seeds. Measurement and interpretation of results	Free speech, use of computer network from the laboratory equipment	2
6. Measurement and interpretation of process parameters for the extraction of beta-carotene from vegetables (carrots)	Free speech, use of computer network from the laboratory equipment	2
7. Analysis of the component parts and the operation of the laboratory installation for the extraction of oils from vegetable substrate. Measurement and interpretation of results	Free speech, use of computer network from the laboratory equipment	2
8. Measurement and interpretation of results in the extraction of oils from the floral substrate	Free speech, use of computer network from the laboratory equipment	2
9 – 10 – Analysis of the component parts and the operation of the laboratory installation for the study of microwave supporting ceramic materials. Measurement and interpretation of results	Free speech, use of computer network from the laboratory equipment	5
11 – 13 – Analysis of the component parts and the operation of the laboratory reactor in the microwave field in order to obtain hybrid materials (conductive, semiconductor or dielectric polymers) by spray pyrolysis processes. Measurement and interpretation of results	Free speech, use of computer network from the laboratory equipment	5
14. Recovery program for laboratory works	Free speech, use of computer network from the laboratory equipment	2

Bibliography

1. Soproni Vasile Darie, Hathazi Francisc Ioan, Molnar Carmen Otilia, Arion Mircea Nicolae - Analiza și modelarea sistemelor cu microunde pentru aplicații industriale (suport îndrumător laborator – format electronic), 2020, pp. 43
2. *** - Proiect PNII 51087, Tehnologii moderne utilizate la îmbunătățirea calității semințelor agricole depozitate, 2007-2010, director proiect – Șoproni Darie, Universitatea din Oradea
3. Manolescu P., ş. a. – Măsurări electrice şi electronice, Ed. Didactică şi Pedagogică, Bucureşti, 1980
4. Adrian Vârtosu – Măsurări cu microunde şi optoelectronice, Univ. Politehnica Timişoara, 1996
5. Carmen O. Molnar – Modelarea numerică a câmpului electromagnetic din instalaţiile electrotermice cu microunde, Editura Universităţii din Oradea, 2006, pg. 190, ISBN 973-613-969-7.

8.4. Project	Teaching methods	No. of hours/ Observations
1. Theoretical considerations regarding microwave heating	Free speech, use of computer network from the laboratory equipment	2
2. Electromagnetic and thermal field in microwave electrothermal installations. Study of the behavior of dielectrics in the microwave field	Free speech, use of computer network from the laboratory equipment	2
3. Processing of dielectric materials in electromagnetic field	Free speech, use of computer network from the laboratory equipment	2
4. Use of microwave energy in the processing of electrical materials. Solutions for the design and optimization of microwave electrothermal installations	Free speech, use of computer network from the laboratory equipment	2
5. Numerical modeling of applicators used for microwave drying. Software tools in education and research.	Free speech, use of computer network from the laboratory equipment	2
6. Microwave field processing of light industry raw materials. Advantages and disadvantages	Free speech, use of computer network from the laboratory equipment	2
7. Applications using professional software. Current issues and trends in efficient drying of light industry raw materials	Free speech, use of computer network from the laboratory equipment	2

Bibliography

1.*** - Proiect PNII 51087, Tehnologii moderne utilizate la îmbunătățirea calității semințelor agricole depozitate, 2007-2010, director proiect – Șoproni Darie, Universitatea din Oradea
2. T. Leuca, Livia Bandici, Carmen Molnar – Aspecte privind încălzirea în câmp de microunde a materialelor dielectrice. Editura Mediamira Cluj-Napoca, 2006.
3. Silaghi M.A., Silaghi H. – Tehnologii cu microunde. Tehnici informatice. Editura Treira, Oradea, 2001.
4. Anca Tomescu – Sisteme cu microunde. Editura Matrix Bucureşti, 2001.
5. Miron D. Tucă M., Cuciureanu V.– Microundele în procesele industriale. Editura ICPE, Bucureşti, 1995

Carmen O. Molnar – Modelarea numerică a câmpului electromagnetic din instalaţiile electrotermice cu microunde, Editura Universităţii din Oradea, 2006, pg. 190.

9. Corroboration of the discipline content with the expectations of the representatives of epistemological community, professional associations and representative employers in the field related to the program

- The content of the discipline is adapted and satisfies the requirements imposed on the labor market, being agreed by the social partners, professional associations and employers in the field related to the license program. The content of the discipline is found in the curriculum of the specialization ADVANCED SYSTEMS IN ELECTRICAL ENGINEERING and from other university centers in Romania that have accredited this specialization, so knowledge of the basics is a stringent requirement of employers in the field.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percent from the final mark

10.4 Course	Oral examination	The evaluation can be done face-to-face or online. Oral examination of students	50 %
10.5 Seminar	-	-	-
10.6 Laboratory	Final evaluation test	The evaluation can be done face-to-face or online. Oral examination of students	20 %
10.7 Project	Oral examination	Oral examination - Project presentation	30%
10.8 Minimum performance standard: • Carrying out the works under the coordination of a teacher, in order to solve specific problems in the electrical field with the correct evaluation of the workload, resources available for the necessary time to complete the risks, under the conditions of application of occupational safety and health norms.			

Completion date:
28.08.2022

Date of endorsement in the department:
01.08.2022

Date of endorsement in the Faculty Board:
23.09.2022

SUBJECT DESCRIPTION

1. Data related to the study program

1.1 Higher education institution	**UNIVERSITY OF ORADEA**
1.2 Faculty	**Faculty of Electrical Engineering and Information Technology**
1.3 Department	Department of Electrical Engineering
1.4 Field of study	Electrical engineering
1.5 Study cycle	Master (2^{nd} cycle)
1.6 Study program/Qualification	Advanced Systems in Electrical Engineering / Master of Science in Engineering

2. Data related to the subject

2.1 Name of the subject		**Technical electromagnetism**					
2.2 Holder of the subject		prof.PhD.eng.Hathazi Francisc – Ioan					
2.3 Holder of the academic seminar/laboratory/project		--- / lecturer PhD eng. Arion Mircea – Nicolae / lecturer PhD eng. Novac Cornelia – Mihaela					
2.4 Year of study	I	2.5 Semester	I	2.6 Type of the evaluation	Ex.	2.7 Subject regime	Imposed / Synthesis discipline (I/DSI)

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	5	of which: 3.2 course	2	3.3 academic seminar/laboratory/project	- / 2 / 1
3.4 Total of hours from the curriculum	70	Of which: 3.5 course	28	3.6 academic seminar/laboratory/project	- / 28/14
Distribution of time					55 hours
Study using the manual, course support, bibliography and handwritten notes					20
Supplementary documentation using the library, on field-related electronic platforms and in field-related places					10
Preparing academic seminaries/laboratories/ themes/ reports/ portfolios and essays					20
Tutorials					1
Examinations					4
Other activities.					---

3.7 Total of hours for individual study	**55**
3.9 Total of hours per semester	**125**
3.10 Number of credits	**5**

4. Pre-requisites (where applicable)

4.1 related to the curriculum	Electromagnetic field theory, superconductors and superconducting systems Electrotechnical Materials, Microwave Technology, Electrothermal
4.2 related to skills	Competences corresponding to the first 3 years of preparation for the degree in Electrical Engineering

5. Conditions (where applicable)

5.1. for the development of the course	The course can be taken face-to-face or online. Laptop, video projector, magnetic board, free speech.
5.2.for the development of the academic seminary/laboratory/project	- / The laboratory can be carried out face to face or online. Computer network with workstation for each student, access to software that is studied in the course, network access to the Internet / Project can be carried out face to face or online. Computer network with workstation for each student, access to software that is studied in the course, network access to the Internet

6. Specific skills acquired	
Professional skills	• C.1. Ensuring skills in the field of electromagnetic field study, at a higher level with direct applicability in technical design, especially in matters of energy quality assurance; • C.3. Analysis and development of applications for optimizing industrial processes of electricity using specific software
Transversal skills	• CT1 – Identify the objectives to be achieved, the available resources, the conditions for their completion, the working stages, the working times, the deadlines and the related risks; • CT2 – Identify roles and responsibilities in a multidisciplinary team and apply effective relationship techniques and teamwork;

7. The objectives of the discipline (resulting from the grid of the specific competences acquired)

7.1 The general objective of the subject	• Completing and developing the knowledge of electromagnetism, emphasizing the technical aspects of the studied problems. Creative approach to advanced engineering problems in the field of electrical engineering.
7.2 Specific objectives	• Ability to apply the notions of mathematics to solving physics problems. Knowledge of experimental data processing and numerical simulation.

8. Contents*

8.1 Course	Teaching methods	No. of hours/ Observations
1 – Electromagnetic field. Maxwell's equations. Laws of material. Electrodynamic potentials. Lorentz calibration condition. Electromagnetic field energy. Poynting vector. Boundary conditions for electromagnetic field components.	Laptop, video projector, IQ Board, free speech	4
2 – Electromagnetic waves in ideal environments. Helmholtz equation. Where spherical. Where plane harmonics. The structure of the plane harmonic wave. Polarization of electromagnetic waves.	Laptop, video projector, IQ Board, free speech	3
3 – Electromagnetic wave in homogeneous, isotropic and absorbent media. Microscopic theory of dispersion and absorption. Skin effect.	Laptop, video projector, IQ Board, free speech	3
4 – Electromagnetic wave in anisotropic media.	Laptop, video projector, IQ Board, free speech	3
5 – Technical conditions for the correct formulation of an electromagnetic field problem: Technical boundary conditions. Sources. Coupled issues.	Laptop, video projector, IQ Board, free speech	3
6 – Electrostatic models: Scalar electric potential. Boundary conditions for scalar electric potential. Potential equipment. Capacity calculation. Model approximations.	Laptop, video projector, IQ Board, free speech	3
7 – Electrokinetic models: Scalar and vector electric potentials. Boundary conditions for scalar and vector electric potentials. Potential equipment. Field lines. Calculation of losses and resistances. Coupling with heating problems. Model approximations. 2D structures.	Laptop, video projector, IQ Board, free speech	3
8. Stationary magnetic field models: Scalar and vector magnetic potential. Boundary conditions for the vector magnetic potential. Calculation of magnetic field energy, inductances and forces. Model approximations.	Laptop, video projector, IQ Board, free speech	3
9. Quasi-magnetic field models: Vector magnetic potential. The complete equation of eddy currents. Calculation of eddy current losses. Coupling with heating problems. Model approximations. 2D structures.	Laptop, video projector, IQ Board, free speech	3

Bibliography

1. Francisc Ioan Hathazi, Vasile Darie Șoproni, Mircea Nicolae Arion, Carmen Otilia Molnar, Supraconductori și sisteme supraconductoare. Fenomenul supraconductibilității și a diamagnetismului perfect, Editura Universității din Oradea, ISBN 978 – 606 – 10 – 1854 – 3, 2016, 2016;
2. Francisc Ioan Hathazi, Mircea Nicolae Arion, Vasile Darie Șoproni, Carmen Otilia Molnar, Elemente de teoria circuitelor electrice. Note de curs, Editura Universității din Oradea, ISBN 978 – 606 – 10 – 1855 – 0, 2016,
3. F.Hantila, T.Leuca, C.Ifrim, "Electrotehnică teoretica", vol. I, Editura Electra, 2002, ISBN 973-8067-69-3;
4. F.Hantila, "Câmpul magnetic în structuri cu magneți permanenți", Editura Electra, 2004, ISBN 973-7728-22-X;
5. F.Hantila, M.Vasiliu, "Campul electromagnetic variabil in timp", Editura Electra, 2005, ISBN 973-7728-48-3;
6. Simion, E. - Interferenta Electromagnetica. Ed. Casa Cartii de Stiinta, Cluj-Napoca, 1999;
7. Munteanu, C., Topa, V., Grindei, L., Advanced Numerical Computation Methods in EMC, Ed. Casa Cărţii de Ştiinţă, Cluj-Napoca, 2001.

8.2. Seminar	Teaching methods	No. of hours/ Observations

8.3. Laboratory	Teaching methods	No. of hours/ Observations
1. Laboratory presentation. Introducing and familiarizing students with numerical simulation programs for 2D and 3D electromagnetic field problems	Free speech, use of computer network from the laboratory equipment	2
2. Introduction to the 2D FEMM Simulator 4.2	Free speech, use of computer network from the laboratory equipment	2
3. Numerical analysis of the electromagnetic field in electrostatic regime in 2D structures. Rectangular capacitor application	Free speech, use of computer network from the laboratory equipment	2
4. Numerical analysis of the electromagnetic field in electrostatic regime in 2D structures. Application of capacity calculation between two power lines	Free speech, use of computer network from the laboratory equipment	2
5. Numerical analysis of the electromagnetic field in stationary magnetic regime in 2D structures. Application of the calculation of an electromagnet	Free speech, use of computer network from the laboratory equipment	2
6. Numerical analysis of the electromagnetic field in stationary magnetic regime in 2D structures. Application of induction heating of semi-finished products	Free speech, use of computer network from the laboratory equipment	2
7. Numerical analysis of the electromagnetic field in stationary magnetic regime in 2D structures. Three-phase transformer application	Free speech, use of computer network from the laboratory equipment	2
8. Numerical analysis of the electromagnetic field in stationary magnetic regime in 2D structures. Magnetic bearing application	Free speech, use of computer network from the laboratory equipment	2
9. Introduction to ANSYS 3D Simulator	Free speech, use of computer network from the laboratory equipment	2
10. Numerical analysis of the electromagnetic field in electrostatic regime in 3D structures. Capacity calculation application	Free speech, use of computer network from the laboratory equipment	2
11. Numerical analysis of the electromagnetic field in electrostatic regime in 3D structures. Application of the calculation of an electromagnet	Free speech, use of computer network from the laboratory equipment	2
12. Numerical analysis of the electromagnetic field in electrostatic regime in 3D structures. Electromagnetic induction heating application	Free speech, use of computer network from the laboratory equipment	2
13. Numerical analysis of the electromagnetic field in electrostatic regime in 3D structures. Electromagnetic induction heating application	Free speech, use of computer network from the laboratory equipment	2
14. Checking the knowledge gained and concluding the	Free speech, use of	2

situation in the laboratory. Recovery of laboratory works.	computer network from the laboratory equipment	

Bibliography

1. Francisc Ioan Hathazi, Vasile Darie Șoproni, Mircea Nicolae Arion, Carmen Otilia Molnar, Supraconductori și sisteme supraconductoare. Fenomenul supraconductibilității și a diamagnetismului perfect, Editura Universității din Oradea, ISBN 978 – 606 – 10 – 1854 – 3, 2016, 2016;
2. Francisc Ioan Hathazi, Mircea Nicolae Arion, Vasile Darie Șoproni, Carmen Otilia Molnar, Elemente de teoria circuitelor electrice. Note de curs, Editura Universității din Oradea, ISBN 978 – 606 – 10 – 1855 – 0, 2016,
3. F.Hantila, T.Leuca, C.Ifrim, "Electrotehnică teoretica", vol. I, Editura Electra, 2002, ISBN 973-8067-69-3;
4. F.Hantila, "Câmpul magnetic în structuri cu magneți permanenți", Editura Electra, 2004, ISBN 973-7728-22-X;
5. F.Hantila, M.Vasiliu, "Campul electromagnetic variabil in timp", Editura Electra, 2005, ISBN 973-7728-48-3;
6. Simion, E. - Interferenta Electromagnetica. Ed. Casa Cartii de Stiinta, Cluj-Napoca, 1999;
7. ***, Manual FEMM 4.2 și aplicații.
8. ***,Documentație Softul profesional ANSYS 3D;

8.4. Project	Teaching methods	No. of hours/ Observations
1. Recapitulation of knowledge of the Matlab programming language and presentation of the Mathcad programming language	Free exposure, with a presentation on how to solve problems on the board or online	2
2. Realization of the mathematical calculation and implementation in Matlab (Matcad) of the intensity of the magnetic field in an external point located at the distance x from the axis of an infinitely long rectilinear conductor traveled by the current i and located in the air.	Free exposure, with a presentation on how to solve problems on the board or online	2
3. Calculate the intensity of the magnetic field at a point on the axis of symmetry of a circular plane of radius a, traversed by the current I. Graph its variation as a function of the distance from the plane of the coil and calculate the maximum value of the intensity magnetic field. (Use Matlab or Matcad)	Free exposure, with a presentation on how to solve problems on the board or online	2
4. Calculate the inductance of a single-phase line with the distance between the axes of the conductors equal to d and the radius a using Matlab or Matcad.	Free exposure, with a presentation on how to solve problems on the board or online	2
5. Mathematical calculation and implementation in Matlab (Matcad) of the inductance of an N-coil coil which is uniformly wound on a rectangular section tor (the material of which the tor is composed is linear and has magnetic permeability m.)	Free exposure, with a presentation on how to solve problems on the board or online	2
6. Calculation of the scattering inductances of two identical cylindrical coils placed on a closed magnetic core. (The two coils are flowing in the opposite direction). (Use Matlab or Matcad)	Free exposure, with a presentation on how to solve problems on the board or online	2
7. Teaching and supporting projects.	Free exposure, with a presentation on how to solve problems on the board or online	2

Bibliography

1. Francisc Ioan Hathazi, Mircea Nicolae Arion, Vasile Darie Șoproni, Carmen Otilia Molnar, Elemente de teoria circuitelor electrice. Note de curs, Editura Universității din Oradea, ISBN 978 – 606 – 10 – 1855 – 0, 2016,
2. F.Hantila, T.Leuca, C.Ifrim, "Electrotehnică teoretica", vol. I, Editura Electra, 2002, ISBN 973-8067-69-3;
3. T.Leuca, M. Novac, Chestiuni speciale de electrotehnica, Curs in format electronic.
4. ***, "*MATLAB User Guide*", The Mathworks
5. Cira, O., Lecţii de Mathcad 2001 Proffesional, Ed. Albastră, Cluj-Napoca, 2006
6. M. Ghinea, V. Fireţeanu, - " Matlab calculul numeric-grafică-aplicaţii.", Editura Teora, 1997.
7. Ivanov, Virginia, Aplicații în Mathcad și Matlab, vol. I, Ed. Universitaria, Craiova, 2007.

9. Corroboration of the discipline content with the expectations of the representatives of epistemological community, professional associations and representative employers in the field related to the program

- The content of the discipline is in accordance with what is taught in other profile faculties both from the University of Oradea and from other university centers in the country and abroad. For a better adaptation to the requirements of the labor market of the content of the discipline, meetings were held both with representatives of the business environment and with teachers from pre-university education.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percent from the final mark
10.4 Course	Oral examination	The evaluation can be done face-to-face or online. Oral examination of students	50 %
10.5 Seminar	-	-	-
10.6 Laboratory	Final evaluation test	The evaluation can be done face-to-face or online. Oral examination of students	20 %
10.7 Project	Oral examination	Oral examination - Project presentation	30%
10.8 Minimum performance standard: • Carrying out the works under the coordination of a teacher, in order to solve specific problems in the electrical field with the correct evaluation of the workload, resources available for the necessary time to complete the risks, under the conditions of application of occupational safety and health norms.			

Completion date:
29.08.2022

Date of endorsement in the department:
01.09.2022

Date of endorsement in the Faculty Board:
23.09.2022

SUBJECT DESCRIPTION

1. Data related to the study program

1.1 Higher education institution	**UNIVERSITY OF ORADEA**
1.2 Faculty	**Faculty of Electrical Engineering and Information Technology**
1.3 Departament	**Electrical Engineering**
1.4 Field of study	**Electrical Engineering**
1.5 Study cycle	**MASTER(2nd cycle)**
1.6 Study program/Qualification	**ADVANCED SYSTEMS IN ELECTRICAL ENGINEERING/ MASTER Of SCIENCE IN ENGINEERING**

2. Date despre disciplină

2.1 Name of the subject		**INTERFERENCES AND ELECTROMAGNETIC PROTECTION COURSE**					
2.2 Holder of the subject		**Prof.Dr.Ing.Ec. Silaghi Alexandru Marius**					
2.3 Holder of the academic seminar/laboratory/project							
2.4 Year of study	**I**	2.5 Semester	**1**	2.6 Type of the evaluation	**Ex**	2.7 Subject regime	**DAP**

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	**2**	of which: 3.2 course	**2**	3.3 academic seminar/laboratory/project	
3.4 Total of hours from the curriculum	**28**	of which: 3.5 course	**28**	3.6 laboratory /project	

Distribution of time	72h
Study using the manual, course support, bibliography and handwritten notes	30
Supplementary documentation using the library, on field-related electronic platforms and in field-related places	14
Preparing academic seminaries/laboratories/ themes/ reports/ portfolios and essays	24
Tutorials	
Examinations	4
Other actvities	

3.7 Total of hours for individual study	**72**
3.9 Total of hours per semester	**100**
3.10 Number of credits	4

4. Pre-requisites (where applicable)

4.1 related to the curriculum	Knowledge of mathematics and physics, Electrotechnics, Electrotechnical materials, Electrical measurements ,Electronics, Microwave
4.2 related to skills	Electrical measurements, Microwave technique, Microwave technologies, New energy sources

5. Conditions (where applicable)

5.1. for the development of the course	- attending at least 50% of the course - the course can be held face to face or online.
5.2.for the development of the academic seminary/laboratory/project	- mandatory presence at all laboratory and seminar hours; - students will perform the hours with the lab work; - maximum 2 works (30%) can be recovered during the semester; - frequency at laboratory less than 70% leads to the restoration of discipline. - the laboratory or seminars can be held face to face or online.

6. Specific skills acquired	
Professional skills	□ knowledge of the main existing regulations in the field □ ensuring competences in the field of electromagnetic field study, at a higher level with direct applicability in the technical design. □ designing equipment in the field of electrical engineering and systems for conversion and use of non-conventional sources □ development of management skills of specific projects in electrical engineering.
Transversal skills	□ the ability to analyze and solve disruptive phenomena in electrical systems □ identification of roles and responsibilities in a multidisciplinary team and the application of communication techniques and effective work within the team □ identification of the objectives to be achieved, the available resources, the conditions for their completion, work stages, working times, related completion deadlines and related risks □ the effective use of information sources and resources for communication and assisted professional training (Internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in an international language.

7. The objectives of the discipline (resulting from the grid of the specific competences acquired)

7.1 Obiectivul general al disciplinei	□ The "Electromagnetic Interference" course proposes a familiarization of electrical engineering students with the introductory notions of the electromagnetic field and some applications related to electromagnetic field interference
7.2 Obiectivele specifice	□ Being a specialized discipline in electrical engineering, its objective is to present calculation methods in a unitary framework of problems of general interest, necessary to solve various specific electrical problems. □ The design part familiarizes students with practical aspects regarding the operation of electrical systems at high frequencies.

8. Contents

8.1 Course	Teaching methods	No. of hours/ Observations
Chapter 1. INTRODUCTORY CONSTITUENTS	Free exposure, with the presentation on-line or on the board	2h

Chapter 2. NON-QUALITY OF ELECTRICAL ENERGY	Free exposure, with the presentation on-line or on the board	4h
Chapter 3. TREATMENT MONITORING ELECTRIC ENERGY	Free exposure, with the presentation on-line or on the board	8h
Chapter 4. INDICATORS FOR EVALUATING THE QUALITY OF ELECTRICAL ENERGY ISO 9000	Free exposure, with the presentation on-line or on the board	4h
Chapter 5. TECHNOLOGY AND MANAGEMENT OF ELECTROMAGNETIC COMPATIBILITY	Free exposure, with the presentation on-line or on the board	6h
Chapter 6. ANALYSIS OF THE TECHNICAL LEVEL AND QUALITATIVE OF ELECTROMAGNETIC INTERFERENCES	Free exposure, with the presentation on-line or on the board	4h
Total		28h

Bibliography

1. R. Badoudal, C. Martin, S.Jacquet - "Les micro-ondes", Masson, Paris, 1993
2. A. De Sabata - Măsurări cu microunde şi optoelectronice, Lit. Universităţii "Politehnica" Timişoara, 1996
3. A. De Sabata - Tehnica Frecvenţelor Înalte, Timişoara: Orizonturi Universitare, 2001
4. R. E. Collin - Foundations for microwave engineering, New York: McGraw-Hill, 1992
5. D. M. Pozar - Microwave Engineering, Second edition, New York: John Wiley and Sons, 1998.
6. U.L. Rohde, M. Rudolph - RF/Microwave Circuit Design for Wireless Applications, 2nd ed., Hoboken, NJ,USA: John Wiley& Sons, 2012, ISBN 978-0-470-90181-6
7. G. Rulea - Bazele teoretice şi experimentale ale tehnicii microundelor, Ed. Şt. şi Enc., Bucureşti, 1989.
8. D.D. Sandu - Dispozitive electronice pentru microunde, Ed. Şt. şi Enc., Bucureşti, 1982.
9. M.A.Silaghi,Helga Silaghi -Tehnologii cu microunde.Tehnici informatice,Treira 2001, ISBN 973-8159-12-1
10.G.D. Vendelin,A. M.Pavio, U.L.Rohde – Microwave Circuit Design Using Linear and Nonlinear Techniques, 2nd ed, John Wiley& Sons, 2005, ISBN 0-471-41479-4
11. Helga Silaghi - *Calitatea energiei in sistemele de actionare electrica cu masina de inductie, Editura Treira , Oradea, 2000, ISBN 973-99649-3-1*
12.. Bruce R. Archambeault - *PCB Design for Real-World EMI Control, Springer, ISBN: 978-1-4020-7130-0*

9. Corroboration of the contents of the discipline with the expectations of representatives of the epistemic community, professional associations and representative employers in the field related to the program

 The content of the discipline can be found in the curricula of the specialization and in other university centers in Romania that have accredited these specializations, thus knowledge of the basic notions and design of this discipline is a strict requirement of employers in the field (Celestica, Connectronics, Faist Mekatronics, Comau, GMAB etc) from the Oradea Industrial Park area.

10. Assessment

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods The evaluation can take place face to face or online.	10.3 Weight of the final grade
10.4 Course	- for grade 5, it is necessary to know the	**Online or written exam** Students each receive a	100%

	fundamental notions required in the subjects, without presenting details about them - for grade 10, thorough knowledge of all subjects is required, according to the exam grid	form with questions with 3 answer options (10 points in total).	

10.5 Final exam grade: **Nfe=Nse**
10.6 Minimum Performance Standard
Course: Knowledge of the constructive parts and the principle of operation of various electrical equipment. Solving and explaining some problems of medium complexity, associated with fundamental and engineering disciplines, specific to engineering sciences.
E110, tel.:+40 259 408 458 , masilaghi@uoradea.ro, **hhtp://masilaghi.webhost.uoradea.ro**

Date of completion
28.08.2022

Signature of the course holder

Prof.univ.dr.ing. ec. Alexandru Marius Silaghi
e-mail: masilaghi@uoradea.ro

Date of approval in the department

01.09.2022

Signature of the director of the department

Prof.dr ing.info.habil. Francisc Hathazi

e-mail: francisc.hathazi@gmail.com

Date of approval in the Faculty Council

23.09.2022

Dean's signature

Prof.univ.dr.ing.habil Ioan Mircea Gordan

e-mail: mgordan@uoradea.ro

SUBJECT DESCRIPTION

1. Data related to the study program

1.1 Higher education institution	**UNIVERSITY OF ORADEA**
1.2 Faculty	**Faculty of Electrical Engineering and Information Technology**
1.3 Departament	**Electrical Engineering**
1.4 Field of study	**Electrical Engineering**
1.5 Study cycle	**MASTER(2nd cycle)**
1.6 Study program/Qualification	**ADVANCED SYSTEMS IN ELECTRICAL ENGINEERING/ MASTER Of SCIENCE IN ENGINEERING**

2. Date despre disciplină

2.1 Name of the subject		**INTERFERENCES AND ELECTROMAGNETIC PROTECTION PROJECT**					
2.2 Holder of the subject		**Prof.Dr.Ing.Ec. Silaghi Alexandru Marius**					
2.3 Holder of the academic seminar/laboratory/project							
2.4 Year of study	**I**	2.5 Semester	**1**	2.6 Type of the evaluation	**Vp**	2.7 Subject regime	**DAP**

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	**1**	of which: 3.2 course		3.3 academic seminar/laboratory/project	**1**
3.4 Total of hours from the curriculum	**14**	of which: 3.5 course		3.6 laboratory /project	**14**

Distribution of time	72h
Study using the manual, course support, bibliography and handwritten notes	30
Supplementary documentation using the library, on field-related electronic platforms and in field-related places	14
Preparing academic seminaries/laboratories/ themes/ reports/ portfolios and essays	24
Tutorials	
Examinations	4
Other actvities	

3.7 Total of hours for individual study	**72**
3.9 Total of hours per semester	**100**
3.10 Number of credits	4

4. Pre-requisites (where applicable)

4.1 related to the curriculum	Knowledge of mathematics and physics, Electrotechnics, Electrotechnical materials, Electrical measurements ,Electronics, Microwave
4.2 related to skills	Electrical measurements, Microwave technique, Microwave technologies, New energy sources

5. Conditions (where applicable)

5.1. for the development of the course	
5.2.for the development of the academic seminary/laboratory/project	- mandatory presence at all laboratory or seminar hours; - students will perform the hours with the lab work; - maximum 2 works (30%) can be recovered during the semester; - frequency at laboratory less than 70% leads to the restoration of discipline. - the project can be held face to face or online.

6. Specific skills acquired	
Professional skills	□ knowledge of the main existing regulations in the field □ ensuring competences in the field of electromagnetic field study, at a higher level with direct applicability in the technical design. □ designing equipment in the field of electrical engineering and systems for conversion and use of non-conventional sources □ development of management skills of specific projects in electrical engineering.
Transversal skills	□ the ability to analyze and solve disruptive phenomena in electrical systems □ identification of roles and responsibilities in a multidisciplinary team and the application of communication techniques and effective work within the team □ identification of the objectives to be achieved, the available resources, the conditions for their completion, work stages, working times, related completion deadlines and related risks □ the effective use of information sources and resources for communication and assisted professional training (Internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in an international language.

7. The objectives of the discipline (resulting from the grid of the specific competences acquired)

7.1 Obiectivul general al disciplinei	□ The "Electromagnetic Interference" course proposes a familiarization of electrical engineering students with the introductory notions of the electromagnetic field and some applications related to electromagnetic field interference
7.2 Obiectivele specifice	□ Being a specialized discipline in electrical engineering, its objective is to present calculation methods in a unitary framework of problems of general interest, necessary to solve various specific electrical problems. □ The design part familiarizes students with practical aspects regarding the operation of electrical systems at high frequencies.

8. Contents

8.1 Course	Teaching methods	No. of hours/ Observations

Design stages: 1. Statistical methods with application to monitoring the quality of electricity 2. The problem of the quality of electricity 3. Improving the quality of electricity 4. The information system of the quality of electricity 5. Designing the electromagnetic compatibility of electrical systems 6. Simulation of specific electromagnetic interference problems 7. Analysis of the circuits that model electromagnetic interference problems	The students receive the design theme and the design methodology and under the guidance of the teaching staff they carry out the stages of the project. Free presentation and discussions based on the homework that the students have to prepare for that class or on line.	2h
1.Metode statistice cu aplicatie la monitorizarea calitatii energiei electrice 2.Problematica calitatii energiei electrice 3.Ameliorarea calitatii energiei electrice 4.Sistemul informational al calitatii energiei electrice 5.Proiectarea compatibilitatii electromagnetice a sistemelor electrice 6.Simulare problemelor specifice de interferente electromagnetice 7. Analiza circuitelor care modeleaza problemele de interferente electromagnetice	Free exposure, with the presentation on-line or on the board	4h
Chapter 3. TREATMENT MONITORING ELECTRIC ENERGY	Free exposure, with the presentation on-line or on the board	8h
Chapter 4. INDICATORS FOR EVALUATING THE QUALITY OF ELECTRICAL ENERGY ISO 9000	Free exposure, with the presentation on-line or on the board	4h
Chapter 5. TECHNOLOGY AND MANAGEMENT OF ELECTROMAGNETIC COMPATIBILITY	Free exposure, with the presentation on-line or on the board	6h
Chapter 6. ANALYSIS OF THE TECHNICAL LEVEL AND QUALITATIVE OF ELECTROMAGNETIC INTERFERENCES	Free exposure, with the presentation on-line or on the board	4h
Total		28h

Bibliography
1. R. Badoudal, C. Martin, S.Jacquet - "Les micro-ondes", Masson, Paris, 1993
2. A. De Sabata - Măsurări cu microunde şi optoelectronice, Lit. Universităţii "Politehnica" Timişoara, 1996

3. A. De Sabata - Tehnica Frecvenţelor Înalte, Timişoara: Orizonturi Universitare, 2001
4. R. E. Collin - Foundations for microwave engineering, New York: McGraw-Hill, 1992

5. D. M. Pozar - Microwave Engineering, Second edition, New York: John Wiley and Sons, 1998.
6. U.L. Rohde, M. Rudolph - RF/Microwave Circuit Design for Wireless Applications, 2nd ed., Hoboken, NJ,USA: John Wiley& Sons, 2012, ISBN 978-0-470-90181-6
7. G. Rulea - Bazele teoretice şi experimentale ale tehnicii microundelor, Ed. Şt. şi Enc., Bucureşti, 1989.
8. D.D. Sandu - Dispozitive electronice pentru microunde, Ed. Şt. şi Enc., Bucureşti, 1982.
9. M.A.Silaghi, Helga Silaghi – Tehnologii cu microunde.Tehnici informatice,Treira 2001, ISBN 973-8159-12-1
10.G.D. Vendelin,A. M.Pavio, U.L.Rohde – Microwave Circuit Design Using Linear and Nonlinear Techniques, 2nd ed, John Wiley& Sons, 2005, ISBN 0-471-41479-4

9. Corroboration of the contents of the discipline with the expectations of representatives of the epistemic community, professional associations and representative employers in the field related to the program

 The content of the discipline can be found in the curricula of the specialization and in other university centers in Romania that have accredited these specializations, thus knowledge of the basic notions and design of this discipline is a strict requirement of employers in the field (Celestica, Connectronics, Faist Mekatronics, Comau, GMAB etc) from the Oradea Industrial Park area.

10. Assessment

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods The evaluation can take place face to face or online.	10.3 Weight of the final grade
10.4 Course	- for grade 5, it is necessary to know the fundamental notions required in the subjects, without presenting details about them - for grade 10, thorough knowledge of all subjects is required, according to the exam grid	**Online or oral exam** Presentation of the project in the presence of colleagues and discussions on each topic. Finally, each student receives a grade, separate from the exam grade, which represents 20% of the final grade. The evaluation can take place face to face or online.	100%
10.5 Final exam grade: **Nfe**=**Np**≥6			
10.6 Minimum Performance Standard			
Project: Carrying out a work / a project, as a leader in a multidisciplinary team and responsibly distributing specific tasks to subordinates, with the adoption of a positive attitude and respect towards team members.			

E110, tel.:+40 259 408 458 , masilaghi@uoradea.ro, **hhtp://masilaghi.webhost.uoradea.ro**

Date of completion 28.08.2022

Signature of the course holder

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Date of approval in the department

01.09.2022

Signature of the director of the department

Prof.dr ing.info.habil. Francisc Hathazi

e-mail: francisc.hathazi@gmail.com

Date of approval in the Faculty Council

23.09.2022

Dean's signature

Prof.univ.dr.ing.habil Ioan Mircea Gordan

e-mail: mgordan@uoradea.ro

SUBJECT DESCRIPTION

1. Data related to the study program

1.1 Higher education institution	**UNIVERSITY OF ORADEA**
1.2 Faculty	**Faculty of Electrical Engineering and Information Technology**
1.3 Department	DEPARTMENT OF ELECTRICAL ENGINEERING
1.4 Field of study	ELECTRICAL ENGINEERING
1.5 Study cycle	Master (2^{nd} cycle)
1.6 Study program/Qualification	Advanced Systems in Electrical Engineering Master of Science in Engineering

2. Data related to the subject

2.1 Name of the subject				**MODERN ELECTROTHERMAL SYSTEMS**			
2.2 Holder of the subject				**Conf.dr.ing. BANDICI LIVIA**			
2.3 Holder of the academic seminar / laboratory / project							
2.4 Year of study	I	2.5 Semester	2	2.6 Type of the evaluation	Ex	2.7 Subject regime	I

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	2	of which: 3.2 course	2	3.3 academic seminar/laboratory/project	-
3.4 Total of hours from the curriculum	28	Of which: 3.5 course	28	3.6 academic seminar/laboratory/project	-

Distribution of time	hours
Study using the manual, course support, bibliography and handwritten notes	14
Supplementary documentation using the library, on field-related electronic platforms and in field-related places	13
Preparing academic seminaries/laboratories/ themes/ reports/ portfolios and essays	14
Tutorials	3
Examinations	3
Other activities.	-

3.7 Total of hours for individual study	**47**
3.9 Total of hours per semester	**75**
3.10 Number of credits	3

4. Pre-requisites (where applicable)

4.1 related to the curriculum	Special issues of electrical engineering, Electrothermal, Electrical installations
4.2 related to skills	Knowledge of how classic heating systems work

5. Conditions (where applicable)

5.1. for the development of the course	- Video projector, computer. - The course can be held face to face or online platform https://e.uoradea.ro/..
5.2.for the development of the academic seminary/laboratory/project	- Preparation of the project after choosing a theme - The project can be carried out face to face or online on the platform https://e.uoradea.ro/.
6. Specific skills acquired	

Professional skills	**C3. Analysis and development of applications for the optimization of industrial electrical energy processes using specific software.**
Transversal skills	**CT1** Identifying the objectives to be achieved, the available resources, the conditions for their completion, the working steps, the working times, the related implementation deadlines and the related risks. Undertaking coordinated projects to solve specific problems in the field with the correct assessment of the workload. Managerial skills in multidisciplinary teams engaged in solving large complex projects.

7. The objectives of the discipline (resulting from the grid of the specific competences acquired)

7.1 The general objective of the subject	The course "Modern electrothermal systems" aims to familiarize students with the study and usefulness of modern electrothermal equipment. As an advanced knowledge discipline, its object is the presentation in a uniform framework of modern electrothermal equipment for the conversion of electric energy into heat, especially those specific to the industrial field. Master's degree students have the opportunity to familiarize themselves with various modern electrothermal installations, to acquire practical skills in the designing, building, sizing and operating of electrothermal installations, with the possibility to execute, maintain, exploit and repair them.
7.2 Specific objectives	Project themes are designed to provide future master's degree engineers practical skills in designing, building, researching, operating, repairing and maintaining modern electrothermal installations. Students have the opportunity to choose the project theme from those proposed by the coordinating teacher or they can come up with their own project themes, which should correspond to the themes of the subject of the course. Students have the opportunity to know the latest trends in the evolution of modern electrothermal systems. Knowledge is useful in forming skills to address specific issues encountered by a specialist in the field.

8. Contents*

8.1 Course	Teaching methods	No. of hours/ Observations
I. Energy problems of electrothermal systems 1.1. Establishing the permissible limits of disturbances caused by the operation of electrothermal systems on the power supply network 1.2. Causes and effects of reactive power circulation	Projector. Intercalated student contributions are requested on subject-specific topics. Some courses take place by teaching subjects and student debates.	2
II. Thermal transfer in electrothermal systems 2.1. Heat transfer by thermal conduction 2.2. Heat transfer by thermal convection	Idem	2
2.3. Heat transmission by thermal radiation 2.4. Heat transfer in complex structures	Idem	2
III. Modern heating systems with electrical resistance 3.1. Calculation of the parameters of the furnace with resistors	Idem	2
3.2. Electric furnaces with resistors for thermal treatments 3.3. Continuous furnaces 3.3.1. Continuous furnaces for burning thick layers	Idem	2
3.4. Heating and drying installations with infrared radiation 3.5. Modern home appliances 3.6. Instant water heating installation	Idem	2
IV. Electromagnetic induction heating equipment and specific technologies 4.1. Induction heating equations 4.2. Electrical equipment for electromagnetic induction heating	Idem	2

4.3. Applications of electromagnetic induction heating		
4.4. Applications of electromagnetic induction heating 4.4.1. Induction furnaces for melting	Idem	2
4.4.2. In-depth heating systems by electromagnetic induction 4.4.3. Surface hardening by electromagnetic induction of moving parts	Idem	2
4.4.4. Gluing parts by electromagnetic induction	Idem	2
V. Modern systems for radio frequency and microwave field processing of dielectric materials 5.1. Physical processing mechanisms 5.2. Numerical analysis of the electromagnetic field	Idem	2
5.3. Systems for processing biscuits and cookies in a radio frequency field 5.4. Systems for drying pasta in a radio frequency and microwave field 5.5. Systems for processing food packed in a radio frequency field	Idem	2
5.6. Systems for the pasteurization and sterilization of liquid products in a radio frequency field 5.7. Systems for rapid heating and defrosting products in a radio frequency field	Idem	2
5.8. New technologies for drying and straightening bent wood using microwaves 5.9. Systems for drying bundles of yarn and combed wool	Idem	2

Bibliography

1. **Livia Bandici** – *Sisteme electrotermice moderne*. Editura Universităţii din Oradea, 2014.
2. F.I. Hănţila, T. Leuca, **Livia Bandici** - *Tehnici informatice utilizate în ingineria electrică*. Editura Universităţii din Oradea, 2011.
3. **Livia Bandici**, D. Hoble, St. Nagy - *Tehnologii inovative în procesarea materialelor*. Editura Universităţii din Oradea, 2011.
4. D. Hoble, **Livia Bandici**, St. Nagy - *Sisteme performante de procesare electrotermică a materialelor*. Editura Universităţii din Oradea, 2012.
5. **Livia Bandici** - *Electrotermie – Aplicaţii*. Editura Universităţii din Oradea, 2003
6. **Livia Bandici** – *Modelarea numerică a câmpului electromagnetic şi termic cuplat în instalaţiile de încălzire în câmp de microunde*. Editura Mediamira – Cluj - Napoca, 2005.
7. V. Fireţeanu - *Procesarea electromagnetică a materialelor*. Editura Politehnică Bucureşti, 1995.
8. V. Fireţeanu, T. Leuca, - *Inducţia electromagnetică şi tehnologii specifice,* Ed. Mediamira, Cluj -Napoca, 1997.
9. N. Golovanov, ş.a. – *Electrotermie şi electrotehnologii*, vol.I. Editura Tehnică, Bucureşti,1997.
10. F. I. Hănţilă, E. Demeter - *Rezolvarea numerică a problemelor de câmp electromagnetic*, Ed. Ari Press, ICPE-ME, Bucureşti, 1995.
11. T.Leuca – *Câmp electromagnetic şi termic cuplat. Curenţi turbionari*. Editura Mediamira, Cluj-Napoca, 1996.
12. Teodor Leuca, **Livia Bandici**, Carmen Molnar – *Aspecte privind încălzirea în câmp de microunde a materialelor dielectrice*. Editura Mediamira – Cluj - Napoca, 2006.
13. Şt. Nagy, ş.a. – *Procesarea materialelor în câmp electromagnetic aplicaţii utilizând tehnici informatice*. Editura Universităţii din Oradea, 2002.
14. C. Samoilă, ş.a. - *Tehnologii moderne de încălzire*. Editura Tehnică, 1986.

9. Corroboration of the discipline content with the expectations of the representatives of epistemological community, professional associations and representative employers in the field related to the program

-

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percent from the final mark
10.4 Course	Minimum required conditions for passing the exam (mark 5): in accordance with the minimum performance standard	The evaluation can be done face to face or online.	
10.5. Project	Minimum required conditions for promotion (grade 5): in accordance		

	with the minimum performance standard		
10.6. Minimum performance standard: Carrying out works under coordination, in order to solve some problems specific to the field, with the correct evaluation of the workload, the available resources, the necessary completion time and the risks, in conditions of application of the norms of safety and health at work; Adequate use of basic knowledge of technological methods and processes used in the machine building and electrical engineering industries.			

Completion date:
29.08.2022

Date of endorsement in the department:
01.09.2022

Date of endorsement in the Faculty Board:

23.09.2022

SUBJECT DESCRIPTION

1. Data related to the study program

1.1 Higher education institution	**UNIVERSITY OF ORADEA**
1.2 Faculty	**Faculty of Electrical Engineering and Information Technology**
1.3 Department	DEPARTMENT OF ELECTRICAL ENGINEERING
1.4 Field of study	ELECTRICAL ENGINEERING
1.5 Study cycle	Master (2nd cycle)
1.6 Study program/Qualification	Advanced Systems in Electrical Engineering Master of Science in Engineering

2. Data related to the subject

2.1 Name of the subject		**MODERN ELECTROTHERMAL SYSTEMS**					
2.2 Holder of the subject							
2.3 Holder of the academic seminar / laboratory / project		**Conf.dr.ing. BANDICI LIVIA - PROJECT**					
2.4 Year of study	I	2.5 Semester	2	2.6 Type of the evaluation	Cv	2.7 Subject regime	I

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	2	of which: 3.2 course	-	3.3 academic seminar/laboratory/project	2
3.4 Total of hours from the curriculum	28	Of which: 3.5 course	-	3.6 academic seminar/laboratory/project	28

Distribution of time	hours
Study using the manual, course support, bibliography and handwritten notes	**4**
Supplementary documentation using the library, on field-related electronic platforms and in field-related places	**7**
Preparing academic seminaries/laboratories/ themes/ reports/ portfolios and essays	**7**
Tutorials	**2**
Examinations	**2**
Other activities.	**-**

3.7 Total of hours for individual study	**22**
3.9 Total of hours per semester	**50**
3.10 Number of credits	**2**

4. Pre-requisites (where applicable)

4.1 related to the curriculum	Special issues of electrical engineering, electrothermics, electrical installations
4.2 related to skills	Knowledge of how classic heating systems work

5. Conditions (where applicable)

5.1. for the development of the course	- Video projector, computer. - The course can be held face to face or on the online platform https://e.uoradea.ro/. - Attendance: at least 50% of the courses.
5.2.for the development of the academic seminary/laboratory/project	- Elaboration of the project after choosing a theme - The project can be presented face to face or online

6. Specific skills acquired	
Professional skills	**C3. Analysis and development of applications for the optimization of industrial electrical energy processes using specific software.**
Transversal skills	**CT1** Identifying the objectives to be achieved, the available resources, the conditions for their completion, the working steps, the working times, the related implementation deadlines and the related risks. Undertaking coordinated projects to solve specific problems in the field with the correct assessment of the workload. Managerial skills in multidisciplinary teams engaged in solving large complex projects

7. The objectives of the discipline (resulting from the grid of the specific competences acquired)

7.1 The general objective of the subject	The course "Modern electrothermal systems" aims to familiarize students with the study and usefulness of modern electrothermal equipment. As an advanced knowledge discipline, its object is the presentation in a uniform framework of modern electrothermal equipment for the conversion of electric energy into heat, especially those specific to the industrial field. Master's degree students have the opportunity to familiarize themselves with various modern electrothermal installations, to acquire practical skills in the designing, building, sizing and operating of electrothermal installations, with the possibility to execute, maintain, exploit and repair them.
7.2 Specific objectives	Project themes are designed to provide future master's degree engineers practical skills in designing, building, researching, operating, repairing and maintaining modern electrothermal installations. Students have the opportunity to choose the project theme from those proposed by the coordinating teacher or they can come up with their own project themes, which should correspond to the themes of the subject of the course. Students have the opportunity to know the latest trends in the evolution of modern electrothermal systems. Knowledge is useful in forming skills to address specific issues encountered by a specialist in the field.

8. Contents*

8.1 Project	Teaching methods	No. of hours/ Observations
Suggested themes: 1. The calculation of the parameters of an electric furnace with resistors for thermal treatments. 2. The calculation of the parameters of an electric furnace with resistors for food processing. 3. The calculation of the parameters of continuous heating system with infrared radiation. 4. The calculation of the parameters of an infrared heating installation for heating a vat. 5. The calculation of the parameters of an induction boiler for heating acids. 6. The calculation of the parameters of a transformer-type boiler for overheating non-conductive liquids. 7. Induction heating of a magnetic steel bar under the Curie point. 8. The calculation of the parameters of an inductor using two frequencies for heating magnetic steel bars. 9. The calculation of the parameters of an inductor with transverse magnetic flux. 10. The calculation of the parameters of an electromagnetic induction melting furnace. 11. The calculation of the parameters of an installation for gluing wood rods by radio frequency heating. 12. The calculation of the parameters of an equipment for microwave field processing of wood products. 13. The calculation of the parameters of an equipment for microwave field processing of granular products.	Choice of theme. Discussions on how to elaborate the project.	2

14. The calculation of the parameters of an equipment for microwave field processing of medicinal plants and forest fruits. 15. The calculation of the parameters of an equipment for microwave field processing of grapes.		
I. General notions on the heating process **II**. Materials used in the construction of the installation	A brief approach to the main issues related to the design and choice of materials used in the construction of the installation	2
III. The theoretical foundations of equipment calculation	A brief approach to the main issues related to the design and choice of materials used in the construction of the installation	2
IV. Determining the parameters of the heating equipment 4.1. Methods of calculation of electrical equipment parameters	Explanations on how to calculate the main electrical quantities and methods of determination.	2
4.2. Determination of thermal parameters 4.3. The influence of material parameters on the heating process	In the first part of the meeting, a review of the theoretical part presented by the students will be made. In the second part, a presentation of the concepts related to the calculation of the electrical parameters of the system will be made.	2
4.4. Determination of the equivalent parameters of the heating assembly and energy indicators	In the first part of the meeting, a review of the theoretical part presented by the students will be made. In the second part, a presentation of the concepts related to the calculation of the electrical parameters of the system will be made.	2
V. Numerical modelling of the heating system using specialized software 5.1. General concepts on numerical modelling	In the first part of the meeting, a review of the calculations presented by the students until this stage will be carried out. In the second	2

	part, a presentation of how to calculate the equivalent parameters and the energy indicators of the heating equipment is made	
5.2. Numerical modelling (HFSS, Cenos, Elta).	During the first part of the meeting, a review of the calculations presented by the students will be made. In the second part, a presentation of how to calculate the efficiency of the processing, respectively the mode of drawing the equivalent electric scheme will be made.	4
Numerical modeling using dedicated software (HFSS, Cenos, Elta)	Numerical modeling using specialized software.	4
Numerical modeling / simulations. Conclusions	Modeling, drawing up the equivalent electrical diagram of the electrothermal system.	4
Final project evaluation. Conclusions	Defence and handing out of the elaborated project.	2

Bibliography

1. **Livia Bandici** – *Sisteme electrotermice moderne*. Editura Universităţii din Oradea, 2014.
2. **Livia Bandici** - *Electrotermie – Aplicaţii*. Editura Universităţii din Oradea, 2003.
3. **Livia Bandici** – *Modelarea numerică a câmpului electromagnetic şi termic cuplat în instalaţiile de încălzire în câmp de microunde*. Editura Mediamira – Cluj - Napoca, 2005
4. V. Fireţeanu - *Procesarea electromagnetică a materialelor*. Editura Politehnică Bucureşti, 1995.
5. V. Fireţeanu, T. Leuca, *Inducţia electromagnetică şi tehnologii specifice,* Ed. Mediamira, Cluj -Napoca, 1997.
6. N. Golovanov, ş.a. – *Electrotermie şi electrotehnologii*, vol.I. Editura Tehnică, Bucureşti,1997.
7. F. I. Hănţilă, E. Demeter - *Rezolvarea numerică a problemelor de câmp electromagnetic*, Ed. Ari Press, ICPE-ME, Bucureşti, 1995.
8. T.Leuca – *Câmp electromagnetic şi termic cuplat. Curenţi turbionari*. Editura Mediamira, Cluj-Napoca, 1996.
9. Teodor Leuca, Livia Bandici, Carmen Molnar – *Aspecte privind încălzirea în câmp de microunde a materialelor dielectrice*. Editura Mediamira – Cluj - Napoca, 2006.
10. Şt. Nagy, ş.a. – *Procesarea materialelor în camp electromagnetic aplicaţii utilizând tehnici informatice*. Editura Universităţii din Oradea, 2002.
11. C. Samoilă, ş.a. - *Tehnologii moderne de încălzire*. Editura Tehnică, 1986.
12. Softuri: Flux 2D, 3D
13. Softuri HFSS 8.0, 10.0, 15.0
14. Soft Comsol
15. Soft Cenos

9. Corroboration of the discipline content with the expectations of the representatives of epistemological community, professional associations and representative employers in the field related to the program

The content of the subject is adapted and satisfies the requirements imposed by the labor market, being agreed by the social partners, professional associations, and employers in the field related to the bachelor's degree program.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percent from the final mark
10.1 Project	The project will be handed in during the last week of classes. Students will present the project in front of the teacher, the other students having the opportunity to intervene during the presentation.	The evaluation can be done face to face or online.	Different grade from the one obtained at the exam.
10.6. Minimum performance standard: Carrying out works under coordination, in order to solve some problems specific to the field, with the correct evaluation of the workload, the available resources, the necessary completion time and the risks, in conditions of application of the norms of safety and health at work; Adequate use of basic knowledge of technological methods and processes used in the machine building and electrical engineering industries. $N=0,70\ Pr+0,30A_i$.			

Completion date:
29.08.2022

Date of endorsement in the department:
01.09.2022

Date of endorsement in the Faculty Board:

23.09.2022

SUBJECT DESCRIPTION

1. Data related to the study program

1.1 Higher education institution	**UNIVERSITY OF ORADEA**
1.2 Faculty	**Faculty of Electrical Engineering and Information Technology**
1.3 Department	Department of Electrical Engineering
1.4 Field of study	Electrical engineering
1.5 Study cycle	Master (2nd cycle)
1.6 Study program/Qualification	Advanced systems in electrical engineering / Master degree

2. Data related to the subject

2.1 Name of the subject				COMPUTERISED ELECTRICAL EQUIPMENTS			
2.2 Holder of the subject				Popa Monica			
2.3 Holder of the academic seminar/laboratory/project				Popa Monica			
2.4 Year of study	II	2.5 Semester	III	2.6 Type of the evaluation	Ex	2.7 Subject regime	I

(I) Imposed; (O) Optional;

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	3	of which: 3.2 course	1	3.3 academic laboratory	2
3.4 Total of hours from the curriculum	42	of which: 3.5 course	14	3.6 academic laboratory	28

Distribution of time	hours
Study using the manual, course support, bibliography and handwritten notes	20
Supplementary documentation using the library, on field-related electronic platforms and in field-related places	20
Preparing academic seminaries/laboratories/ themes/ reports/ portfolios and essays	22
Tutorials	4
Examinations	3
Other activities.	

3.7 Total of hours for individual study	**69**
3.9 Total of hours per semester	**125**
3.10 Number of credits	**5**

4. Pre-requisites (where applicable)

4.1 related to the curriculum	Electrical installations, Electrical devices
4.2 related to skills	Computer operation

5. Conditions (where applicable)

5.1. for the development of the course	on-site
5.2. for the development of the academic laboratory	on-site Computers and software packages, intelligent relays

6. Specific skills acquired	
Professional skills	**C2** Use of modern acquisition techniques, data processing and their use in complex equipment systems in electrical engineering **C3** Analysis and development of applications for optimizing industrial processes of electrical engineering using specific software
Transversal skills	

7. The objectives of the discipline (resulting from the grid of the specific competences acquired)

7.1 The general objective of the subject	▪ Integration of intelligent equipments in electrical installations
7.2 Specific objectives	▪ Programing of intelligent equipments ▪ Choosing the intelligent equipments and their integration in complex installations

8. Contents *

8.1 Course	Teaching methods	No. of hours/ Observations
1. Basics of programmable equipments	notes on blackboard, Power Point presentation	2
2. Fundamentals of programming in ladder language. Ladder diagrams	notes on blackboard, Power Point presentation	2
3. FBD language(functional block diagram). Developing of complex applications.	notes on blackboard, Power Point presentation	2
4. Intelligent relays – basics and their programming	notes on blackboard, Power Point presentation	2
5. Applications of AP in electrical installations. Communication betwwens comutation equipments HMI (human machine interface)	notes on blackboard, Power Point presentation	2
6. Principles and local area networks technologies. LAN standards.	notes on blackboard, Power Point presentation	2
7. Wireless technologies in electrical installations..	notes on blackboard, Power Point presentation	2

Bibliografie 1. Monica Popa – Course notes, **http://webhost.uoradea.ro/mpopa/** 2. Shengwei Wang – Intelligent buildings and building automation, Spoon Press New York 2010 3. Equipments user guide 4. Web resources		
8.3 Laboratory	Teaching methods	No. of hours/ Observations
L1, L2 – Ladder language presentation and the intelligent equipments in the laboratory	assisting the students in solving applications on computer	4
L3 – AAR – two or three sources	assisting the students in solving applications on computer	2
L4 – Applications in lighting control	assisting the students in solving applications on computer	2
L5 – The temperature and ventilation control in a green house	assisting the students in solving applications on computer	2
L6 – Monitoring the access in a car parking	assisting the students in solving applications on computer	2
L7 – Control of a tank systems	assisting the students in solving applications on computer	2
L8 – Control of a pumping group	assisting the students in solving applications on computer	2
L9 – Control af three transportors belts	assisting the students in solving applications on computer	2
L10 – Cotrol of an irrigation system	assisting the students in solving applications on computer	2
L11- Control af a feeding system in a pharm	assisting the students in solving applications on computer	2
L12 – Control of a mixing system	assisting the students in solving applications on computer	2
L13 – Remote control of a pumping station	assisting the students in solving applications on computer	2
L14 – Evaluation of laboratory activity	final verification of applications	2

9. Corroboration of the discipline content with the expectations of the representatives of epistemological community, professional associations and representative employers in the field related to the program

- The content of the subject is in accordance with the one in other national or international universities. In order to provide a better accomodation to the labour market requirements, there have been organized meetings both with representatives of the socio-economic environment and with academic staff with similar professional interest fields.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percent from the final mark
10.4 Course	Ability to solve a CAD	Oral examination	80%

	application	Application on computer	
10.5 Laboratory	Solving the tasks	Activity at laboratory classes	20%
10.6 Minimum performance standard:			
Passing the subject - grade ≥ 5.			

Completion date: Signature of subject holder Signature of academic laboratory holder

29.08.2022 Assoc. Prof. Monica Popa
E-mail: mpopa@uoradea.ro

Assoc. Prof. Monica Popa

Date of endorsement in the department: Signature of Department Head

01.09.2022 Prof. Francisc – Ioan Hathazi
E-mail: francisc.hathazi@gmail.com

Date of endorsement in the Faculty Board: Signature of Dean

23.09.2022 Prof. Mircea Gordan
E-mail: mgordan@uoradea.ro

SUBJECT DESCRIPTION

1. Data related to the study program

1.1 Higher education institution	**UNIVERSITY OF ORADEA**
1.2 Faculty	**Faculty of Electrical Engineering and Information Technology**
1.3 Department	Department of Electrical Engineering
1.4 Field of study	Electrical engineering
1.5 Study cycle	Master (2nd cycle)
1.6 Study program/Qualification	Advanced systems in electrical engineering / Master degree

2. Data related to the subject

2.1 Name of the subject	Optimization in electrical engineering						
2.2 Holder of the subject	Assoc. prof. Pasca Sorin						
2.3 Holder of the academic seminar/laboratory/project							
2.4 Year of study	2	2.5 Semester	3	2.6 Type of the evaluation	Ex - Exam	2.7 Subject regime	Specialized Discipline

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	2	of which: 3.2 course	2	3.3 academic seminar/laboratory/project	-/-/-
3.4 Total of hours from the curriculum	28	of which: 3.5 course	28	3.6 academic seminar/laboratory/project	-/-/-

Distribution of time	hours
Study using the manual, course support, bibliography and handwritten notes	28
Supplementary documentation using the library, on field-related electronic platforms and in field-related places	16
Preparing academic seminaries/laboratories/ themes/ reports/ portfolios and essays	-
Tutorials	-
Examinations	3
Other activities.	-

3.7 Total of hours for individual study	47
3.9 Total of hours per semester	75
3.10 Number of credits	3

4. Pre-requisites (where applicable)

4.1 related to the curriculum	(Conditions) -
4.2 related to skills	-

5. Conditions (where applicable)

5.1. for the development of the course	Teaching activities will normally take place face to face. If special measures will be imposed in the epidemiological context generated by the COVID-19 pandemic, the courses can be held online.
5.2.for the development of the academic seminary/laboratory/project	

6. Specific skills acquired	
Professional skills	C3. Analysis and development of applications for optimizing industrial processes of electrical engineering using specific software
Transversal skills	

7. The objectives of the discipline (resulting from the grid of the specific competences acquired)

7.1 The general objective of the subject	▪ Knowledge of optimization methods / techniques applicable in electrical engineering and how they can be applied in order to increase the efficiency or improve the operating parameters of electrical devices, equipment or electrical installations
7.2 Specific objectives	▪ Analysis of energy indicators and operating parameters of some installations and equipment for electric power use ▪ Learning the basic principles and notions regarding the optimization techniques applicable in the field of electrical engineering ▪ Identification, correct setting and initiation in solving optimization problems in electrical engineering ▪ Ability to develop optimal design algorithms ▪ Development of skills regarding the use of specific software

8. Contents*

8.1 Course	Teaching methods	No. of hours/ Observations
1. Introduction to optimization issues. Short history. Classification of optimization problems. Optimization and optimal design / synthesis	For on-site activity: Presentation with video-projector and additional explanations on the blackboard For the on-line activity: The university's e-learning platform and / or Microsoft Teams, in video-audio conferencing mode, are used	2
2. Optimization problems in engineering - examples. Formulation of optimization problems. Obtaining the mathematical model		2
3. Identification of optimization problems, respectively optimal design, in electrical engineering. Energetic parameters of electrothermal installations with resistors. General balance of powers and efficiency of the resistance furnace. Optimality conditions.		2
4. Identification of optimization problems, respectively optimal design, in electrical engineering. Energetic parameters of electromagnetic induction heating systems. The efficiency of induction furnaces. Optimality conditions		2
5. One-dimensional minimization. Zero-order algorithms based on search methods		2
6. One-dimensional minimization. First order algorithms based on polynomial approximation methods		2
7. Multidimensional minimization. Zero order deterministic methods. The descending simplex method. Powell method		4
8. Multidimensional minimization. First order deterministic methods. Conjugate gradient method. Quasi-Newtonian method		4
9. Multidimensional minimizations. Stochastic optimization methods. Genetic algorithms		4
10. Applications – examples. Application 1 - Aspects regarding the optimal design of power transformers. Optimization of the magnetic core section		2
11. Applications - examples Application 2 - Aspects of the optimal design of a graphite crucible induction furnace		2

Bibliography (selection)

1. C.I. Mocanu – Electromagnetic Field Theory (in Romanian), Didactic and Pedagogical Publishing House, Bucharest, 1981
2. D. Comsa – Electrothermal Industrial Installations, Technical Publishing House, Bucharest, 1986
3. I. Sora, N. Golovanov – Electrothermal and electrotechnologies (in Romanian), Vol. I,II, Technical Publishing House, Bucharest, 1998,1999
4. V. Fireteanu – Electromagnetic Processing of Materials (in Romanian), Politehnica Publishing House, Bucharest, 1995
5. S. Călin, M. Tertişco, I. Dumitrache – Optimization and industrial automation (in Romanian), Technical Publishing House, Bucharest,1979
6. G. Ciuprina, D. Ioan, I. Munteanu, M. Rebican, R. Popa – Numerical optimization of electromagnetic devices (in Romanian), Printech Publishing, Bucharest, 2002
7. S. S. Rao – Engineering Optimization. Theory and Practice, John Wiley & Sons, Inc., 2009
8. M. Rudnicki, A. Savini (eds.) – Optimization and Inverse Problems in Electromagnetism, Kluwer Academic Publishers, 2003
9. P. Neittaanmäki, M. Rudnicki, A. Savini – Inverse Problems and Optimal Design in Electricity and Magnetism, Claredon Press, Oxford, 1996
10. E. Rapoport, Yu. Pleshivtseva – Optimal Control of Induction Heating Processes, CRC Press, Taylor & Francis Group, 2007
11. Mohamed Bakr – Nonlinear Optimization in Electrical Engineering with Applications in MATLAB, The Institution of Engineering and Technology IET, London, 2013
12. I. Necoara – Numerical optimization methods (in Romanian), Politehnica Publishing Press, Bucharest, 2013
13. E. Vladu, T. Leuca – Using genetic algorithms in the synthesis of electromagnetic devices (in Romanian), Rev. EEA Electrotehnica, No. 1, 2004
14. T. Leuca, E. Vladu, M. Popa – Using genetic algorithms in optimal design of electromagnetic devices, Revue Roumaine des Sciences Techniques – Electrotechnique et Energetique, 49, 3, pp. 319-327, Bucharest, 2004
15. I. Necoara, A. Patrascu, D. Clipici – Numerical optimization methods. Problems (in Romanian), Politehnica Publishing Press, Bucharest, 2013
16. G. Ciuprina – Study of the electromagnetic field in nonlinear media. Contributions on optimization of nonlinear electromagnetic devices, PhD thesis (in Romanian), University Politehnica of Bucharest, 1998
17. M. Popa – Contributions regarding the numerical modeling of the heating in transversal magnetic flux, PhD thesis (in Romanian), University of Oradea, 2001
18. S. Pasca – Contributions regarding the numerical modeling of the electrothermal processes in crucible induction furnaces, PhD thesis (in Romanian), University of Oradea, 2004
19. M. Tomse, S. Pasca – Optimization of Magnetic Pulse Forming Installations Based on PSPICE Model of Equivalent Electrical Circuit, Nonconventional Technologies Review, ISSN 1454-3087, vol. XIV, no. 4/2010, pp. 59-66, 2010
20. E. Vladu, M. Tomse, S. Pasca – Using Genetic Algorithms for Optimization of Magnetic Pulse Forming Installations Based on PSPICE Model, Journal of Electrical and Electronics Engineering, No. 1/2009, Part I Electrical Engineering, ISSN 1844-6035, p. 104-108, 2009
21. V. Fireteanu, M. Popa, S. Pasca – Optimal Parameters of One-side Traveling Field Inductors for Stirring and Pumping Applications, International Scientific Colloquium "Modeling for Electromagnetic Processing" MEP 2008, Hannover, Germany, Proceedings, ISBN 978-3-00-026003-2, p. 223-228, 2008
22. S. Pasca – Optimization în electrical engineering - lecture notes (in Romanian), (electronic)

8.2 Project	Teaching methods	No. of hours/ Observations

9. Corroboration of the discipline content with the expectations of the representatives of epistemological community, professional associations and representative employers in the field related to the program

- The content of the subject is in accordance with the one in other national or international universities. In order to provide a better accomodation to the labour market requirements, there have been organized meetings both with representatives of the socio-economic environment and with academic staff with similar professional interest fields.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percent from the final mark
10.4 Course	- Exam Grade E	Written or oral exam, at the students' choice. The exam consists in solving two topics from the course topic. The exam can be taken face to face or online.	100 %
10.6 Project			
10.8 Minimum performance standard: - Passing the exam (obtaining the credits) assumes E $\geq$ 5			

Completion date:
29.08.2022

Signature of the course holder
Assoc. prof. Sorin Paşca
E-mail: spasca@uoradea.ro

Date of endorsement in the department:
01.09.2022

Signature of the head of department
Prof. habil. Francisc-Ioan Hathazi
E-mail: francisc.hathazi@gmail.com

Date of endorsement in the Faculty Board:
23.09.2022

Signature of the dean
Prof. habil. Ioan-Mircea Gordan
E-mail: mgordan@uoradea.ro

SUBJECT DESCRIPTION

1. Data related to the study program

1.1 Higher education institution	**UNIVERSITY OF ORADEA**
1.2 Faculty	**Faculty of Electrical Engineering and Information Technology**
1.3 Department	Department of Electrical Engineering
1.4 Field of study	Electrical engineering
1.5 Study cycle	Master
1.6 Study program/Qualification	Advanced systems in electrical engineering

2. Data related to the subject

2.1 Name of the subject				OPTIMIZATION IN ELECTRICAL ENGINEERING - PROJECT			
2.2 Holder of the subject				Popa Monica			
2.3 Holder of the academic seminar/laboratory/project				Popa Monica			
2.4 Year of study	II	2.5 Semester	III	2.6 Type of the evaluation	PR	2.7 Subject regime	I

(I) Imposed; (O) Optional;

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	2	of which: 3.2 course		3.3 academic project	2
3.4 Total of hours from the curriculum	28	of which: 3.5 course		3.6 academic project	28

Distribution of time	hours
Study using the manual, course support, bibliography and handwritten notes	4
Supplementary documentation using the library, on field-related electronic platforms and in field-related places	6
Preparing academic seminaries/laboratories/ themes/ reports/ portfolios and essays	8
Tutorials	2
Examinations	2
Other activities.	

3.7 Total of hours for individual study	**22**
3.9 Total of hours per semester	**50**
3.10 Number of credits	**2**

4. Pre-requisites (where applicable)

4.1 related to the curriculum	Computer aided design
4.2 related to skills	Computer operation

5. Conditions (where applicable)

5.1. for the development of the course	on-site
5.2. for the development of the academic laboratory	on-site Computers and software packages Matlab, Flux

6. Specific skills acquired	
Professional skills	C3. Analysis and development of applications for optimizing industrial processes of electrical engineering using specific software C6. Developing leadership skills of specific projects in electrical engineering

7. The objectives of the discipline (resulting from the grid of the specific competences acquired)

7.1 The general objective of the subject	▪ Knowledge of optimization methods applied in electrical engineering and their use in improving the efficiency of electrical devices
7.2 Specific objectives	▪ Identification and proper formulation of an optimization problem in electrical engineering ▪ Ability to develop algorithms for optimal design ▪ Learning of using specific software packages. ▪ Implementation of an optimal design application

8. Contents *

8.2 Project	Teaching methods	No. of hours/ Observations
Transposing the electrical engineering problems in optimal synthesis problems	Power Point presentation	2
Introductive notions - Matlab Optimization Toolbox	Power Point presentation	2
Solving optimization problems. Using the functions – *fminbnd, fminunc, fminsearch, linprog, fmincon*	computer application	4
Application - optimal problem for the synthesis of a coil	computer application	2
Application - optimal problem for the synthesis of a transverse flux inductor	computer application	4
Presentation of the project subject – optimization of efficiency for an induction heating application	discussions	2
Implementation of the optimization problem	assisting the students in developing the application	10
Results interpretation	discussions	2

Bibliography

1. V. Fireteanu, Monica Popa, T. Tudorache – Modele numerice in studiul si conceptia dispozitivelor electrotehnice, Ed. Matrix Rom Bucuresti 2004
2. Monica Popa – Bazele proiectarii asistate. Metode de optimizare, Editura Universitatii din Oradea 2003
3. G. Ciuprina, D. Ioan, I. Munteanu, M. Rebican, R. Popa – Optimizarea numerică a dispozitivelor electromagnetice, Ed. Printech, București, 2002
4. P. Neittaanmäki, M. Rudnicki, A. Savini – Inverse Problems and Optimal Design in Electricity and Magnetism, Claredon Press, Oxford, 1996
5. I. Necoară – Metode de optimizare numerică, Ed. Politehnica Press, București, 2013
6. V. Fireţeanu, Monica Popa, T. Tudorache, E. Vladu: "Numerical analysis of induction through heating processes and optimal parameter evaluation", Symposium Reports, Sixth International Symposium on Electric and Magnetic Fields, EMF 2003, Aachen, Germania, pag. 309-312

7. T. Leuca, E. Vladu, M. Popa – Using genetic algorithms in optimal design of electromagnetic devices, Revue Roumaine des Sciences Techniques – Electrotechnique et Energetique, 49, 3, pp. 319-327, Bucharest, 2004
8. T. Tudorache, V. Fireteanu, E. Vladu, Monica Popa: "3D finite element based optimization of sheet heating in transverse flux inductors", Advanced Topics in Electrical Engineering, ATEE 2004, Bucureşti
9. Virgiliu Fireteanu, Tiberiu Tudorache, Monica Popa - Contrat de recherche sur les simulations numeriques en flux transverse – Optimisation de la machine *CELES_FLT*, Beneficiar Societe CELES SA, Lautenbach, France – 2004 – 2006
10. Virgiliu Fireteanu, Tiberiu Tudorache, Monica Popa - Investigations on the possibilities of 3D FE computations related to AC direct resisitive heating of steel tubes before forge welding, Beneficiar EFD Induction a.s. , Skien, Norway – 2005-2007
11. G. Ciuprina – Studiul câmpului electromagnetic în medii neliniare. Contribuții privind optimizarea dispozitivelor electromagnetice neliniare, teză de doctorat, Universitatea Politehnica București, 1998
12. Monica Popa – Contribuții privind modelarea numerică a încălzirii în flux magnetic transversal, teză de doctorat, Universitatea din Oradea, 2001
13. Sorin Pașca – Contribuții privind modelarea numerică a proceselor electrotermice din cuptorul de inducţie cu creuzet, teză de doctorat, Universitatea din Oradea, 2004
14. Matlab Optimization Toolbox – User guide, documentation

9. Corroboration of the discipline content with the expectations of the representatives of epistemological community, professional associations and representative employers in the field related to the program

- The content of the subject is in accordance with the one in other national or international universities. In order to provide a better accomodation to the labour market requirements, there have been organized meetings both with representatives of the socio-economic environment and with academic staff with similar professional interest fields.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods face to face or on-line	10.3 Percent from the final mark
10.5 Project	Solving the tasks	Activity at project classes	100%
10.6 Minimum performance standard:			
Passing the subject - grade ≥ 5.			

Completion date: 29.08.2022

Signature of academic project holder

Assoc. Prof. Monica Popa
E-mail: mpopa@uoradea.ro

Date of endorsement in the department: 01.09.2022

Signature of Department Head

Prof. Francisc – Ioan Hathazi
E-mail: francisc.hathazi@gmail.com

Date of endorsement in the Faculty Board: 23.09.2022

Signature of Dean

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