SVEUČILIŠTE U SPLITU

FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE

DETAILED PROPOSAL OF THE STUDY PROGRAMME

UNDERGRADUATE VOCATIONAL STUDY IN ELECTRICAL ENGINEERING

SPLIT, May 2025

1.1. List ofmandatory and elective courses

List ofcourses								
Year of study:1.								
Semester: II.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FEMY02	Applied Mathematics	30	0	30	0	0	5
	L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise							

List ofcourses								
Year of study:2.								
Semester: III.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
	FENO07	Power Electronics	45	0	0	30	0	6
	FENO08	Control Engineering	30	0	15	15	0	5
	L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise							

List ofcourses								
Year of study:2.								
Semester: IV.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
	FENO12	Electrical Distribution Networks	30	0	15	15	0	5
	FENO10	Electrical Installations	30	0	0	30	0	5
	L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise							

List ofcourses								
Year of study:3.								
Semester: V.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FENO15	Electrical Safety	30	0	0	30	0	5
	FENO21	Electronic Converters for Power Supplies	30	0	15	15	0	5
	FENO29	Renewable Energy Sources	30	0	0	30	0	5
	L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise							
List ofcourses								

Year of study:3.									
Semester: VI.									
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
	FENO22	Power system and environment	30	0	0	30	0	5
	L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise							

List ofcourses								
Year of study:3.								
Semester: V.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
	FELO44	Biomechanics Practicum	15	0	0	45	0	5
	FELO21	Electromagnetic Compatibility	30	0	0	30	0	5
	FELO30	Radio Communications	30	0	15	15	0	5
	FELO32	Human Exposure to Electromagnetic Radiation	30	0	0	30	0	5
	FELO31	Computer Aided Analysis of Radiating Structures	30	0	0	30	0	5
	L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise							

List ofcourses								
Year of study:3.								
Semester: VI.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
	FELO36	Sensors and Transducers	30	0	0	15	0	4
	L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise							

1.2. Course description

NAME OF THE COURSE	**APPLIED MATHEMATICS**		
Code	FEMY02	Year of study	1
Course teacher	Ivančica Mirošević, M.Sc., Lecteter	Credits (ECTS)	5
Associate teachers	Lea Dujić	Type of instruction (number of hours)	L: 30; S: ; AE: 30; LE: ; DE:
Status of the course	obligatory	Percentage of application of e-learning	10

Type of instruction (number of hours)	L	S	AE	LE	DE
	30		30		

COURSE DESCRIPTION

Course objectives	Training students for: - applicationofmathematicalconceptsandtoolsfromtheareaofordinarydifferentialequations, numericalmathematics, statisticsandprobability to analyzeandsolveengineeringproblems.
Course enrolment requirements and entry competences required for the course	GoodknowledgeofHighSchoolmathematicsandpassed State ExaminMathematics.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - state definitions and theorems from the enitre course, - illustrate theorems with examples, - solve some first and second order differential equations, - apply Laplace transform to linear differential equations - find approximate solution of a nonlinear equation - approximate function with Lagrange interpolation polynomial - approximate empirical data with constant, linear or quadratic function - solve definite integral and Cauchy problem of the first order approximately - use statistical techniques in data analysis - find probability distributions of random variables in random experiments

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L or S hours	AE hours
1. Introduction to DifferentialEquations. Basicconceptsanddefinitions. Equationswithseparablevariables.	2	2
2. Homogeneousdifferentialequations. Lineardifferentialequationsofthefirstorder.	2	2
3. Differentialequationsof ¸thesecondorder. Lineardifferentialequationsofthesecondorderwithconstantcoefficients.	2	2
4. Laplacetransform – definitionandbasicproperties. InverseLaplacetransformandbasicproperties.	2	2
5. Solvinglineardifferentialequationswithwithconstantcoefficientsu singLaplacetransform.	2	2
6. Introduction to Numericalmathematics. Solvingnonlinearequations. Graphicalmethod. Bisectionmethod. Iterativemethod.	2	2
7. Lagrange interpolation polynomial	2	2
8. Leastsquaremethod. Approximating empirical data with constant, linear or quadratic function.	2	2
9. Numericalintegration. Trapezoidalrule. Simpson'srule. Euler'smethod for Cauchyproblems.	2	2
10. Descriptivestatistics. Discrete data andcontinuous data. Numericalcharacteristics.	2	2
11. Introduction to Probabilitytheory. Elementaryoutcomes. BasicsofCombinatorics.	2	2

	12. Discreterandomvariable. Expectationandvariance. Binomialdistribution. Poissondistribution.				2	2
	13. Continuousrandomvariable. Expectationandvariance. Normaldistribution.				2	2
	List oflaboratoryor design exercises					LE or DE hours
Format of instruction	☒lectures ☐seminars and workshops ☒exercises ☐*on line*in entirety ☐partial e-learning ☐field work		☒independent assignments ☐multimedia ☐laboratory ☐work with mentor ☐ (other)			
Studentresponsibilities	Regularattendence to andactiveparticipationinlecturesandexcercises.					

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2	Research		Practical training	
	Experimental work		Report		Selfstudy	2.6
	Essay		Seminar essay		(Other)	
	Tests	0.2	Oral exam		(Other)	
	Written exam	0.2	Project		(Other)	

Grading and evaluating student work in class and at the final exam	Duringsemestertwomid-termexams are held. Thefirstexamisscheduledafter 7 weeksoflectures, andthesecondintheweekfollowingthelectures. At eachmid-termexam students canget 40 points, whiletheremaining 20 points are attainedthroughassignementsduringlecturesandexcercises. Thecondition for passingthecourseis minimum 20 points on eachmid-termexamsand a total of at least 50 points. Aftersemester, twofinalexamsand a correctionexam are held. Students whichdidnotpass one mid-termexam, can take onlythispartoftheexamduringfinalexams. Students whichdidnotpassanymid-termexam, take thefinalexamwithcomprehensivecoursecontent. In thatcase, maximumnumbersofavailablepointsis 80. Thecondition for passingthecourseis minimum 40 pointsinthefinalexamand a total of at least 50 points. The grade isformedafterthesecondfinalexamaccording to article 75 ofthe Statute of FESB: 15% ofthebest students getthemarkexcellent (5), next 35% students getthemarkverygood (4), next 35% students getthemarkgood (3), andthelast 15% students getthetmarksufficient (2). Students whodidnotpassthecourseafterfinalexams, andhaveobtained total of at least 10 points, canattendthecorrectionexam. On thecorrectionexammaximalnumberofpointsis 100, andthe minimum requirement for a passing grade is 50 points. Mid-termexams, finalexamsandcorrectionexams are heldaccording to theexamschedule.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Lecturematerials on FESB e-learning portal.		https://elearning.fesb.hr/
Optional literature (at the time of submission of study	T. Bradić, J. Pečarić, R. Roki, M. Strunje: Matematika za tehnološke fakultete, Element, Zagreb, 1998. B. P. Demidovič: Zbirka zadataka iz više matematike, Školska knjiga, Zagreb 1998.		

programme proposal)	Ivo Pavlić, Statisticka teorija i primjena, Zagreb, 1971
Quality assurance methods that ensure the acquisition of exit competences	- homework - short tests - quizzes - mid-termexams - finalexam - student questionnaires
Other (as the proposer wishes to add)	

NAME OF THE COURSE	**POWER ELECTRONICS**						
Code	FENO07	Year of study	2				
Course teacher	Dinko Vukadinović, Ph.D., Full Professor	Credits (ECTS)	6				
Associate teachers	Mateo Bašić, Ph.D. Assistant Professor Ivan Grgić, Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			45	0	0	30	0
Status of the course	Obligatory	Percentage of application of e-learning	0				
COURSE DESCRIPTION							
Course objectives	Training students for: - understanding of basic principles of power electronics devices switching, - understanding of power converters operating principles - analysis of rectifiers, inverters and non-isolated DC-DC converters						
Course enrolment requirements and entry competences required for the course	None						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1) define ways of power electronics devices switching 2) explain the natural commutation in phase-controlled rectifiers 3) 5nalyse the operation of rectifiers, inverters and non-isolated DC-DC converters 4) adjust the firing angle of full-controlled bridge converter in accordance the desired mean value of the output voltage 5) make the simulation model of the phase-controlled three-phase converter 6) make the simulation model of the buck non-isolated DC-DC converter 7) operate with the buck non-isolated DC-DC converter 8) calculate the power factor of the load connected to the electric grid via the power converter 9) calculate the thermal resistance of certain power electronics device 10) specifywaysofpowerelectronicsdevicesprotection						

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	
	Introduction and basic principles of power electronics devices	4	
	Ways of power electronics devices turning-off and natural commutation	4	
	Diode rectifiers	4	

	Comparison of the diode rectifiers	2	
	Thyristor-based converters	4	
	Power flow in electric grids with power electronics converters and effects of current distortion	4	
	AC converters	3	
	Inverters	4	
	Non-isolated DC-DC converters	5	
	Direct AC-AC converters	4	
	Heat transfer in power electronics devices and power electronics devices protection	3	
	List of laboratory exercises		LE hours
	Resistor and inductor with a power electronics device (simulation)		3
	Natural commutation (simulation)		3
	Single-phase full-controlled bridge converter for the DC motor supply (simulation)		6
	Three-phase full-controlled bridge converter (simulation and experiments)		6
	Single-phase AC voltage controller (experiments)		6
	Single-phase AC voltage controller (simulation and experiments)		6

Format of instruction	x lectures ☐ seminars and workshops ☒ exercises ☐*on line* in entirety ☐ partial e-learning ☐ field work	x independent assignments ☒ multimedia x laboratory ☐ work with mentor ☐ **(other)**
Studentresponsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1	Research		Practical training	
	Experimental work		Report		Individual work	3
	Essay		Seminar essay		Laboratory exercises	1
	Midterm exams	0.3	Oral exam		Auditory exercises	0.5
	Written exam	0.2	Project		(Other)	

Grading and evaluating student work in class and at the final exam

During the semester, two midterm exams are held – the first after 7 weeks of lectures and the second after 13 weeks of lectures. Each midterm exam consists of 4 problems, either theoretical or numerical. In the final exams, students take those parts of the course which they did not pass in the midterm exams.

The requirement for passing grade is that the sum of the laboratory exercises' grade (L) and the midterms' grades (M1 and M2), expressed as a percentage, is 50% or more. The sum is calculated as

$$\text{Grade (\%)} = 0.25L + 0.375(M1 + M2)$$

where the number of points achieved in each midterm exam has to be at least 50%.

The students that do not pass the midterm exams take the final written exam which consists of 4 problems. The requirement for a positive evaluation of the final exam is at least 50% points achieved. In the final exam, the students that did not pass one of the midterm exams are presented with 4 problems from the corresponding part of the course. Subsequently, the grade is determined as follows:

$$\text{Grade (\%)} = 0.25L + 0.75(I)$$

where I is the number of points achieved in the final written exam (at least 50%).

The final grade for the course is determined as follows:

	50% to 61% - Sufficient (2) 62% to 74% - Good (3) 75% to 87% - Very good (4) 88% 100% - Excellent (5)		
Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	D. Vukadinović, Lj. Kulišić: Predavanja iz energetske elektronike za šk. god. 2013/14		e-learning portal
	D. W. Hart: Power Electronics, McGraw-Hill, 2011.		e-learning portal
Optional literature (at the time of submission of study programme proposal)	N. Mohan, T. N. Undeland, T. N. Robbins, Power Electronics: Converters, Applications, and Design, 3nd Edition, John Wiley✓Sons, 2003.		
Quality assurance methods that ensure the acquisition of exit competences	- Keeping records of student attendance - Annual analysis of the performance at midterm exams and final exams - Feedback from students via surveys - Self-evaluation of teachers - Feedback from graduated students		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	**CONTROL ENGINEERING**						
Code	FENO08	Year of study	2				
Course teacher	Mateo Bašić, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory	Percentage of application of e-learning	0				
COURSE DESCRIPTION							
Course objectives	Training students for: - understanding and application of basic principles of automatic control, - analysis and synthesis of automatic control systems.						
Course enrolment requirements and entry competences required for the course	None						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - solve by calculation specific engineering problems in the field of automatic control, - describe the basic components of automatic control systems - sketch Nyquist and Bode plots of automatic control systems, - apply Laplace transform and block algebra in the analysis and synthesis of automatic control systems,						

	- calculate the stability and quality indicators of automatic control, - carry out the experimental analysis and synthesis of the passive R-C elements typically found in automatic control systems, - experimentally test the dynamic quality indicators of an air-temperature control system, - explain the basic features of digital control systems.

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L hours	AE hours
Basic concepts of automatic control and classification of automatic control systems	2	0
Laplace transform, elements of a control circuit and evaluation of the time function properties	2	1
Frequency domain analysis: Nyquist and Bode methods	2	1
Transfer functions and time responses of elementary linear elements	2	1
Frequency characteristics of circuits with operational amplifiers	2	1
DC machine as an object of control	2	1
Transfer functions of multiloop automatic control systems (block algebra)	2	1
First midterm exam		
Stability of automatic control systems. Stability criterions by Hurwitz, Nyquist, and Bode.	2	1
Control quality indicators	2	1
PID controllers: subtypes and discrete form. Ziegler–Nichols method of tuning the PID controller parameters.	2	1
Experimental synthesis of a cascade speed-control system of a DC motor	1	1
Synthesis of linear systems of automatic control (serial and parallel correction)	1	1
Digital control: z-transform, sampling process and digital control systems	2	1
State-space representation of a system	2	1
Second midterm exam		

List of laboratory exercises	LE hours
Passive circuits with R-C elements	3
Active circuits with R-C elements	3
Bode magnitude and phase plots	3
Air-temperature control system	3
Speed control system of a separately-excited DC motor	3

Format of instruction		
	☒ lectures ☐ seminars and workshops ☒ exercises ☐*on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ **(other)**

Studentresponsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*

Class attendance	1	Research		Practical training	
Experimental work		Report		Individual work	2.7
Essay		Seminar essay		Laboratory exercises	0.5
Midterm exams	0.2	Oral exam		Auditory exercises	0.5
Written exam	0.1	Project		(Other)	

<table>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">During the semester, two midterm exams are held - the first after 7 weeks of lectures and the second after 13 weeks of lectures. Each midterm exam consists of 4 problems, either theoretical or numerical. In the final exams, students take those parts of the course which they did not pass in the midterm exams.

The requirement for passing grade is that the sum of the laboratory exercises’ grade (L) and the midterms’ grades (M1 and M2), expressed as a percentage, is 50% or more. The sum is calculated as

Grade (%) = 0.25L + 0.375(M1 + M2)

where the number of points achieved in each midterm exam has to be at least 50%.

The students that do not pass the midterm exams take the final written exam which consists of 4 problems. The requirement for a positive evaluation of the final exam is at least 50% points achieved. In the final exam, the students that did not pass one of the midterm exams are presented with 4 problems from the corresponding part of the course. Subsequently, the grade is determined as follows:

Grade (%) = 0.25L + 0.75(I)

where I is the number of points achieved in the final written exam (at least 50%).

The final grade for the course is determined as follows:

50% to 61% - Sufficient (2)
62% to 74% - Good (3)
75% to 87% - Very good (4)
88% 100% - Excellent (5)</td></tr>
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<tr><td>- Vukadinović, D., „PredavanjaizRegulacijsketehnike za šk. god. 2010/11“, FESB, Split, 2014.</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- Goodwin, G.C., Graebe, S.F., Salgado M.E., „Control System Design“, Prentice Hall, 2001.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of student attendance
- Annual analysis of the performance at laboratory exercises
- Annual analysis of the performance at midterm exams and final exams
- Feedback from students via surveys
- Self-evaluation of teachers</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	**ELECTRICAL DISTRIBUTION NETWORKS**						
Code	FENO12	Year of study	2				
Course teacher	Damir Jakus, Ph.D. Assistant Professor	Credits (ECTS)	5				
Associate teachers	Josip Vasilj, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	
Status of the course	Mandatory	Percentage of application of e-learning	30				

COURSE DESCRIPTION

Course objectives	Training students for: - Understanding the specifics related to the network structure, grid planning and operation as well as network element construction - Development of models for the distribution network analysis under stationary conditions - Understanding the specifics related to the distribution network neutral earthing - Calculation of short circuit currents in distribution networks - Selection of network elements while respecting the technical requirements and ability to propose measures for the network operation improvements - Understanding the effects of distribution generation connection on network conditions - Deepening the basic knowledge in the field of electricity transmission and distribution
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Identify the typical structures of the distribution networks and their components with all their specifics - Define the classic single line diagram and disposition of distribution substations - Determine the equivalent circuits of distribution network elements for different type of calculations - Perform the distribution network power flow and voltage conditions analysis using specialized software packages - Simulate the impact of distributed generation connection on distribution network conditions - Parametrize the distribution network elements to ensure normal network operation - Select low voltage network protection devices and dimensioned TS 10 / 0.4 kV earthing system - To carry out a techno-economic analysis of the excessive consumption of reactive power and to propose measures for power factor improvement - Simulate the operation of the distribution network and to calculate energy losses

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L or S hours	AE hours
1. DISTIRIBUTION NETWORK POSITION AND ROLE IN ELECTRIC POWER SYSTEMS: - production, transmission and distribution of electrical energy - basic characteristics and differences of transmission and distribution networks	2	
2. DISTIRBUTION NETWORK TOPOLOGY AND STRUCTURE: - Middle voltage network structure - Low voltage network structure	2	
3. DISTIRBUTION NETWORK SUBSTATIONS: - Distribution substations - Examples of real distribution substations 110/35 V, 35/10 kV and 10/0.4 kV	2	

4.	BASIC ELECTRIC PARAMETERS AND EQUVIVALNET SCHEMES FOR NETWORK ELEMENTS - Symmetrical components system - Physical interpretation of direct, inverse and zero system - Calculation of element impedances - Equivalent schemes	2
5.	DISTRIBUTION NETWORK FAULT ANALYSIS (PART 1) - Three phase fault - Two phase fault - Single phase faults - Single phase faults in low voltage grid	3
6.	DISTRIBUTION NETWORK FAULT ANALYSIS (PART 2) - Transformer earthling options in middle voltage distribution networks - Single phase faults - Single phase faults in networks earthed using low-ohm resistors - ground faults in unearthed networks - Examples of fault analysis calculations	2
7.	APROXIMATIVE NETWORK ANALYSIS UNDER STATIONARY CONDITIONS - Approximate load flow calculations in radial distribution networks - Approximate voltage drop calculations - Rating power lines and transformers based on load flow and voltage drop calculations - Examples of load flow and voltage profile calculations	2
8.	LOAD FLOW CALCULATION USING BACKWARD-FORWARD METHOD - Formation of incidence matrix: BIBC, BCBV, DLF - Load flow calculations in radial distribution networks - Load flow calculations in weakly meshed distribution networks	3
9.	LOW VOLTAGE DISTRIBUTION NETWORKS (PART 1) - Specificities of low voltage distribution networks - Low voltage distribution network types based on earthing type - Load modeling and load flow calculations - Load flow / voltage conditions calculations	2
10.	LOW VOLTAGE DISTRIBUTION NETWORKS (PART 2) - Planning and design of low voltage networks - Network protection and fuse selection criteria - Grounding system calculation in low voltage distribution networks	2
11.	ACTIVE POWER/ENERGY LOSS CALCULATION - Power/energy loss classification - Power losses in transformers and power lines - Energy loss calculations using approximate approach and using load duration curve	2
12.	REACTIVE POWER COMPENSATION - Individual/group/central/mixed compensation - Positive effects of reactive power compensation - Dimensioning of capacitors banks	2
13.	IMPACT OF DISTRIBUTED GENERATION CONNECTION - Impact on network voltage conditions and control - Impact on network losses - Impact on network protection - Higher harmonics, voltage/current asymmetry, flickers…	2
14.	DISTIRBUTION NETWORK OPERATION AND CONTROL - Supervision, control, SCADA - Network reliability and energy not served - MTU system	2

List of laboratory or design exercises	LE or DE hours

	1.	Preparing for the lab. exercises and demonstration of software tools used in exercises	2
	2.	Load flow / voltage conditions/ power losses analysis and compensation of reactive power in the distribution networks	3
	3.	The preparatory exercise for the load flow calculations in low-voltage distribution networks	3
	4.	Low-voltage distribution network project: load modeling / load flow / voltage calculations; selection and rating of lines and transformers, short circuit analysis, selection and compliance testing of fuses, ground resistance calculation and design of pole mounted substation 10/0.4 kV earthing (Part 1)	2
	5.	Low-voltage distribution network project: load modeling / load flow / voltage calculations; selection and rating of lines and transformers, short circuit analysis, selection and compliance testing of fuses, ground resistance calculation and design of pole mounted substation 10/0.4 kV earthing (Part 2)	2
	6.	Analysis of distributed generation connection on the distribution networks	3

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐*on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Studentresponsibilities	- The presence on lectures in the amount of at least 70 % of the scheduled time. - Completed all required laboratory exercises. - Completed and graded seminar work assignment.	

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1	Research		Practical training	
	Experimental work		Report		Self work	1.5
	Essay		Seminar essay	1	Laboratory work	0.5
	Tests	0.5	Oral exam		(Other)	
	Written exam	0.5	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there will be two midterm exams covering lectures. The first midterm exam will be in the eighth week of summer semester, and the second one in the last week of summer semester. As a part of laboratory exercises students will be given their seminar assignments. Student can pass the class by passing two midterm exams and by completing their seminar assignments. In the two final exams in June and July, students can pass reaming part(s) which they didn't pass through midterm exams. Also, if the student passes one part of class materials through first final exam, then he is not obliged to re-take that part of the exam in the second final exam. The class subject is divided into two parts according to separation defined for midterm exams. Students who have failed to pass the class after two final exams can try to pass the subject by taking the disciplinary exam which is organized in first part of autumn term. The last chance to pass the subject is through commission exam which will be held in the second part of the autumn exam period. During the disciplinary and commission exam students have to re-take whole exam covering both subject parts regarding their previous results in mid-term and final exams. In autumn term the requirement for positive mark is that the student has at least 50% success on the exam as well as positive mark from seminar assignment. The requirement for positive mark is that the student has at least 50% points from each part of the course subject during midterm and final exams (or 50% points for the entire course subject on disciplinary and commission exam), as well as positively evaluated seminar assignment. The final score (in percentage) is formed on the basis of all activities according to the formula:

<table>
<tr><td></td><td colspan="3">Grade (%) = 0,3xG1 + 0,3xG2 + 0,3xS + 0.1xP
Grade (%) = 0,6xG + 0,3xS + 0.1xP (for disciplinary and commission exam)

wherein:
• G1, G2 - points obtained for each subject part during midterms and(or) final exams
• G - points obtained during disciplinary and commission exam
• S – point given for seminar assignment
• P - presence at lectures
The final grade is determined as follows:
Grade (%) — Mark
50 % do 61% — sufficient (2)
62 % do 74 % — good(3)
75 % do 87 % — very good(4)
88 % do 100 % — excellent(5)

Exam terms:
The first and second final exam: June / July
The disciplinary and commission exam: August / September

Under the Article 65 of the Faculty Statute, the student is required to participate in all forms of teaching and attend: lectures at least 70% of scheduled time and laboratory exercises 100% of scheduled time. If you do not meet these requirements, the student will not be able to take the examination.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Goić R., Jakus D., Penović I.: Distribucija električne energije - interna skripta, FESB, 2014.</td><td></td><td>e-learning</td></tr>
<tr><td>Goić, R. - Upute za energetske proračune u niskonaponskoj distributivnoj mreži (2009), Split, FESB</td><td></td><td>e-learning</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- E. Lakaervi, E.J. Holmes: Electricity Distribution Network Design, Peter Peregrinus Lt, 1989.
- Abdelhay A. Sallam, Om P. Malik:Electric Distribution Systems, Wiley-IEEE Press, 2011.
- Dale R. Patrick, Stephen W. Fardo: Electrical Distribution Systems, The Fairmont Press, 2009.
- E. Lakaervi, E.J. Holmes: Electricity Distribution Network Design, Peter Peregrinus Lt, 1989.
- William H. Kersting: Distribution System ModelingandAnalysis, CRC Press, 2002.
- Programski paket PowerCAD, upute za rad (2009), Split, FRACTAL d.o.o.
- ProgramskipaketWINdis, upute za rad (2009), Split, FRACTAL d.o.o.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of student class attendance
- Annual review of the exam success
- Feedback from students via surveys
- Self-evaluation of teachers
- Feedback on the subject relevance from the former students who have already graduated</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	ELECTRICAL INSTALLATIONS						
Code	FENO10	Year of study	2.				
Course teacher	Rino Lucić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Ante Veža, assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	regular	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - practical knowledge related to electrical installations, - implementation of basic standards related to electrical installations, - making project of simple electrical installations using AutoCAD software
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - apply relevant standards for electrical installations, - explain a danger of possible electric shock in electrical installations, - explain the basic requirements for correct operation of electrical installations, - develop a simpler design documents for electrical installations in AutoCAD software

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L or S hours	AE hours
Electrical regulations	2	
Basic types of low voltage networks and installations.	2	
Electrical schemes. Classification and characteristics of low voltage loads.	4	
Protective measures and protection of low voltage installations.	6	
Cable type and cross section selection. Calculation of voltage drop and short circuit current.	6	
Switching devices in low-voltage installations.	2	
Testing electrical installations	2	
Design of electrical installations.	2	

List of laboratory or design exercises	DE hours
Layout and types of project documentation (preliminary, main and detailed design) of wiring in the case of a residential building. The basic rules related to electrical installation. Valid legislation and technical regulations.	2
Basic commands in AutoCAD software used for the project documentation of electrical installations.	2
AutoCAD list of symbols used in the project and drawing.	2
Drawing single line diagrams, electrical schemes, plans, wiring, lighting installation and sockets, communication installation, grounding and lightning protection.	3
Introduction to "Ecodial" software, voltage drop, short circuit protection and protection against indirect contact.	2
Design of electrical installations according to the given plan and the terms of reference	2

Format of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence at the lectures at least 70% of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	0,7	Research		Practical training	
	Experimental work		Report		Independent work	2
	Essay		Seminar essay		Laboratory exercises	1
	Tests	0,2	Oral exam		Preparation for laboratory exercises	
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there will be two tests. The first test will be at the eighth week of classes, the second at the first week of the exam period. Student can pass the entire exam by tests. At the two final exams, students take parts of the curriculum that did not pass by tests. If at the first final exam student passes one of the two parts of curriculum that part of curriculum the student does not have to take on another final exam. The condition for positive assessment is that the student has at least 50% of each part of the curriculum at the tests or at the final exam The final grade (in percent) is formed on the basis of all activities according to the formula: Rating (%) = 0.1 * KV + 0.45 * (G1 + G2) wherein the activity is expressed in percentage according to: KV - percentage obtained by laboratory exercises, G1, G2 - percentage obtained by tests or exams of the parts of curriculum given in lectures. Students who did not pass the exam after two final exams can pass the exam at the last week of August or the first week of September. Last chance to take the exam in this school year is a commission exam. In a commission exam all students take the entire curriculum, and the condition for positive assessment is that the student has at least 50% of entire curriculum. The final score (in percentage) is formed on the basis of all activities according to the formula: Rating (%) = 0.1 * KV + 0.9 * G wherein the activity is expressed in percentage according to: KV - percentage obtained by laboratory exercises, G - percentage obtained by exams of the entire curriculum given in lectures. The final grade is determined as follows: Rating Grade

	50% to 61% sufficient (2) 62% to 74% good (3) 75% to 87% very good (4) 88% 100% excellent (5) Under Article 48 of the Statute of the Faculty, the student is required to participate in all forms of teaching activities: lessons attendance at least 70% and 100% of laboratory exercises. Student should make 100% of laboratory reports. If a student does not meet these requirements, s student will not be able to take the exams.		
Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	R.Lucic: Lectures, FESB		e-learning portal
Optional literature (at the time of submission of study programme proposal)	- G. G. Seip: Electrical Installation Handbook-Third Edition, John&Wiley, 2000. - E. Mileusnić: Testing of electrical installations of low voltage, ZIRSI,2006.		
Quality assurance methods that ensure the acquisition of exit competences	- Keeping records of his attendance - Annual review of the performance of the examinations - Student survey in order to evaluate teachers - Self-evaluation of teachers - Feedback from students who have already graduated from the relevance of the course content		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	**ELECTRICAL SAFETY**						
Code	FENO15	Year of study	3.				
Course teacher	Ivica Jurić-Grgić, Ph.D., Associate Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Obligatory	Percentage of application of e-learning	0				
COURSE DESCRIPTION							
Course objectives	Training students for: - permanent adoption and understanding of the most important technical protective measures against electric shock, - adoption of the methodology, procedures and measures for protection when working with electrical equipment, machinery and plants. - testing of electrical installation						
Course enrolment requirements and entry competences required for the course	None						

Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - explain the danger of possible electric shock on low and high voltage facilities, - describe and define the most important technical protective measures against electric shock on low and high voltage facilities, - examine the validity of protection against direct and indirect contact in low voltage and high voltage installations, - examine the validity of protection against overloads and short circuits in electrical installations.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Effect of electrical current on the human body.	2
	Typesofhazardsassociatedwithelectricalcurrent: directcontact, indirectcontact, transferredpotential, inducedvoltages, electricarc, staticelectricity, residualcharge, lightningstrikes, effectofelectricalandmagneticfieldson the human body.	4
	Technicalsafetyperformanceoflowvoltageinstallations. Typesoflowvoltagesystems, grounding, groundingprotectionagainstdirectorindirectcontact, simultaneousprotectionagainstdirectorindirectcontact.	6
	Protection byelectricalseparation, overvoltageprotectionfromhighvoltage system, protectionagainstatmosphericandswitchingovervoltage. Specialprotectionmeasures on constructionsitesandlimitedconductivearea.	4
	Technicalsafetyinhighvoltageinstallations.	2
	Overheadlines, safetydistancesandheights. Groundingofcolumns.	2
	Rulesandsafetymeasureswhenworking on electricalinstallations.	2
	Security measuresinswitchyards, substationsandpowerplants.	2
	Safetymeasureswhenworking on overheadlines, cablesandinundergroundfacilities. Live-line working.	2
	List of laboratory exercises	LE hours
	Conductor continuity measurement	3
	Insulation resistance measurement	3
	Fault loop impedance measurement	3
	Line impedance and prospective short circuit current measurement	3
	Testing of RCD Protection Devices	3
	Earth Resistance Measurement	3
	Earth Resistivity Measurement	3
	Leakage Current Measurement	3
	Technical safety in high voltage installations (field work)	6
Format of instruction	☒lectures ☐seminars and workshops ☐exercises ☐*on line*in entirety ☐partial e-learning ☒field work	☐independent assignments ☒multimedia ☒laboratory ☐work with mentor ☐ (other)
Studentresponsibilities	Thepresence at thelectures at least 70% ofthetimesscheduled. Performedallrequiredlaboratoryexercises.	

Screening student work(*name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1	Research		Practical training	
	Experimental work		Report		Independent work	2,5
	Essay		Seminar essay		Laboratoryexercises	1
	Tests	0,2	Oral exam		Preparation for laboratoryexercises	0,2
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there will be two midterm tests. The first test will be at the eighth week of classes, the second at the first week of the exam period. Student can pass the entire exam by midterm tests.

<table>
<tr><td></td><td colspan="3">At the two final exams, students take parts of the curriculum that did not pass by midterm tests. If at the first final exam student passes one of the two parts of curriculum that part of curriculum the student does not have to take on another final exam.
The condition for positive assessment is that the student has at least 50% of each part of the curriculum at the midterm tests or at the final exams. The final grade (in percent) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.45 * (G1 + G2)

wherein the activity is expressed in percentage according to:

LV -percentage obtained by laboratory exercises,
G1, G2 - percentage obtained by midterm tests or final exams of the parts of curriculum given in lectures.

Students who did not pass the exam after two final exams can pass the exam at the last week of August or the first week of September. Last chance to take the exam in this school year is a so-called commission exam. In a so-calledcommission exam all students take the entire curriculum, and the condition for positive assessment is that the student has at least 50% of entire curriculum.

The final score (in percentage) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.9 * G

wherein the activity is expressed in percentage according to:

LV -percentage obtained by laboratory exercises,
G - percentage obtained by exams of the entire curriculum given in lectures.

The final grade is determined as follows:

Rating Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% 100% excellent (5)</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>I. Jurić-Grgić: Lectures, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">E. Mileusnić: Ispitivanjeelektričnihinstalacijaniskognapona, ZIRS, Zagreb, 2006.
Siemens: ElectricalInstalationHandbook-Third Edition,(Editor: Gunter G Seip) John&Wiley, 2000.</td></tr>
<tr><td>Qualityassurancemethodsthatensuretheacquisitionofexitcompetences</td><td colspan="3">- Evaluation of students presence on lectures
- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	ELECTRONIC CONVERTERS FOR POWER SUPPLIES						
Code	FENO21	Year of study	3				
Course teacher	Dinko Vukadinović, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Mateo Bašić, Ph.D. Assistant Professor Ivan Grgić, Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of basic principles of electronic converters for power supplies - making a selection of components for electronic converters for power supplies
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1) Explain the operating principles of electronic converters in the linear and switch mode 2) Describe the characteristics of electronic converters components 3) Analyze single-phase half-wave diode rectifier loaded with the capacitor and the resistor 4) Analyze the impact of the power transformer leakage inductance on the natural commutation in the single-phase bridge rectifier 5) Calculate the minimal inductance in the DC-DC converters which ensures the operation in continuous mode 6) Discuss the current and voltage waveforms in isolated DC-DC converters 7) Derive the voltage transfer ratio for isolated DC-DC converters 8) Explain the active power factor correction 9) Comparethe UPS systemswhichoperateinnormal mode ofoperation, instored-energy mode ofoperationandbypass mode ofoperation

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L hours	AE hours
Introduction. Schemes of electronicconverters for powersupplies	1	
Components of electronicconverters for powersupplies	1	
Diode rectifiers	3	3
Switch-mode non-isolated DC-DC converters (buck, boost, buck-boost, Ćuk and bridge)	3	4
Switch-mode isolated DC-DC converters (forward, flyback, push-pull, half-bridge and bridge)	6	4
Single-phase and three-phase inverters	4	3
Frequency converters	2	
Active and passive power factor correction	2	1
Uninterruptable power supply	2	
Examples of electronic converters in electric drives and electric power generation	2	

List of laboratory exercises	LE hours
Single-phase half-wave diode rectifier	4
Single-phase full-wave diode rectifier	4
Non-isolated DC-DC boost converter	4
Non-isolated DC-DC buck-boost converter	3
Speed control system of a separately-excited DC motor	3

Format of instruction	x lectures ☐ seminars and workshops ☒ exercises ☐*on line* in entirety ☐ partial e-learning ☐ field work	x independent assignments ☒ multimedia x laboratory ☐ work with mentor ☐ **(other)**
Studentresponsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1	Research		Practical training	
	Experimental work		Report		Individual work	2
	Essay		Seminar essay		Laboratory exercises	1
	Midterm exams	0.3	Oral exam		Auditory exercises	0.5
	Written exam	0.2	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester, two midterm exams are held - the first after 7 weeks of lectures and the second after 13 weeks of lectures. Each midterm exam consists of 4 problems, either theoretical or numerical. In the final exams, students take those parts of the course which they did not pass in the midterm exams. The requirement for passing grade is that the sum of the laboratory exercises' grade (L) and the midterms' grades (M1 and M2), expressed as a percentage, is 50% or more. The sum is calculated as Grade (%) = 0.25L + 0.375(M1 + M2) where the number of points achieved in each midterm exam has to be at least 50%. The students that do not pass the midterm exams take the final written exam which consists of 4 problems. The requirement for a positive evaluation of the final exam is at least 50% points achieved. In the final exam, the students that did not pass one of the midterm exams are presented with 4 problems from the corresponding part of the course. Subsequently, the grade is determined as follows: Grade (%) = 0.25L + 0.75(I) where I is the number of points achieved in the final written exam (at least 50%). The final grade for the course is determined as follows: 50% to 61% - Sufficient (2) 62% to 74% - Good (3) 75% to 87% - Very good (4) 88% 100% - Excellent (5)

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Vukadinović, D.: Predavanja iz kolegija Elektronički pretvarači za napajanje, šk. god. 2014/15.		e-learning portal
Optional literature (at the time of submission of study programme proposal)	Hase, Y.: Handbook of power systems engineering with power electronics applications, John Wiley, 2013. Emadi A., Nasiri A., Bekiarov S. B.: Uninterruptable Power SuppliesandActiveFilters, CRC Press, New York, 2005.		
Quality assurance methods that ensure the acquisition of exit competences	- Keeping records of student attendance - Annual analysis of the performance at midterm exams and final exams - Feedback from students via surveys - Self-evaluation of teachers - Feedback from graduated students		

Other (as the proposer wishes to add)	

NAME OF THE COURSE	**RENEWABLE ENERGY SOURCES**						
Code	FENO29	Year of study	3				
Course teacher	Damir Jakus, Ph.D. Assistant Professor	Credits (ECTS)	5				
Associate teachers	Josip Vasilj, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	
Status of the course	Elective	Percentage of application of e-learning	30				
COURSE DESCRIPTION							
Course objectives	Training students for: - Understanding the specifics related to the working principles and operating characteristics of renewable energy sources as well as project financing options - Implementation of a legislative framework that promotes production from RES - Assessment of the annual energy potential for various types of RES - Selection of the optimal parameters and project solutions for different RES - Analysis of network conditions after connection of RES - Project economic feasibility assessment for different RES						
Course enrolment requirements and entry competences required for the course	None						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Define different RES technologies, explain their methods of operation and list main system components for different RES plants - Explain and critically analyze different financial promotion mechanisms for RES - Estimate the annual electricity production for certain types of RES power plants - Perform project profitability assessments for certain types of RES - Define the basic technical requirements which need to be met by RES when connecting to the power system - Conduct the RES grid connection analysis and elaborate gird impacts - Explain the impact of RES large scale integration on power system development, planning, operation and management - Select the parameters for standalone and grid connected system …						

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	1. RENEWABLE ENERGY SOURCES INTRODUCTION The need for renewable energy sources The main sources and forms of energy	2	

	Properties of renewable energy sources The current status of renewable energy	
2	RES REGULATION FRAMEWORK The EU directive on RES Renewable energy sources in the Croatian law	3
3	WIND POWER PLANTS The wind power and energy WPP types and mains components The working principle of WPP WPP grid connection requirements The WPP market and the situation in Croatia	4
4	SOLAR POWER PLANTS Calculation of solar radiation Solar power plants working principles and main parts PV power plant electricity production Grid connected and standalone systems	4
5	SOLAR THERMAL POWER PLANTS	1
6	IMPACT OF WIND AND PV POWER PLANTS ON POWER SYSTEM OPERATION AND MANAGEMENT	3
7	HYDRO POWER PLANTS Hydropower resources Hydro power and energy The basic components, their roles, performance and operating principles Turbines and generators for small HPP	4
8	BIOMASS ENERGY Types and basic characteristics of biomass The different technologies for utilization of biomass The potentials and biomass production Different principles of biomass conversion into solid and liquid fuels	3
9	GEOTHERMAL ENERGY The origin and nature of geothermal energy Geothermal resources Direct use of geothermal energy for heating The use of geothermal energy for electricity gen.	3
10	OTHER TYPES OF RES Wave energy converters Tidal power Ocean thermal energy converters	3

List of laboratory or design exercises	LE or DE hours
1. Technical visit to roof mounted PV power plant	4
2. Technical visit to wind power plant	6
3. Introduction to software package Homer	4
4. Project assignment regarding standalone and grid connected system design and profitability calculation	4
5. Project assignment regarding solar collector system design and profitability analysis	4
6. Techno-economic analysis of investment in PV power plant	4

<table>
<tr><td></td><td colspan="6">7. Analysis of RES connection impacts on power losses and voltage profile change in the MV distribution network</td><td>4</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☐ seminars and workshops
☐ exercises
☐on line in entirety
☐ partial e-learning
☒ field work</td><td colspan="4">☒ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="7">- The presence on lectures in the amount of at least 70 % of the scheduled time.
- Completed all required laboratory exercises.
- Completed and positively graded seminar assignment.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td colspan="2"></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td>1</td><td>Self work</td><td colspan="2">1.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory work</td><td colspan="2">0.5</td></tr>
<tr><td>Tests</td><td>0.5</td><td>Oral exam</td><td></td><td>(Other)</td><td colspan="2"></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td>(Other)</td><td colspan="2"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="7">During the semester there will be two midterm exams covering lectures. The first midterm exam will be in the eighth week of summer semester, and the second one in the last week of summer semester. As a part of laboratory exercises students will be given their work assignments which will be graded after completion. Student can pass the class by passing two midterm exams and by completing their laboratory work assignments. In the two final exams in February and March, students can pass reaming part(s) which they didn't pass through midterm exams. Also, if the student passes one part of class materials through first final exam, then he is not obliged to re-take that part of the exam in the second final exam. The class subject is divided into two parts according to separation defined for midterm exams.

Students who have failed to pass the class after two final exams can try to pass the subject by taking the disciplinary exam which is organized in first part of autumn term. The last chance to pass the subject is through commission exam which will be held in the second part of the autumn exam period. During the disciplinary and commission exam students have to re-take whole exam covering both subject parts regarding their previous results in mid-term and final exams. In autumn term the requirement for positive mark is that the student has at least 50% success on the exam as well as positive mark from seminar assignment.
The requirement for positive mark is that the student has at least 50% points from each part of the course subject during midterm and final exams (or 50% points for the entire course subject on disciplinary and commission exam), as well as positively evaluated seminar assignment. The final score (in percentage) is formed on the basis of all activities according to the formula:

Grade (%) = 0,35Xg1 + 0,35Xg2 + 0,3Xs
Grade (%) = 0,7Xg + 0,3Xs (for disciplinary and commission exam)

wherein:
• G1, G2 – points obtained for each subject part during midterms and(or) final exams
• G – points obtained during disciplinary and commission exam
• S – point given for seminar assignment

The final grade is determined as follows:
Grade (%) Mark
50 % do 61% sufficient (2)</td></tr>
</table>

	62 % do 74 % good(3) 75 % do 87 % very good(4) 88 % do 100 % excellent(5) Exam terms: The first and second final exam: February / March The disciplinary and commission exam: August / September Under the Article 65 of the Faculty Statute, the student is required to participate in all forms of teaching and attend: lectures at least 70% of scheduled time and laboratory exercises 100% of scheduled time. If you do not meet these requirements, the student will not be able to take the examination.		
Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Jakus, D.: Obnovljivi izvori energije, skripta + slajdovi s predavanja + dodatni materijali		e-learning
	Jakus, D., Krstulović Opara, J. : Obnovljivi izvori energije – upute za laboratorijske vježbe -, Split 2013.		e-learning
	Šljivac, D., Šimić, Z.: Obnovljivi izvori energije s osvrtom na uštede, udžbenik, ETF Osijek, 2008.		
	Rajkovič, D.: Proizvodnja i pretvorba energije, Rudarsko-geološko-naftni fakultet, Zagreb, 2011		
Optional literature (at the time of submission of study programme proposal)	- L. Freris, D.Infield: Renewable Energy in Power Systems, Wiley, 2008 - T. Ackerman: Wind Power in Power Systems, Wiley, 2012. - J. Twidell, T. Weir: Renewable Energy Resources, Taylor ✓ Francis, 2005.		
Quality assurance methods that ensure the acquisition of exit competences	- Keeping records of student class attendance - Annual review of the exam success - Feedback from students via surveys - Self-evaluation of teachers - Feedback on the subject relevance from the former students who have already graduated		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	POWER SYSTEM AND ENVIRONMENT						
Code	FENO22	Year of study	3.				
Course teacher	Tonći Modrić, Ph.D., Assistant Professor Mate Dabro, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for understanding and application specialized knowledge of: - characteristics of the power system in the Republic of Croatia, - various aspects of the impact of electric power facilities, plants and lines on the environment, - environmental protection from the effects of power facilities, plants and lines.
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - describe the characteristics of the power system in the Republic of Croatia, - describe the various aspects of the impact of electric power facilities, plants and lines on the environment, - specify the reference levels of powerfrequency electric and magnetic fields, - measure the power frequency magnetic flux density and electric field intensity, - explain the principle of measuring ground resistance of the grounding system, - explain the principle of measuring touch voltage, step voltage and transferred potential, - measure resistivity of soil and explain the principle of interpretation of geoelectric sounding data, - describe the protective measures against harmful effects of electric power facilities, plants and lines on the environment, - explain the occurrence of electrical corrosion and the basic principles of protection against electrical corrosion, - explain the basic principles of fire protection and noise levels measurements in the environment of electric power plants and power lines.

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L hours
Power system in the Republic of Croatia.	2
Electricity generation.	4
Electric power transmission and distribution.	4
Electric power consumption.	2
Calculation of powerfrequency electromagnetic fields of power lines and plants.	4
Measurement of powerfrequency electromagnetic fields of power lines and plants. Prescribed reference levelsofpowerfrequencyelectricandmagneticfields.	2
The impact of the power system on the environment.	4
Fire and noise protection.	2
Safetyrequirementsinsideandoutsidetheelectric power plants.	2
List of laboratory exercises	**LE hours**
Calculation ofpowerfrequencymagneticfluxdensity.	3
Measurement of powerfrequency magneticfluxdensity.	3
Calculation ofpowerfrequencyelectricfieldintensity.	3
Measurement of powerfrequency electricfieldintensity.	3
Geoelectric sounding.	3

<table>
<tr><td rowspan="4"></td><td colspan="5">Interpretation of geoelectric sounding data.</td><td>3</td></tr>
<tr><td colspan="5">Ground resistance measurement of a small grounding system.</td><td>3</td></tr>
<tr><td colspan="5">Checking the system of the fire protection.</td><td>3</td></tr>
<tr><td colspan="5">Noise measurement in the environment of electricpower plant.</td><td>3</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☐ seminars and workshops
☐ exercises
☐on line in entirety
☐ partial e-learning
☒ field work</td><td colspan="3">☒ independent assignments
☐ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">The presence on lectures in the amount of at least 70% of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2,0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>1,7</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td>0,8</td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>0,2</td></tr>
<tr><td>Written exam</td><td>0,1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. Each midterm test consists of 10 theoretical questions while final tests consist of 20 theoretical questions. In the final exams students that did not pass the midterm exams take part. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula:
Grade (%) = 0,1 LV + 0,45 (G1 + G2)
the activities in percentage:
• LV – laboratory assessment,
• G1, G2 – midterm test results.
In a case of final exams, grade (in percentage) is formed according to the formula:
Grade (%) = 0,1 LV + 0,9 G
the activities in percentage:
• LV – laboratory assessment,
• G – final test result.
Thefinal grade isdetermined as follows:
• 50 – 61 % sufficient (2)
• 62 – 74 % good (3)
• 75 – 87 % verygood (4)
• 88 – 100 % excellent (5)</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="4">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="4">T. Modrić, M. Dabro: „Predavanja iz predmeta Elektroenergetski sustav i okoliš (511)“, Sveučilište u Splitu, FESB, Split, 2017.
(interna skripta u elektroničkom obliku)</td><td></td><td>e-learning portal</td></tr>
<tr><td colspan="4">D. Feretić i dr.: „Elektrane i okoliš“, Element, Zagreb, 2000.</td><td>5</td><td></td></tr>
<tr><td colspan="4">B. Udovičić: „Elektroenergetski sustav“, Kigen, Zagreb, 2005.</td><td>10</td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study</td><td colspan="6">• CIGRETechnicalBrochure 535, „EMC within Power Plants and Substations“, 2013.</td></tr>
</table>

programme proposal)	• CIGRE Technical Brochure 592, "Guide for Assessment of Transferred EPR on Telecommunication Systems due to Faults in A.C. Power Systems", 2014. • CIGRE Technical Brochure 95, "Guide on the Influence of High Voltage A.C. Power Systems on Metallic Pipelines", 1995. • CIGRE TechnicalBrochure 290, „AC Corrosion on MetallicPipelinesdue to Interferencefrom AC Power Lines –Phenomenon, ModellingandCountermeasures", 2006.
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of student presence on lectures - Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutionalandnon-institutionalevaluations
Other (as the proposer wishes to add)	-

NAME OF THE COURSE	**BIOMECHANICS PRACTICUM**						
Code	FELO44	Year of study	3.				
Course teacher	Josip Music, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	Tea Marasović, PhD	Type of instruction (number of hours)	L	S	AE	LE	DE
			15	0	0	45	0
Status of the course	Elective	Percentage of application of e-learning	0				
COURSE DESCRIPTION							
Course objectives	Training students for: - understanding basic principles and terminology in the area of biomechanics. - application of acquired knowledge on design and conduction of experiments with emphasis on used measurement equipment.						
Course enrolment requirements and entry competences required for the course	None						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - recognize technical systems used in biomechanical measurements. - calculate human anthropometric parameters. - apply appropriate measurement equipment for human gait measurements, as well as ground reaction forces, EMG and range of movement measurements. - analyze human gait kinematics. - calculate forces and moments in human joints using inverse kinematics. - illustrate application of computer vision in biomechanics.						
Course content broken down in detail by weekly	Course content						L or S hours
	Introduction to biomechanics; Overview of technical systems for measurement of human biomechanical parameters.						1

class schedule (syllabus)	Measurement methods and procedures in biomechanics.	1
	Human anthropometric parameter identification.	1
	Gait analysis: terminology and measurements. Human gait parameter measurements; Kinematics and Kinetics.	2
	Position and balance of human body during the gait.	1
	Ground reaction forces during the gait.	1
	Electromyography, measuring muscle activity during human movement.	3
	Inverse kinematics for identification of muscle activity.	2
	Application of computer vision in biomechanics.	1
	List of laboratory or design exercises	LE or DE hours
	Introductory lecture on laboratory protocols, available measurement equipment as well as tasks during laboratory exercises.	4
	Measurement of human anthropometric parameters via finite element method.	5
	Measurement of human gait parameters via fast cameras.	6
	Measurement of ground reaction forces during the gait via force plate.	6
	Measurement of EMG signals during the gait.	6
	Estimation of muscle activity and joint moments during human gait based on measured kinematic parameters and ground reaction forces; comparison with measured EMG signals.	6
	Measurement of range of motion of cervical spine via inertial sensor units.	6
	Application of computer vision for classification and automatic translation of Croatia sign language.	6

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐*on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Studentresponsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	0,5	Research		Practical training	
	Experimental work		Report		Individual work	2
	Essay		Seminar essay		Laboratory exercises	2
	Tests	0,1	Oral exam		Preparation for laboratory exercises	0,3
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there are two midterm exams. The first midterm exam is after 7 weeks of lectures and the second one is after 13 weeks of lectures. Each midterm test (as well as the final test) is carried out in a written format with duration of 90 minutes. It consists of both theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The final exam test consists of 6 theoretical questions and numerical problems. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 40% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5L + 0,5(M1 + M2) where: • L – laboratory assessment,

<table>
<tr><td></td><td colspan="3">• M1, M2 – midterm test results.

Final grade (based on percentages) is formed as follows:
Percentage Grade
50% do 62% sufficient (2)
63% do 74% good (3)
75% do 86% very good (4)
87% do 100% excellent (5)

According to Article 65. of Faculty’s Bylaw, student is required to participate in all teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. In accordance with that student is required to solve and turn over for grading 100% of all laboratory exercises. If student does not meet these criteria, she or he won’t be able to take part in the final exam, and will be required to enroll in the course the next year.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Winter D.A.: The Biomechanics and Motor Control of Human Gait, University of Waterloo Press, Waterloo, 1991.</td><td></td><td>teacher</td></tr>
<tr><td>V. Zanchi, J. Musić: Biomehanika I dio, internal script, FESB, 2005.</td><td></td><td>teacher</td></tr>
<tr><td>V. Zanchi, V. Papić, T. Šupuk: Biomehanika II dio, internal script, FESB, 2005.</td><td></td><td>teacher</td></tr>
<tr><td>T. Marasović, Guidelines for laboratory exercises, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>J. Musić: Authorized lecture notes, FESB</td><td></td><td>é-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">1. J. Perry: Gait Analysis: Normal and Pathological Function, Slack Inc. 1992
2. R. J. Jagacinski, J. M. Flach: Control Theory for Humans: Quantitative Approaches to Modeling Performance, Lawrence Erlbaum Associates Inc., 2003
3. Zanchi V., Cecić M., Grujić T., Kuzmanić A., Papić V. : Laboratory for Identification of Human Movement with LaBACS Software Support, International Congress on Computational Bioengineering, ICCB’03, 24-26 September 2003., Zaragoza, Spain, p.p. 155-161.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of student attendance.
- Annual analysis of course statistics in terms of midterm and finals exams
- Feedback from students via surveys.
- Feedback from graduated students (or senior students) on course content relevance.
- Self-evaluation of teachers.
- Periodic institutional evolution of course teachers.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3">/</td></tr>
</table>

NAME OF THE COURSE	**ELECTROMAGNETIC COMPATIBILITY**						
Code	FELO21	Year of study	3.				
Course teacher	Vicko Dorić, Ph.D., Associate Professor	Credits (ECTS)	5				
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of basic principles of electromagnetic compatibility (EMC), - understanding of basic principles of electromagnetic coupling between systems and technics used for its suppression, - interpreting governing EMC standards - analyzing EMC problems using adequate computational models, - measuring radiated EM fields both on high and low frequencies.
Course enrolment requirements and entry competences required for the course	Fundamentals of Electrical Engineering1 & 2.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define the fundamental terms in electromagnetic compatibility, - classify types of the electromagnetic interference, - recognize potential EMC problems in practical situations, - measure radiated EM fields both on high and low frequencies., - calculate basic parameters of the internal dosimetry using simple human body models, - use commercial antenna simulation software for the analysis of the EMC programs, - compare results obtained by calculations or measurement with relevant EMC standards.

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L or S hours	AE hours
Introduction to the engineering modeling and electromagnetic compatibility.	2	0
Historical overview of EMC modeling.	2	0
Classification of the EMC problems.	2	0
Signal spectrum, radiated emissions and susceptibility.	2	0
Conducted emissions and susceptibility.	2	0
European and international standards.	2	0
Low frequencies (LF) models with concentrated parameters.	2	0
High frequencies (HF) models with distributed parameters.	2	0
Wire antenna analysis in the EMC applications.	2	0
Transmission line models.	2	0
Humans and equipment protection from EM radiation.	2	0
Lightning protection systems, grounding systems.	2	0
Electromagnetic compatibility of collocated radio transmission systems.	2	0

List of laboratory or design exercises	LE or DE hours
Cable losses measurement.	3
Frequency characteristics of the electronic circuits	3
Non ideal behavior of the electronic components.	3
Modulations and modulators.	3
Crosstalk in cables.	3
Noise measurement using induction.	3
Shielding.	3

	Calibration of electric and magnetic field measurement probes.	3
	Measurement of electric and magnetic field of the transformer station.	3
	Calibration and measurement of the antenna parameters in GTEM cell.	3

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐*on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Studentresponsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2,0	Research		Practical training	
	Experimental work		Report		Individual work	2,0
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0,2	Oral exam		Preparation for laboratory exercises	0,2
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam

There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students take tests they didn't pass on the midterm exams. Both midterm tests last for the 75 min. and consists of 10 questions or problems. In order to pass the exam, students are required to finish all laboratory exercises and gain at least 50% of total points at both midterm exams. Final score is determined in following way:

$$\text{Score}(\%) = 0{,}5\,(M1 + M2)$$

where M1 and M2 are midterm exams score.

Final grade is determined according the final score:

Score	Grade
50% to 62%	sufficient (2)
63% to 75%	good (3)
76% to 88%	very good (4)
89% to 100%	excellent (5)

In the final exams students take tests they didn't pass on the midterm exams. Exam is performed in the written form. It lasts for the 75 min. and consists of 10 questions or problems. In order to pass the exam, students are required to gain at least 50% of total points. The final grade is then determined as explained above.
There is possibility to take a seminar instead of the test.

Required literature (available in the library and via other media)	Title	Number of copies in the library	Availability via other media
	Clayton R. Paul: "Introduction to ElectromagneticCompatibility", Wiley, New Jersey, 2006		
	Dragan Poljak: "Advanced modelingincomputationalelectromagneticcompatibility", WileyInterscience, 2007.		
	Poljak, D., Dorić, V., Antonijević S.: Modeliranježičanihantenaprimjenomračunala, Kigen, Zagreb, 2009.		

Optional literature (at the time of submission of study

1. D.Poljak, *Teorijaelektromagnetskihpolja s primjenama u inženjerstvu*, Šk. knjigaZagreb, 2014.
2. Tesche, F.M.: Ianoz, M.V., Karslsson, T.: EMCAnalysisMethodsandComputationalModels, John Wiley&Sons, 1997

programme proposal)	3. Macnamara, T.: HandbookofAntennas for EMC, Artech House, 1995.
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutional and non-institutional evaluations
Other (as the proposer wishes to add)	

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="7">RADIO COMMUNICATIONS</td></tr>
<tr><td>Code</td><td>FELO30</td><td>Year of study</td><td colspan="5">3.</td></tr>
<tr><td>Course teacher</td><td>Zoran Blažević, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="5">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Maja Škiljo, Ph.D., Assistant</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>30</td><td>0</td><td>15</td><td>15</td><td>0</td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="5">0</td></tr>
<tr><td colspan="8">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="7">Training students for:
- understanding and application of basic principles and mechanisms of Earth radio-propagation,
- basic radio-channel physical phenomena modelling,
- permanent adoption and deepening of knowledge in the field of radio engineering.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="7">None.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="7">Students will be able to:
- define the fundamental phenomena, the quantities and the laws of Earth radio-propagation,
- apply fundamental laws of radio-propagation and model basic radio-channels,
- calculate and estimate basic radio-channel parameters,
- apply basic methods of radio-channel measurements</td></tr>
<tr><td rowspan="9">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Course content</td><td>L hours</td><td>AE hours</td></tr>
<tr><td colspan="5">Introduction to Radio Communications. History perspective of radio engineering. SI units.</td><td>2</td><td>-</td></tr>
<tr><td colspan="5">Antennas. Radiowave propagation.</td><td>4</td><td>3</td></tr>
<tr><td colspan="5">Atmospheric influence on radio-propagation-propagation by troposphere.</td><td>6</td><td>1</td></tr>
<tr><td colspan="5">Atmospheric influence on radio-propagation-propagation by ionosphere.</td><td>4</td><td>1</td></tr>
<tr><td colspan="5">Propagation by diffraction</td><td>4</td><td>3</td></tr>
<tr><td colspan="5">Propagation by reflection.</td><td>6</td><td>3</td></tr>
<tr><td colspan="5">Digital radio-communication channel. Shannon theorem.</td><td>2</td><td>4</td></tr>
<tr><td colspan="5">Cellular radio systems</td><td>2</td><td>1</td></tr>
</table>

	Midterm exam		
	List of laboratory exercises		LE hours
	Introduction to laboratory instruments, devices and other equipment		1
	Antenna parameters measurements		5
	Radio-channel parameters measurements by spectrum analyser		4
	Measurements of radio-channels by vector network analyser		3
	Software estimations of radio-channels		2
Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐*on line* in entirety ☐ partial e-learning ☒ field work	☐ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)	
Studentresponsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all laboratory exercises required.		

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	2,0	Research		Practical training	
	Experimental work		Report		Individual work	1.5
	Essay		Seminar essay		Laboratory exercises	0,8
	Tests	0,5	Oral exam		Preparation for laboratory exercises	0,2
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are one midterm and one final exam. Both midterm test and final test consist of theoretical questions and numerical problems. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises, 40 % points on the midterm exam or the final exam, and the rest of the grade depends on the seminary work presented by the student. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M + S) the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment, • M – test results., • S – seminary work results and presentation

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	I. Zanchi, Z. Blažević: Radiokomunikacije, predavanja, FESB		e-learning portal
	Boithias, L.: Radio WavePropagation, North Oxford Academic 1987.	1	
	Zentner, E.: Radiokomunikacije, Školska knjiga - Zagreb, 1980.	2	

Optional literature (at the time of submission of study programme proposal)	Zentner, E.: Antene i radiosustavi, Graphis Zagreb, 2001. Parsons, J. D.: "The Mobile Radio Propagation Channel", Pentech Press Publishers - London, GB, 1992. Doble, J.: "Introduction to Radio Propagation for Fixed and Mobile Communications", Artech House Boston - London, GB, 1996.
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutional and non-institutional evaluations

Other (as the proposer wishes to add)	

NAME OF THE COURSE	**HUMAN EXPOSURE TO ELECTROMAGNETIC RADIATION**							
Code	FELO32	Year of study	3.					
Course teacher	Vicko Dorić, Ph.D., Associate Professor	Credits (ECTS)	5					
Associate teachers	Anna Šušnjara	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0	0	30		
Status of the course	Elective	Percentage of application of e-learning	0					
COURSE DESCRIPTION								
Course objectives	Training students for: - understanding and application of basic principles of electromagnetic and thermal dosimetry, - assessment of human exposure to a sources of both high frequency and low frequency electromagnetic fields, - accepting knowledge from the area of the bio electromagnetics, - using national and international legislation for the assessment of human exposure to EM radiation							
Course enrolment requirements and entry competences required for the course	None.							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define the fundamental terms in bio electromagnetics, - measure external EM fields both on high and low frequencies, - calculate external EM fields both on high and low frequencies - analyze levels of human exposure to EM radiation according to national and international legislation, - calculate basic parameters of the internal dosimetry using simple human body models, - use commercial software packages for the internal dosimetry analysis based on the realistic human body models.							
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours					
	Electromagnetic pollution. Ionizing and non-ionizing radiation.	2	0					
	EM field coupling to human body. Biological effects of the EM fields. High and low frequency effects. Epidemiological and statistical studies.	2	0					
	Basic parameters of electromagnetic dosimetry: current density, induced electric field, specific absorption rate (SAR), external fields, power density.	2	0					
	Electromagnetic radiation protection guidelines. National and international legislation. Basic restrictions and reference levels.	2	0					
	Methods for the theoretical and experimental dosimetry. Incident and internal field dosimetry.	2	0					

	Characterization of the radiation sources. Calculation and measurement of the low frequency electric field. Exposure to the power lines and transformer stations.	2	0
	Calculation and measurement of the high frequency EM field. Exposure to the RFID antennas, mobile phones and base stations.	2	0
	Classification of the internal dosimetry models. Simplified and anatomical models of the human body.	2	0
	Electromagnetic modeling of the human body at low frequencies (LF). Whole body exposure to the LF fields.	2	0
	Electromagnetic modeling of the human body at high frequencies (HF). Human eye and brain exposure to the nonionizing radiation.	2	0
	Human exposure to the transient fields.	2	0
	Thermal response of the human body exposed to the HF fields. Thermal response of the human eye and brain exposed to the plane wave.	2	0
	Biomedical applications of EM fields. Electrical stimulation of the nerves. Laser treatment of the eye. Brain stimulation methods. Transcranial magnetic stimulation (TMS)	2	0
	List of laboratory or design exercises		LE or DE hours
	Simulation models for the human exposure to nonionizing EM radiation (frequencies up to 10 MHz)		4
	Simulation models for the human exposure to nonionizing EM radiation (frequencies above 10 MHz)		4
	Measurement setup and methods for the assessment of human exposure to EM fields.		6
	LF electric fields measurement.		4
	LF magnetic fields measurement.		4
	HF electromagnetic fields measurement.		4
	EM field calculation in vicinity of the base station.		4
Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐*on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)	
Studentresponsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.		

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	2,0	Research		Practical training	
	Experimental work		Report		Individual work	2,0
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0,2	Oral exam		Preparation for laboratory exercises	0,2
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students take tests they didn't pass on the midterm exams. Both midterm tests last for the 75 min. and consists of 10 questions or problems. In order to pass the exam, students are required to finish all laboratory exercises and gain at least 50% of total points at both midterm exams. Final score is determined in following way: Score(%) = 0,5 (M1 + M2) where M1 and M2 are midterm exams score.

<table>
<tr><td rowspan="1"></td><td colspan="3">Final grade is determined according the final score:

Score Grade
50% to 62% sufficient (2)
63% to 75% good (3)
76% to 88% very good (4)
89% to 100% excellent (5)

In the final exams students take tests they didn't pass on the midterm exams. Exam is performed in the written form. It lasts for the 75 min. and consists of 10 questions or problems. In order to pass the exam, students are required to gain at least 50% of total points. The final grade is then determined as explained above.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>D.Poljak, Teorija elektromagnetskih polja s primjenama u inženjerstvu, Šk. knjiga Zagreb, 2014.</td><td>5</td><td></td></tr>
<tr><td>D. Poljak: Izloženost ljudi elektromagnetskom zračenju, Kigen, Zagreb, 2007.</td><td>5</td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">4. D. Poljak, AdvancedModelinginComputationalElectromagneticcompatibility, WileyInterscience, New York 2007.
5. D. Poljak: Human Exposure to Electromagnetic Fields, WIT Press, Southampton-Boston, 2003
6. R.W.Y. Habash, ElectromagneticFieldsandRadiation, Marcel Dekker, 2002.
7. D. Poljak: ExposureofHumans to ElectromagneticRadiation, SoftCOMLibrary 2002.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="7">COMPUTER AIDED ANALYSIS OF RADIATING STRUCTURES</td></tr>
<tr><td>Code</td><td>FELO31</td><td>Year of study</td><td colspan="5">3.</td></tr>
<tr><td>Course teacher</td><td>Vicko Dorić, Ph.D., Associate Professor</td><td>Credits (ECTS)</td><td colspan="5">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Maja Škiljo, Ph.D.</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>30</td><td>0</td><td>0</td><td>30</td><td></td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="5">0</td></tr>
<tr><td colspan="8">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="7">Training students for:
- understanding of basic principles and laws of electromagnetics,
- knowing basic terms and principles of antennas and EM waves propagation,
- using commercial software packages for wire antenna analysis.
- developing computer models of typical antenna systems</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="7">Mathematics, Fundamentals of Electrical Engineering.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="7">Students will be able to:
- define the fundamental terms in electromagnetic theory,
- classify numerical methods for engineering problems,
- name and explain basic antenna parameters,
- recognize characteristic parameters of the radiation pattern,
- use software package SuzANA,
- use software package NEC.</td></tr>
<tr><td rowspan="23">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Course content</td><td>L or S hours</td><td>AE hours</td></tr>
<tr><td colspan="5">Introduction. Electric field. Magnetic field. Maxwell equations in differential form. Wave equations.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Electrical properties of the materials. Isotropic, linear and homogenous materials. Boundary conditions.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Electromagnetic waves. Plane wave propagation in free space. Reflection of the perfectly conducting boundary.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Electromagnetic radiation. Hertz dipole. Image method.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Introduction to the numerical modeling. Frequency and time domain analysis. Domain discretization methods. Boundary discretization methods.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Introduction to the Finite element method.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Introduction to the antenna theory. Antenna parameters. Polarization.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Radiation pattern. Directivity. Gain.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Radiated power and radiation resistance. Near and far field.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Typical antenna systems.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Antenna design.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Basics of antenna modeling in frequency domain.</td><td>2</td><td>0</td></tr>
<tr><td colspan="5">Basics of antenna modeling in time domain – direct and indirect approach.</td><td>2</td><td>0</td></tr>
<tr><td colspan="6">List of laboratory or design exercises</td><td>LE or DE hours</td></tr>
<tr><td colspan="6">EM waves propagating in dielectric</td><td>2</td></tr>
<tr><td colspan="6">EM wave incident to the PEC ground</td><td>2</td></tr>
<tr><td colspan="6">Short dipole radiated EM field</td><td>2</td></tr>
<tr><td colspan="6">Software package SuzANA – frequency domain</td><td>4</td></tr>
<tr><td colspan="6">Software package SuzANA – time domain</td><td>4</td></tr>
<tr><td colspan="6">Software package NEC</td><td>6</td></tr>
<tr><td colspan="6">Design and analysis of a commercial antenna system using NEC software</td><td>10</td></tr>
</table>

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<tr><td></td><td colspan="8"></td></tr>
<tr><td>Format of instruction</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☒ independent assignments
☐ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="8">The presence on lectures in the amount of at least 70 % of the times scheduled.
Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2,0</td><td>Research</td><td></td><td>Practical training</td><td colspan="3"></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td colspan="3">1,0</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td colspan="3">1,5</td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td colspan="3">0,2</td></tr>
<tr><td>Written exam</td><td>0,1</td><td>Project</td><td></td><td>(Other)</td><td colspan="3"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students take tests they didn't pass on the midterm exams. First midterm test lasts for the 75 min. and consists of 10 questions or problems. For the second midterm exam student is required to present computer model of a commercial antenna system developed during laboratory exercises. In order to pass the exam, students are required to finish all laboratory exercises, gain at least 50% of total points at first midterm exam and positive evaluation of the second midterm exam. Final score is determined in following way:
Score(%) = 0,5 (M1 + M2)

where M1 and M2 are midterm exams score.

Final grade is determined according the final score:

Score Grade
50% to 62% sufficient (2)
63% to 75% good (3)
76% to 88% very good (4)
89% to 100% excellent (5)

In the final exams students take tests they didn't pass on the midterm exams. Exam is performed in the written form for the first part and in the oral form for the second part of the course. In order to pass the exam, students are required to gain at least 50% of total points at written exam and positive evaluation of the oral exam. The final grade is then determined as explained above.</td></tr>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td colspan="5">Title</td><td colspan="2">Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="5">Poljak, D., Dorić, V., Antonijević S.: Modeliranje žičanih antena primjenom računala, Kigen, Zagreb, 2009.</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="5">G. J. Burke, A.J. Poggio, "Numerical Electromagnetics Code NEC Method of Moments – Part III: User's guide", Lawrence Livermore National Laboratory, 1981.</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="5">E. Zentner: Antene i radiosustavi, Graphis, Zagreb 2001.</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="5">Poljak, D., Dorić, V., Antonijević S.: Modeliranje žičanih antena primjenom računala, Kigen, Zagreb, 2009.</td><td colspan="2"></td><td></td></tr>
</table>

Optional literature (at the time of submission of study programme proposal)	D.Poljak, *Teorija elektromagnetskih polja s primjenama u inženjerstvu*, Šk. knjiga Zagreb, 2014. D.Poljak N.Kovač, V. Dorić, Numeričke metode u elektrotehnici – interna skripta, FESB-Split 2006. Macnamara, T.: Handbook of Antennas for EMC, Artech House, 1995.
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutional and non-institutional evaluations
Other (as the proposer wishes to add)	

NAME OF THE COURSE	**SENSORS AND TRANSDUCERS**						
Code	FELO36	Year of study	3.				
Course teacher	Josip Musić, Ph.D., Assistant Professor	Credits (ECTS)	4				
Associate teachers	Ivo Stančić, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION		
Course objectives	Training students for: - understanding role and significance of measurement equipment and measurement transducers in autonomous systems via control loops. - acquiring basic practical knowledge about physical limitations and possible issues while using different measurement equipment and transducers. - understanding working principles of different sensors as well as their advantages and disadvantages. - analyzing influence of A/D and D/A converters on sensor characteristics.	
Course enrolment requirements and entry competences required for the course	None	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - recognize sensors and transducers in automatic control loops. - explain importance of sensors and transducers in automation. - explain basic characteristic of measurement transducers (and sensors). - give examples of some of widely used sensors (pressure sensors, flow sensors, temperature sensors, optical sensors, inertial sensors). - examine sensor datasheets, - apply basic measurement transducers. - evaluate A/D and D/A work principle and its influence on measurements/control.	
Course content broken down in	Course content	L or S hours

detail by weekly class schedule (syllabus)	Introductory considerations and systematic approach to automatic control. Measurement sensor and actuators in the control loop.	2
	Sensor and transducer types. General consideration of most important sensor characteristics (accuracy, sensitivity, repeatability, etc.)	2
	A/D and D/A converters and their influence and sensor characteristics.	2
	Application examples of measurement sensors in control loops.	2
	Pressure sensors: capacitive, inductive, resistive and piezoelectric (working principles, characteristics and applications).	2
	Inertial sensors: accelerometer (working principles, characteristics and applications).	2
	Inertial sensors: gyroscope (working principles, characteristics and applications).	2
	Inertial sensor units (inertial sensors + magnetometers): working principles, characteristics and applications.	2
	Optical sensors: photoresistors, photodiodes, position sensors (encoders) and shift sensors (working principles, characteristics and applications).	2
	Pressure and force sensors: types, working principles, characteristics and applications.	2
	Flow sensors: mechanical, ultrasonic and magnetic (working principles, characteristics and applications).	2
	Intelligent sensors. Dislocated measurement devices: measuring at distant location.	2
	Actuators and sensors: functional unit.	2
	List of laboratory or design exercises	LE or DE hours
	Temperature sensors: application ad measurement characteristics.	3
	Pressure and touch sensors: QTC (quantum tunneling compound) and tasters.	3
	Distance sensors: capacitive ultrasound and laser.	3
	Inertial sensors and magnetometers.	3
	Servo motors: control and measurement transducers.	3

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐*on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Studentresponsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1	Research		Practical training	
	Experimental work		Report		Individual work	1,2
	Essay		Seminar essay		Laboratory exercises	1,5
	Tests	0,1	Oral exam		Preparation for laboratory exercises	0,1
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there are two midterm exams. The first midterm exam is after 7 weeks of lectures and the second one is after 13 weeks of lectures. Each midterm test (as well as the final test) is carried out in a written format with duration of 90 minutes. It consists of both theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The final exam test consists of 6 theoretical questions and numerical problems. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 40% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points.

<table>
<tr><td></td><td colspan="3">Grade (in percentage) is formed according to the formula:

Grade(%) = 0,5L + 0,5(M1 + M2)

where:
• L – laboratory assessment,
• M1, M2 – midterm test results.

Final grade (based on percentages) is formed as follows:
Percentage Grade
50% do 62% sufficient (2)
63% do 74% good (3)
75% do 86% very good (4)
87% do 100% excellent (5)

According to Article 65. of Faculty’s Bylaw, student is required to participate in all teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. In accordance with that student is required to solve and turn over for grading 100% of all laboratory exercises. If student does not meet these criteria, she or he won’t be able to take part in the final exam, and will be required to enroll in the course the next year.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Božičević, J.: Temeljiautomatike 1, Školskaknjiga , Zagreb, 2008.</td><td>2</td><td></td></tr>
<tr><td>Šurina, T.: Automatskaregulacija, Školskaknjiga, Zagreb, 1981.</td><td>1</td><td></td></tr>
<tr><td>M.B. Histand, D.G. Alciatore: Introduction to Mechatronics and Measurement Systems, McGraw Hill, 1999.</td><td></td><td>teacher/Internet</td></tr>
<tr><td>I. Stančić, Guidelines for laboratory exercises, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>J. Musić: Authorized lecture notes, FESB</td><td></td><td>é-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">2. Friedland, B.: Control System Design, McGraw-Hill, New York, 1986.

2. Sinclair, I.: Sensors and Transducers, 3rd edition, Newnes, Oxford, 2001.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of student attendance.
- Annual analysis of course statistics in terms of midterm and finals exams
- Feedback from students via surveys.
- Feedback from graduated students (or senior students) on course content relevance.
- Self-evaluation of teachers.
- Periodic institutional evolution of course teachers.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3">/</td></tr>
</table>