1. GENERAL INFORMATION				
1.1. Course teacher	Associate Professor Tomislav Kurevija, PhD		1.6. Year of the study	II.
1.2. Name of the course	Enhanced geothermal systems and revitalization of deep wells as energy resources		1.7. ECTS credits	4
1.3. Associate teachers	Teaching Assistant Marija Macenić, PhD		1.8. Type of instruction (number of hours L + E + S + e-learning)	30L+15E+10S+5e-learning
1.4. Study programme (undergraduate, graduate, integrated)	graduate		1.9. Expected enrolment in the course	15
1.5. Status of the course	☐ mandatory	☒ elective	1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	level 2, 8,3% online
2. COUSE DESCRIPTION				
2.1. Course objectives	Students will learn about principles of design and use of enhanced geothermal systems, abandoned well revitalization and deep borehole heat exchangers.			
2.2. Enrolment requirements and/or entry competences required for the course	None.			
2.3. Learning outcomes at the level of the programme to which the course contributes	Independently solve complex engineering problems in petroleum engineering and geoenergy engineering; Design wellbore for hydrocarbon and geothermal water exploitation; Analyse reservoir rock and reservoir fluids properties; Plan hydrocarbon and geothermal reservoir management; Predict reservoir behaviour and the behaviour of hydrocarbon and geothermal water production system; Optimize hydrocarbon and geothermal water production; Compare specific procedures and processes in petroleum engineering and geoenergy engineering; Appraise process and facility's efficiency in petroleum engineering and geoenergy engineering; Assess the environmental impact of petroleum engineering and geoenergy engineering.			
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	Elaborate types of enhanced geothermal systems; Elaborate the revitalization process via deep borehole heat exchangers; Solve heat transfer equations; Evaluate available thermal energy when using deep borehole heat exchanger;			

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	Elaborate fluid flow through fractures and heat transfer in enhanced geothermal systems; Analyse environmental effects of using enhanced geothermal systems and deep borehole heat exchangers.
2.5. Course content (syllabus)	Introduction to the course, course overview; Deep well revitalization, deep borehole heat exchanger system, hydrocarbon and geothermal fluid coproduction, workover needed in revitalization process, case studies of revitalized deep wells; Analytical modelling of heat transfer in the case of revitalized deep wells, part I; Analytical modelling of heat transfer in the case of revitalized deep wells, part III; Numerical modelling of heat transfer in the case of revitalized deep wells, part II; Numerical modelling of heat transfer in the case of revitalized deep wells, part II; Determining available thermal energy of the deep borehole heat exchanger; Technoeconimical analysis of using deep borehole heat exchanger systems and environmental influence; Types of enhanced geothermal systems - HDR (hot dry rock), EHS (enhanced hydrothermal systems), HSA (hot sedimentary aquifer), hydraulic fracturing in the case of enhanced; Geothermal systems, fluid flow through fractures, heat transfer; Modelling of enhanced geothermal systems, part I; Modelling of enhanced geothermal systems, part II; Modelling of enhanced geothermal systems, part III; Case studies of enhanced geothermal systems - Soultz-sous-Forêts & Groß Schönebeck; Technoeconomical analysis of enhanced geothermal systems and environmental influence; Overview of regulations and directions of managing enhanced geothermal systems & revitalized wells.
2.6. Format of instruction:	☒ lectures ☒ seminars and workshops ☒ exercises ☐ online in entirety ☒ partial e-learning ☐ field work ☒ independent assignments ☒ multimedia and the internet ☐ laboratory ☒ work with mentor ☐ (other)
2.7. Comments:	-
2.8. Student responsibilities	Active participation in lecture, preparation and presentation of the seminar paper, taking the oral exams

2.9. Monitoring student work									
	Class attendance	YES		Research	YES		Oral exam	YES	
	Experimental work		NO	Report		NO			
	Essay		NO	Seminar paper	YES				
	Preliminary exam		NO	Practical work		NO			
	Project		NO	Written exam		NO	ECTS credits (total)	4	

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Tester, J.W., Anderson, B.J., Batchelor, A.S., Blackwell, D.D., DiPippo, R., Drake, E.M., Garnish, J., Livesay, B., Moore, M.C., Nichols, K. and Petty, S. (2006.): *The future of geothermal energy*. Massachusetts Institute of Technology, 358.	NO	YES

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	Huenges, E. and Ledru, P. eds. (2011.): *Geothermal energy systems: exploration, development, and utilization*, John Wiley & Sons.	NO	YES
	Chiasson, A.D. (2016.): *Geothermal heat pump and heat engine systems: Theory and practice*, John Wiley & Sons.	NO	YES
2.11. Optional literature			
2.12. Other (as the proposer wishes to add)			

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