AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Reservoir simulation and optimisation

Academic year: 2019/2020 Code: ZSDA-3-0295-s ECTS credits: 4

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: prof. dr hab. inż. Stopa Jerzy (stopa@agh.edu.pl)

Module summary

1. Theoretical backgrounds
2. Mathematical models
3. Black oil type models and compositional
3. Numerical models
4. Reservoir simulators
5. Optimisation and optimal control

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	group working and technical discussions	SDA3A_K01	Activity during classes
Skills: he can			
M_U001	Building the simulation models of oil, gas or water reservoirs	SDA3A_U01	Project
Knowledge: he knows and understands			
M_W001	Theoretical backgrounds and paractical aspects of the reservoir simulations	SDA3A_W01	
M_W002	Extended knowledge of modern methods for reservoir optimisation	SDA3A_W02	Test results

Number of hours for each form of classes

	Form of classes										
Suma	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
45	15	15	0	15	0	0	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	group working and technical discussions	-	-	-	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	Building the simulation models of oil, gas or water reservoirs	-	+	-	+	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Theoretical backgrounds and paractical aspects of the reservoir simulations	+	+	-	-	-	-	-	-	-	-	-
M_W002	Extended knowledge of modern methods for reservoir optimisation	-	-	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	45 h
Preparation for classes	10 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	5 h
Realization of independently performed tasks	20 h
Examination or Final test	2 h
Contact hours	2 h
Summary student workload	84 h
Module ECTS credits	4 ECTS

Additional information

Module content

Lectures

1. Theoretical backgrounds
2. Mathematical models
3. Black oil type models and compositional
3. Numerical models
4. Reservoir simulators
5. Optimisation and optimal control

Auditorium classes

work with specialized programming language dedicated to reservoir simulation software packages: defining models and controls

Project classes

Working in specialized computer laboratory with specialized software packages, building static and dynamic models, optimization of the controls and well locations, results visualisation, analysis of the results

Teaching methods and techniques:

Lectures: 1. Multimedial presentations
2. Discussions
3. Practical examples
Auditorium classes: Interactive work, preparation and running models for various possible examples, discussions of the link between theoretical models and real physical phenomena in underground reservoirs of oil, gas and water.
Project classes: Interactive work with specialized software packages: building static and dynamic models, optimization of the controls and well locations, results visualisation and discussions.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

Final test is required for the lecture. At least 80% attendance rate is required in project and auditorium

classes. The realization of all projects is required for a positive final grade. In the absence of positive grade in the basic date, student is entitled to two additional deadlines for the pass mark.

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:
– Attendance is mandatory: No
– Participation rules in classes: The lecture attendance is not obligatory
Auditorium classes:
– Attendance is mandatory: Yes
– Participation rules in classes: The attendance is obligatory
Project classes:
– Attendance is mandatory: Yes
– Participation rules in classes: The attendance is obligatory

Method of calculating the final grade

50% test + 50% projects

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

If the student does not pass any form of classes at the required date, he/she is entitled to write a retake in a form agreed with the lecturer. If someone omits the test, then have to write it on the date agreed with the lecturer.

Prerequisites and additional requirements

This course is for postgraduate students. Basics of geology, reservoir engineering and mathematics required to participate.

Recommended literature and teaching resources

1. J. Fanchi, Principles of applied reservoir simulation, Elsevier, 2001
2. ECLIPSE Reference Manual, Schlumberger 2019.
3. ECLIPSE Technical Description, Schlumberger 2019

Scientific publications of module course instructors related to the topic of the module

1.Computer modeling of coal bed methane recovery in coal mines / Jerzy STOPA, Stanisław NAWRAT // Journal of Energy Resources Technology ; ISSN 0195-0738. — 2012 vol. 134 iss. 3,s. 032804-1–032804-11
2.Influence of fracture-matrix interaction on thermal front movement in fractured reservoir /J. SIEMEK, J. STOPA // Bulletin of the Polish Academy of Sciences. Technical Sciences ; ISSN 0239-7528. — 2015 vol. 63 no. 4, s. 965–969. — Bibliogr. s. 969, Abstr.
3.Determination of minimum miscibility pressure for CO2 and oil system using acoustically monitored separator / Robert CZARNOTA, Damian JANIGA, Jerzy STOPA, Paweł WOJNAROWSKI // Journal of CO2 utilization ; ISSN 2212-9820. — 2017 vol. 17, s. 32–36
4.Performance of nature inspired optimization algorithms for polymer Enhanced Oil Recovery process / Damian JANIGA, Robert CZARNOTA, Jerzy STOPA, Paweł WOJNAROWSKI, Piotr KOSOWSKI // journal of Petroleum Science & Engineering; ISSN 0920-4105. — 2017 vol. 154, s. 354–366
5.Empirical modeling of two-phase CBM production using analogy to nature / Jerzy STOPA, Edyta MIKOŁAJCZAK // Journal of Petroleum Science & Engineering : an international journal devoted to integrated reservoir studies ; ISSN 0920-4105. — 2018 vol. 171, s. 1487–1495
6.Huff and puff process optimization in micro scale by coupling laboratory experiment and numerical simulation / Damian JANIGA, Robert CZARNOTA, Jerzy STOPA, Paweł WOJNAROWSKI // Fuel : the science and technology of fuel and energy ; ISSN 0016-2361. —2018 vol. 224, s. 289–301.
7.Model of two-phase production from gas wells conning water inspired by natural processes / Edyta KUK, Jerzy STOPA // Journal of Natural Gas Science and Engineering ; ISSN 1875-5100. — 2019 vol. 66, s. 96–106
8.Self-adapt reservoir clusterization method to enhance robustness of well placement optimization/

Damian JANIGA, Robert CZARNOTA, Jerzy STOPA, Paweł WOJNAROWSKI // Journal of Petroleum Science & Engineering; ISSN 0920-4105. — 2019 vol. 173, s. 37–52. — Bibliogr. s. 51–52,

Additional information

None