Z1-PU7	WYDANIE N1	Strona 1 z 2

(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: ***CFD modelling of wind turbines***	**2. Course code**
3. Validity of course description: 2016/2017	
4. Level of studies: BA, BSc programme	
5. Mode of studies: intramural studies / extramural studies	
6. Field of study: : Power engineering	(FACULTY SYMBOL) (RIE)
7. Profile of studies: general	
8. Programme: Sustainable energy engineering	
9. Semester: V	
10. Faculty teaching the course: Institute of Thermal Engineering	
11. Course instructor: dr inż. Zbigniew Buliński	
12. Course classification: selective subject	
13. Course status: compulsory /elective	
14. Language of instruction: English	
15. Pre-requisite qualifications: none	

16. Course objectives:

The aim of the course is the ability to identify and estimate risks in the workplace, prevention of health damage and assessment of results of risks in the workplace.

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Student knows basic constructions of wind turbines and fundamentals of wind turbine aerodynamics	Test	Lecture	K_W18, K_W13
2.	Student knows governing equations of isothermal and incompressible flows	Test	Lecture	K_W13
3.	Student knows methods of modelling of the turbulent flows	Test	Lecture	K_W13
4.	Student knowns basic numerical methods for solving incompressible flows in the frame of Finite Volume Method	Test	Lecture	K_W04
5.	Student knows methods for modelling of the moving mesh problems	Test	Lecture	K_W04
6.	Is able to apply advanced Computational Fluid Dynamics methods to design rotor of the wind turbine	Deliver a group project covering application of the CFD to design a wind turbine	Project	K_U01, K_U03, K_U05, K_U10, K_U11

18. Teaching modes and hours

Lecture 15 hours, Project 30 hours

19. Syllabus description:

Lectures

1. Introduction to wind energy
2. Governing equations of incompressible flows
3. Modelling turbulent flows
4. Finite Volume Method
5. Pressure-velocity coupling in incompressible flows

6. Techniques for dynamic mesh modelling

Project

Application of the Computer Fluid Dynamics techniques to design vertical or horizontal axis wind turbine

20. Examination:

21. Primary sources:

1. H.K. Versteeg, W. Malalasekera, An Introduction to Computational Fluid Dynamics. The Finite Volume Method, Pearson Education Limited, Harlow, 2nd edition, 2007.
2. E. Hau, Wind Turbines. Fundamentals, Technologies, Application, Economics, Springer-Verlag, Berlin; Heidelberg; New York, 2nd edition, 2006.
3. S. Mathew, Wind Energy. Fundamentals, Resources Analysis and Economics, Springer-Verlag, Berlin; Heidelberg, 2006.

22. Secondary sources:

1. F. M. White, Fluid mechanics, McGraw-Hill, New York, 5th edition, 2003.
2. J.H. Ferziger, M. Perić, Computational Methods for Fluid Dynamics, Springer-Verlag, Berlin; Heidelberg; New York, 3rd edition, 2002.
3. T.J. Chung, Computational Fluid Dynamics, Cambridge University Press, New York, 2002.
4. ANSYS Software documentation, www.ansys.com

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	15/15
2	Classes	/
3	Laboratory	/
4	Project	30/30
5	BA/ MA Seminar	/
6	Other	/
	Total number of hours	45/45

24. Total hours: 90

25. Number of ECTS credits:

26. Number of ECTS credits allocated for contact hours:

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):

26. Comments:

Approved:

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(date, Instructor's signature)

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(*date , the Director of the Faculty Unit signature)*