11. MO18-5207 Computational Fluid Dynamics

Module name	Computational Fluid Dynamics
Module level, if applicable	Master
Code, if applicable	MO18-5207
Subtitle, if applicable	-
Course, if applicable	Computational Fluid Dynamics
Semester	2nd Semester
Person responsible for the module	Suntoyo, S.T., M.Eng., Ph.D.
Lecturer	Suntoyo, S.T., M.Eng., Ph.D.
Language	Indonesian
Relation to curriculum	Mandatory course for master degree program in Ocean Engineering, 2nd semester.
Type of teaching, contact hours	Lecture, <50 students 150 minutes x 16 weeks per semester
Workload	1. Class, 3 × 50' = 150 minutes per week 2. Independent Study, 3 × 60' = 180 minutes per week 3. Structured Activities, 3 × 60' = 180 minutes per week
Credit points	3 CREDITS ~ 4.8 ECTS CREDITS × 1.6 ECTS
Requirements according to the examination regulations	A student must have attended at least 80% of the lectures to sit in the exams.
Recommended prerequisites	-

Learning outcomes **and their corresponding PLOs**	CLO.1. Able to understand the concept of computational fluid dynamics (CFD) and its application in ocean engineering CLO.2. Able to understand and governing equations about conservative laws of physics CLO.3. Able to understand the classification of fluid flow CLO.4. Able to understand the concept and process of CFD numerical method CLO.5. Able to understand the boundary layer concept CLO.6. Able to understand turbulence modeling with Reynold-stress equation, mixing-length model, two-equation model, and 2^{nd}-order closure.	LO.8. Able to identify, formulize and solved the science and technology problems related to ocean engineering through the accurate and innovative theoretical, experimental or computational approach
	CLO.7. Able to set up the free surface model CLO.8. Able to model the CFD using numerical method	
Content	This course discusses the concept of CFD its application in ocean engineering. Students will get the folloing materials: - Overview of CFD - Important variables in CFD analysis - conservative laws of physics - classification of fluid flow - Overview of numerical method: Discretization example, general solution method, convergence, accuracy and numerical diffusion, pressure velocity coupling, segregated versus coupled solver methods, and multigrid solver. - Boundary condition in CFD analysis: inlet and outlet boundaries, wall, symmetry, periodic and axis boundaries, internal cell zones, internal face boundaries, and material properties. - Turbulence model - Boundary layers and separation - Free surface modelling setup - Introduction to CFX	
Study and examination requirements and forms of examination	12. In-class exercise 13. Assignment 14. Mid-term exam 15. Final exam	

Media employed	Offline: LCD, whiteboard, PowerPoint presentation Online: websites (myITS Classroom), Zoom, Microsoft Teams, PowerPoint presentation
Reading list	1. Chung, T. 2002. *Computational Fluid Dynamics*. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511606205 2. C. Pozrikidis. 2016. *Fluid Dynamics: Theory, Computation, and Numerical Simulation* (3rd. ed.). Springer Publishing Company, Incorporated. 3. Versteeg, H. K. (Henk Kaarle), 1955-. *An Introduction to Computational Fluid Dynamics: The Finite Volume Method. Harlow, Essex*, Englan, Longman Scientific & Technical, New York, Wiley.