UNIVERSITAS GADJAH MADA

Faculty of Mathematics and Natural Sciences

Department of Computer Science and Electronics

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Doctoral Programme of Computer Science

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Module name	: **A**DVANCE **C**OMPUTATION
Module level, if applicable	: **D**OCTORAL
Code, if applicable	: MII7235
Semester(s) in which the module is taught	: 1 (Odd)
Person responsible for the module	: Dr. Suprapto, M.I.Komp.
Lecturer(s)	: Dr. Suprapto, M.I.Komp.
Language	: Indonesia
Relation to curriculum	: Doctorate Degree program, elective, 1st and 2nd semester
Credit points	: 3 credit points
Type of teaching, contact hours	: Doctorate: lectures for < 5 students. Contact hours are lecture hours.
Workload	: Lectures and discussion: 3 x 50 = 150 minutes (2.5 hours) per week. Exercises and assignments: 3 x 60 = 180 minutes (3 hours) per week. Independent study: 3 x 60 = 180 minutes (3 hours) per week.
Requirements according to the examination regulations	: A student must have attended at least 75% of the lectures to sit in the exams.
Recommended prerequisite	: -
Module objectives/ intended learning outcomes	: After completing this module, a student is expected to CO1: masters the basic concepts required in methods of DFD (domain free discretization), LSFD (least square-based finite difference), RBF-DQ (radial basis function-based differential quadrature), and standard LBM (lattice Boltzmann). CO1 supports PLO3. CO2: be able to explain and implement the methods of DFD, LSFD, RBF-DQ, and standard LBM. CO2 supports PLO4. CO3: be able to criticize and give inputs or suggestions to revise the methods of DFD, LSFD, RBF-DQ, and standard LBM. CO3 supports PLO4.

	CO4: masters the basic concepts of classical, propositional, and predicate logics. CO4 supports PLO3. CO5: understands and is able to explain deduction for predicate logic (i.e., natural deduction, soundness, completeness, computational issues), some model theories (i.e., basic definitions, compactness, definability and automorphisms, the L¨owenheim-Skolem theorems), intuitionistic logic, and modal logic. CO5 supports PLO4. CO6: be able to criticize the substances of deduction for predicate logic (i.e., natural deduction, soundness, completeness, computational issues), some model theories (i.e., basic definitions, compactness, definability and automorphisms, the L¨owenheim-Skolem theorems), intuitionistic logic, and modal logic. CO6 supports PLO5.
Content	1. DFD (domain free discretization) method and its applications, the equation of Navier-Stokes. 2. LSFD (least square-based finite difference) method, and numerical analysis of convergence rate. 3. The applications of LSFD method in the flow problems, RBF and the function approach. 4. DQ method for derivative approach, RBF-DQ method, and local RBF-DQ method. 5. The implementation of local RBF-DQ method for flow problems. 6. LGCA (lattice gas cellular automata), and standard LBM method. 7. Practical implementation of LBM for Lid-Driven Square Cavity Flows. 8. Deductions for predicate logics (natural deduction, soundness, completeness, computational issues). 9. Some model theories (basic definitions, compactness, definability and automorphisms, The L¨owenheim-Skolem theorems, discussions). 10. Intuitionistic logic. 11. Modal logic.
Study and examination requirements and forms of examination	: Evaluation is done in 3 forms, namely: 1. Two examinations, mid-term and final, 2. Two case-based assignment, and 3. A short review paper on state-of-the-art methods in formal methods.
Media employed	: LCD, blackboard, and websites.

Reading List	1. Shu, C., *Notes on Advanced Computational Fluid Dynamics*, NUS, National University of Singapore. 2. Avigad, J., 2002, *Logic and Computation Lecture notes,* Carnegie Mellon University.

The Mapping of COs to PLOs

COs	PLOs							
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CO1			■					
CO2				■				
CO3				■				
CO4			■					
CO5				■				
CO6				■	■			

The PLO of DP-CS

PLO	**Knowledge Area**	**PLO Description**
PLO1	[Values and principles]	A graduate should be devoted to God Almighty, uphold the humanity values, internalize academic values and ethics, responsible in working around expertise independently.
Managerial Capability		
PLO2	[Professional attitudes]	A graduate should have good interpersonal skills; able to work together within the organization, both as a leader and a member; able to be the initiator; able to manage and delegate tasks; and have a sense of responsibility for their own work as well as take responsibility for the achievement of the organization's work.
PLO3	[Communication skills]	A graduate should be able to communicate effectively and efficiently with stakeholders from various backgrounds; use English well; and able to write and present scientific papers correctly and well.
PLO4	[Life-long learning]	A graduate should be up to date with the state-of-the-art especially in computer science field, able to take parts in the development of computer science field that is engaged in and relate it to other fields throughout life.
Working Capability		
PLO5	[Problem-solving and Scientific skills]	A graduate should be able to analyse science and technology problems in the computer science field, develop alternative solutions through intra disciplinary, interdisciplinary, and trans disciplinary approaches to produce innovative, original, and tested works.

PLO6	[Ability to formulate and do research]	A graduate should be able to formulate research problems through critical, exploratory, and innovative studies both independently and in groups of computer science field that is engaged in and present research results in a scientific paper at regional or international level.
Mastering Knowledge		
PLO7	[Fundamental knowledge]	A graduate should be able to develop knowledge in the field of computer science that is engaged, which includes abstraction, complexity, evolution and philosophy of changes or developments in the field of science.
PLO8	[Applied knowledge]	A graduate should be able to develop theoretical, philosophical, and applied concepts in the field of computer science that is engaged in, and to represent them in a structured and systematic manner.