SEMESTER LEARNING ACTIVITY PLANS
(SLAP)
SEMESTER EVEN 2022/2023

Fluid Mechanics

MFF5404 / 3 Credits

Lecturer Coordinator:

Dr. Arief Hermanto, Drs., S.U., M.Sc.

UNIVERSITAS GADJAH MADA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
2022

Universitas Gadjah Mada
Faculty of Mathematics and Natural Science
Physics Department / Study Program Master Physics
Semester Even 2022/2023

SEMESTER LEARNING ACTIVITY PLANS (SLAP)

Code	Course Name	Credits (credits)	Semester	Status	Prerequisite
MFF5404	*Fluid Mechanics*	*3*	*Even*	*Elective*	*None*

Short Description

Fluid Mechanics course is Elective course 3 credits (Theory) in the 2022 Curriculum Master Physics Study Program, Faculty of Mathematics and Natural Science UGM.

The syllabus of this course is as follows:
1. Introduction: flowing substances, physical properties of flowing substances, flow mechanics and their role in physics, basic concepts of continuous medium mechanics.
2. Ideal flowing substances: Lagrange's descriptions and Euler's descriptions, the concept of kinematics, mass conservation equation, momentum conservation equation, energy conservation equation, momentum flux, energy flux, potential flow, sound wave propagation, and the instability of flowing substances.
3. Viscous liquids: equations for viscous fluids, energy dissipation, some examples, viscosity due to suspension, correct answers to equations of motion of viscous liquids.
4. Multiple applications: the equation of flowing substance in various coordinate systems, stars as fluid systems, accretion disks in astrophysics, etc.
5. Optional: relativistic flow substance, turbulence.

The courses are held in class for 14 weeks, each week's session last for 3 x 50 minutes. Four weeks of course period is used for Midterm Exam and Final Exam, each held for two weeks as scheduled.

Student evaluation for course assessments is performed summative and formative. The summative evaluation is implemented as written exams, both Midterm and Final Exam, which take a maximum of 120 minutes. The formative evaluation is implemented as individual assignments for each student in the form of completing an assignment individually. Monitoring is carried out by observing student activities during the course, such as attendance, Q&A and discussion about the material presented, and student performance in completing individual assignments.

Program Learning Outcomes (PLO) Imposed on the Course

PLO 3	Mastering further knowledge of classical and modern physics theory, and its relationship with other disciplines, and has mastered an advanced field of physics specialization that allows him to keep up with the latest international research developments.
PLO 4	Mastering various mathematical disciplines related to an advanced field of physics, and able to develop physical models using various mathematical and computational tools with an inter or multidisciplinary approach to solving problems related to an advanced field of physics.
PLO 6	Able to apply knowledge to analyze, synthesize, formulate problems and solve problems comprehensively in one of advanced field of physics, through experimental or theoretical research, then be able to classify and draw conclusions about their findings for the development of science and technology.

Course Outcomes (CO)	**Upon completion of this course, students should be able to:**	
	CO1	Understand the introduction of flowing substances, physical properties of flowing substances, flow mechanics and their role in physics, basic concepts of continuous medium mechanics, ideal flowing substances, Lagrange's descriptions, and Euler's descriptions.
	CO2	Understand the concept of kinematics, mass conservation equation, momentum conservation equation, energy conservation equation, momentum flux, energy flux, potential flow, and sound wave propagation.
	CO3	Understand the instability of flowing substances, viscous liquids, equations for viscous fluids, energy dissipation, some examples, viscosity due to suspension, and correct answers to equations of motion of viscous liquids.
	CO4	Understand multiple applications: the equation of flowing substance in various coordinate systems, stars as fluid systems, accretion disks in astrophysics, etc.
	CO5	Understand the substance of relativistic flow and turbulence.
	CO6	
	CO7	
	CO8	

The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO1	Introduction: fluids, physical properties of fluids, mechanics of fluids and their role in physics.	Lecture, discussion	3 x 50 minutes
	CO1	The basic concepts of continuous medium mechanics.	Lecture, discussion	3 x 50 minutes
	CO1	Ideal flowing substances: Lagrange's description and Euler's description.	Lecture, discussion	3 x 50 minutes
	CO2	Kinematic concepts, equations for conservation of mass, equations for conservation of momentum, equations for conservation of energy.	Lecture, discussion	3 x 50 minutes
	CO2	Momentum flux and energy flux.	Lecture, discussion	3 x 50 minutes
	CO2	Potential flow, propagation of sound waves.	Lecture, discussion	3 x 50 minutes
	CO2	Fluid instability.	Lecture, discussion	3 x 50 minutes
	CO3	Viscous fluids: equations for viscous fluids, energy dissipation, some examples.	Lecture, discussion	3 x 50 minutes

	CO3	Viscosity due to suspension, the exact answer to the equation of motion of a viscous fluid.	Lecture, discussion	3 x 50 minutes
	CO3	Some applications: flow equations in various coordinate systems.	Lecture, discussion	3 x 50 minutes
	CO4	Stars as fluid systems.	Lecture, discussion	3 x 50 minutes
	CO4	Discusses the application of fluid mechanics in the structure of stars.	Lecture, discussion	3 x 50 minutes
	CO4	Discusses the application of fluid mechanics in star structures (2).	Lecture, discussion	3 x 50 minutes
	CO4	Introduction to the phenomenon of fluid accretion on the surface of stars.	Lecture, discussion	3 x 50 minutes
	Final Exam/ Project Task Results/ Case Analysis Results			
Learning Methods	Lecture, discussion			
Student Learning Experience	Learn to analyze and review: Introduction: fluids, physical properties of fluids, mechanics of fluids and their role in physics., The basic concepts of continuous medium mechanics., Ideal flowing substances: Lagrange's description and Euler's description., Kinematic concepts, equations for conservation of mass, equations for conservation of momentum, equations for conservation of energy., Momentum flux and energy flux., Potential flow, propagation of sound waves., Fluid instability., Viscous fluids: equations for viscous fluids, energy dissipation, some examples., Viscosity due to suspension, the exact answer to the equation of motion of a viscous fluid., Some applications: flow equations in various coordinate systems., Stars as fluid systems., Discusses the application of fluid mechanics in the structure of stars., Discusses the application of fluid mechanics in star structures (2)., Introduction to the phenomenon of fluid accretion on the surface of stars..			
Access to Learning Media/ LMS and Offline and Online Percentage	Sync (google meet), Asynchronous (google classroom, video)			

Assessment Methods and Synchronization with CO

Assessment Methods	**Assessment Percentage**	**Criteria/Indicators**	**CO1**	**CO2**	**CO3**	**CO4**
Participatory Activity*						
Project Results/ Case Study Results/ PBL Results*						
Cognitive						
Assignment	30%		7,5%	7,5%	7,5%	7,5%
Quiz						
Midterm Exam	35%		17,5%	17,5%		
Final Exam	35%				17,5%	17,5%

	[*)] can also be obtained from the Midterm or Final Exam as the result of participatory activities or project/ case study results. According to IKU 7, the percentage of project results/ case study/ PBL results is at least 50%.	
References	**Main references:** 1. Clarke C.J. dan Carswell R.F., 2007, Principles of Astrophysical Fluid Dynamics, Cambridge University Press, Cambridge. 2. Batchelor G.K., 2000, An Introduction to Fluid Dyanmics, Cambridge University Press, Cambridge. 3. Landau L.D. dan Lifshitz E.M., 1987, Fluid Mechanics, edisi kedua, Pergamon Press, New York.	
Lecturers (*Team Teaching*)	1. Dr. Arief Hermanto, Drs., S.U., M.Sc. 2. 3. 4.	

Authorization	**Date of Drafting**	**Lecturer Coordinator**	**Head of Curriculum Committee**	**Head of Study Program**
		Dr. Arief Hermanto, Drs., S.U., M.Sc.	Dr.Ing. Ari Setiawan	Mirza Satriawan, M.Si., Ph.D