	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Physics Education Masters Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Advanced Mechanics	8410302004	Compulsory Study Program Subjects	T=2	P=0	ECTS=4.48	1	July 19, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Dr. Oka Saputra, M.Pd.	Prof. Dr. Munasir, M.Si.	Dr. Titin Sunarti, M.Si.

Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-6	Realizing the character of being honest, independent, caring, tough, and has an entrepreneurial and leadership spirit and has the ability to develop oneself continuously and sustainably in the life of society, nation and state
	PLO-7	Develop logical, critical, systematic, creative and innovative thinking in the context of implementing science and technology in social life and act as a global citizen with a global perspective.
	PLO-14	Master the theoretical concepts of classical and modern physics in depth
	Program Objectives (PO)	
	PO - 1	Mastering the study of Classical Mechanics, especially Newtonian Mechanics, Lagrange formalism, Central potential, Small oscillations, Hamiltonian formalism, Canonical Transformations and Hamilton-Jacobi Theory
	PO - 2	Mastering various mathematical formulations relevant to the field of Classical Mechanics
	PO - 3	Have the character of faith, intelligence, honesty, caring and toughness as well as commendable professionalism as a scientist in general and especially as a physicist.
	PLO-PO Matrix	

P.O	PLO-6	PLO-7	PLO-14
PO-1			
PO-2			
PO-3			

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1			✔	✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔
PO-2	✔	✔							✔	✔						
PO-3																

Short Course Description	This Classical Mechanics course studies the basic principles and methods in classical mechanics which include Newtonian Mechanics, Lagrange Formalism, Central Potential, Small Oscillations, Hamiltonian Formalism, Canonical Transformations and Hamilton-Jacobi Theory.	
References	**Main :**	
	1. Goldstein, H.; Poole, C.P.; and Safko, J.L. (2001). Classical Mechanics, 3rd Edition, Addision-Wesley	
	Supporters:	

	1. Landau, L.; Lifshitz, E. (2000). Mechanics, 3rd Edition, Butterworth-Heinemann
Supporting lecturer	Prof. Dr. Munasir, S.Si., M.Si. Nugrahani Primary Putri, S.Si., M.Si.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (*offline*)	Online (*online*)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Able to understand the concepts, principles and applications of Classical Mechanics in solving physical problems	able to understand the Newtonian concept of particle motion	**Form of Assessment** : Participatory Activities	Lectures and discussions 2 x 50	Lectures and discussions 2 x 50	**Material:** Ch 1 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	2%
2	Able to understand the concepts, principles and applications of Classical Mechanics in solving physical problems, especially Newton's Laws	able to understand the Newtonian concept of particle motion	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Participatory Activities	Lectures and discussions 2 x 50	Lectures and discussions 2 x 50	**Material:** Ch 1 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	2%
3	Able to use Lagrange's formulation to solve physics problems	Able to solve problems involving equivalent one-body problems, equations of motion, and apply them to solve physical problems regarding motion	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Participatory Activities	Presentation, discussion 2 x 50 minutes	Presentation, discussion 2 x 50	**Material:** Ch 1 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	3%
4	Able to use Lagrange's formulation to solve physics problems	Able to solve problems involving equivalent one-body problems, equations of motion, and apply them to solve physical problems regarding motion	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Participatory Activities	Presentation, discussion 2 x 50 minutes	Presentation, discussion 2 x 50	**Material:** Ch 1 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	3%
5	Students can master the Lagrange formulation to solve physics problems		**Form of Assessment** : Participatory Activities	Presentation, discussion 2 x 50 minutes	Presentation, discussion 2 x 50	**Material:** Ch 2 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	2%
6	Students can use the Hamiltonian formalism to solve physics problems	Able to use the Hamiltonian formulation to solve physics problems	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Participatory Activities	Presentation, discussion 2 x 50 minutes	Presentation, discussion 2 x 50	**Material:** Ch 2 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	3%

7	Students can use the Hamiltonian formalism to solve physics problems	Able to use the Hamiltonian formulation to solve physics problems	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Participatory Activities	Presentation, discussion 2 x 50 minutes	Presentation, discussion 2 x 50	**Material:** Ch 2 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	3%
8	Students are able to use Newtonian, Lagrangian and Hamiltonian approaches to solve simple physical problems	Students are able to solve simple physical problems using Newtonian, Lagrangian and Hamiltonian approaches	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Test	Midterm 2 x 50 minutes	UTS 2 x 50	**Material:** Ch 1 and 2 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	20%
9	Students are able to master classical mechanics concepts related to the motion of rigid bodies	Students are able to solve rigid body motion problems using classical mechanics concepts	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Participatory Activities	Lectures, discussions 2 x 50 minutes	Lectures, discussions 2 x 50	**Material:** Ch 4 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	2%
10	Students are able to master classical mechanics concepts related to the motion of rigid bodies	Students are able to solve rigid body motion problems using classical mechanics concepts	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Participatory Activities	Lectures, discussions 2 x 50 minutes	Lectures, discussions 2 x 50	**Material:** Ch 4 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	5%
11	Students are able to use Lagrange‘s formulation regarding the motion of rigid bodies	Students are able to solve rigid body motion problems using the Lagrange concept	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Participatory Activities	Presentation, discussion 2 x 50 minutes	Presentation, discussion 2 x 50 minutes	**Material:** Ch 4 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	5%
12	Students are able to use the Lagrange and Hamilton formulations to solve oscillatory motion problems	Students are able to solve oscillatory motion problems using the Lagrange and Hamilton formulations	**Form of Assessment** : Portfolio Assessment	Presentation, discussion 2 x 50 minutes	Presentation, discussion 2 x 50 minutes	**Material:** Ch 6 **Bibliography:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	5%
13	Students are able to use the Lagrange and Hamilton formulations to solve oscillatory motion problems	Students are able to solve oscillatory motion problems using the Lagrange and Hamilton formulations	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Portfolio Assessment	Presentation, discussion 2 x 50 minutes	Presentation, discussion 2 x 50 minutes	**Material:** Ch 6 **Bibliography:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	5%

14		Students can solve damped oscillation problems using the Lagrange and Hamilton formulations	**Form of Assessment** : Portfolio Assessment	Discussion, giving assignments 2 x 50 minutes	Discussion, giving assignments 2 x 50 minutes	**Material:** Ch 6 **Bibliography:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	5%
15	Students can use the Lagrange and Hamilton formulations to solve problems related to damped oscillations	Students can solve damped oscillation problems using the Lagrange and Hamilton formulations	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Project Results Assessment / Product Assessment, Portfolio Assessment	Discussion, giving assignments 2 x 50 minutes	Discussion, giving assignments 2 x 50 minutes	**Material:** Ch 6 **Bibliography:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	5%
16	Students can use Newtonian concepts, Lagrange and Hamiltonian formulations to solve physics problems	Students can solve physics problems using Newtonian, Lagrangian and Hamiltonian	**Criteria:** Students will get full marks if they meet the assessment indicators **Form of Assessment** : Test	UAS 2 x 50 minutes	UAS 2 x 50 minutes	**Material:** Ch 4 and 6 **References:** *Goldstein, H.; Poole, C.P.; and Safko, J. L. (2001). Classical Mechanics, 3rd Edition, Addition-Wesley*	30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	30%
2.	Project Results Assessment / Product Assessment	2.5%
3.	Portfolio Assessment	17.5%
4.	Test	50%
		100%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.