Semester Learning Plan

	UNIVERSITAS NEGERI SURABAYA Faculty of Mathematics and Natural Sciences Physics Study Program	Document Code

SEMESTER LEARNING PLAN

COURSE	CODE	Group of Course	CREDIT POINTS		SEMESTER	Date of arrangement
MATHEMATICAL PHYSICS 1			T=3	P=0	2	25 September 2020

Authorization Department of Physics	Semester Learning Plan Developer	Group of Course Coordinator	Head of Study Program
	Nugrahani Primary Putri, M.Si	**Dr. Z.A. Imam Supardi, M.Si**	**Nadi Suprapto, Ph.D**

Learning Outcome (LO)	**PLO in course**	
	PLO-2	Able to formulate a physical systems as physical model by using mathematics
	PLO-3	Able to solve problems in physical systems comprehensively by using mathematics and computational tools.
	PLO-4	Able to analyze a physical system by applying mathematics and computational tools/ICT.
	Course Learning Outcome (CLO)	
	CLO1	Students master the knowledge of classical and modern physics to identify the properties of a simple physical system using mathematical physics approach.
	CLO2	Students are able to formulate a simple physical system into mathematical model using relevant symbolic/numeric language.
	CLO3	Students are able to use high order thinking processes to form solutions from the simple physical model.
	CLO4	Students are able to apply scientific manners, critical thinking, and innovation skills for examining physics learning problems using mathematics.
	Final competencies for each learning stage (Sub-CLO)	
	Sub-CLO1	Students master the knowledge of mechanics and thermodynamics to identify the relevant properties of a simple physical system.
	Sub-CLO2	Students are able to formulate simple physical system problems related to mechanics and thermodynamics into mathematical model using relevant symbolic/numeric language.
	Sub-CLO3	Students are able to use high order thinking processes to form solutions from the simple physical model related to mechanics and thermodynamics.
	Sub-CLO4	Students are able to apply scientific manners, critical thinking, and innovation skills for examining mechanics and thermodynamics learning problems at high school using mathematics.
Short description about the course	This course examines infinite series, partial differential, ordinary differential equations, and vector analysis through active learning by combining the methods of discussion, questions and answers, also assignment using IT.	
Course Content: Learning Material	• Infinite series • Partial differential	

	• Ordinary differential equations • Vector analysis
References	**Main reference:**
	[1] Boas, M.L. 2006. *Mathematical Methods in the Physical Science*, 3rd ed. New York: John Wiley & Sons.
	Supporting references:
	[2] Arfken, G. 1995. *Mathematical Methods for Physicists.* Academic Press. [3] Riley, K.F., Hobson, M.P., Bence, S.J. 2006. *Mathematical Methods for Physics and Engineering*, 3rd ed. Cambridge Univ. Press. [4] Hassani, Sadri. 2009. *Mathematical Methods for Students of Physics and Related Fields*, 2nd ed. Illinois: Springer.
Lecturers	Dr. Z.A. Imam Supardi, M.Si Drs. Supardiyono, M.Si Nugrahani Primary Putri, M.Si
Requirement course	Basic Mathemathics

Week	**Final competencies for each learning stage (Sub-CLO)**	**Assessment**		**Learning Type, Learning Method, Student Tasks, [Time Estimation]**		**Learning Material [References]**	**Assessment Percentage (%)**
		Indicator	**Criteria & Type**	**Offline**	**Online**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1-3	a. Students master the knowledge of mechanics and thermodynamics to identify the relevant properties of a simple physical system. b. Students are able to formulate simple physical system problems related to mechanics and thermodynamics into mathematical model using relevant symbolic/numeric language.	1. Students are able to undertake convergence test of a series. 2. Students are able to analyze a function into power series. 3. Students are able to solve mechanics and thermodynamics problems using series concept.	Criteria: quantitative Type: test	Type: assignment Method; discussion Assignment: independent Time: 6 x 50 minutes	Type: Course Method: Lecture and discussion Time: 3 x 50 minutes	1. Definition and notation 2. Convergence test of infinite series 3. Alternating series 4. Power series 5. Convergence interval of power series 6. Taylor Analysis of a function	Sub CLO 1 (20%) and 2 (20%)
4-6	a. Students master the knowledge of mechanics and thermodynamics to identify the relevant properties of a simple physical system. b. Students are able to formulate simple physical system problems related	1. Students are able to execute partial differential using chain rules. 2. Students are able to execute implicit differentiation, change variable and limit requirement	Criteria: quantitative Type: test	Type: assignment Method; discussion Assignment: independent Time: 6 x 50 minutes	Type: Course Method: Lecture and discussion Time: 3 x 50 minutes	Partial differential: 1. Total differential 2. Chain rules 3. Implicit differentiation 4. Variable changing 5. Limit requirement 6. Minimum and maximum value with limitation, Lagrange Multiplier	Sub CLO 1 (20%) and 2 (20%)

	to mechanics and thermodynamics into mathematical model using relevant symbolic/numeric language.	3. Students are able to look for minimum and maximum value of a function 4. Students are able to solve mechanics and thermodynamics problems using partial differential concept					
7	a. Students master the knowledge of mechanics and thermodynamics to identify the relevant properties of a simple physical system. b. Students are able to formulate simple physical system problems related to mechanics and thermodynamics into mathematical model using relevant symbolic/numeric language. c. Students are able to use high order thinking processes to form solutions from the simple physical model related to mechanics and thermodynamics.	1. Students are able to identify first and second order differential equations related to physics concept particularly mechanics and thermodynamics. 2. Students are able to solve first order differential equation. 3. Students are able to find solutions for first order differential equation in physics problems.	Criteria: quantitative Type: test	Type: assignment Method; discussion Assignment: independent Time: 3 x 50 minutes	Type: Course Method: Lecture and discussion Time: 3 x 50 minutes	Ordinary differential equations: 1. Separable equations 2. Linear first-order equations 3. Other methods for first-order equations	Sub CLO 1 (20%), 2 (20%) and 3 (20%)
8	**Midterm Semester Evaluation / Midterm Exam**						Sub CLO 1(40%), 2 (10%)
9-10	b. Students are able to formulate simple physical system problems related to mechanics and thermodynamics into mathematical model using relevant symbolic/numeric language. c. Students are able to use high order thinking	1. Students are able to solve second order differential equation. 2. Students are able to find solutions for second order differential equation in physics problems. 3. Students are able to apply ordinary differential equation to solve physics problems in accordance	Criteria: quantitative Type: test	Type: assignment Method; discussion Assignment: independent Time: 3 x 50 minutes	Type: Course Method: Lecture and discussion Time: 3 x 50 minutes	Ordinary differential equations: 1. Second-order linear equations with constant coefficients and zero right-hand side. 2. Second-order linear equations with constant coefficient and right-hand side not zero	Sub CLO 2 (10%) and 3 (20%)

	processes to form solutions from the simple physical model related to mechanics and thermodynamics.	with the concept of mechanics and thermodynamics.				3. Other second-order equations	
11-13	b. Students are able to formulate simple physical system problems related to mechanics and thermodynamics into mathematical model using relevant symbolic/numeric language. c. Students are able to use high order thinking processes to form solutions from the simple physical model related to mechanics and thermodynamics. d. Students are able to apply scientific manners, critical thinking, and innovation skills for examining mechanics and thermodynamics learning problems at high school using mathematics.	1. Students are able to hold vector multiplication and vector differentiation, also formulate simple physical system using vector multiplication and vector differentiation concepts. 2. Students are able to use vector operator in cartesian coordinate, gradient, divergence and curl in simple physical model. 3. Students are able to understand Green Theorem, divergence theorem and Stokes theorem.	Criteria: quantitative Type: test	Type: assignment Method; discussion Assignment: independent Time: 6 x 50 minutes	Type: Course Method: Lecture and discussion Time: 3 x 50 minutes	Vector analysis: 1. Vector multiplication: dot product and cross product 2. Differentiation of vectors 3. Operator vector 4. Gradient, Divergence and Curl 5. Line integrals 6. Green's theorem in the plane 7. Divergence theorem 8. Stokes theorem	Sub CLO 2 (10%), 3 (20%) and 4 (30%)
14-15	c. Students are able to use high order thinking processes to form solutions from the simple physical model related to mechanics and thermodynamics. d. Students are able to apply scientific manners, critical thinking, and innovation skills for examining mechanics and thermodynamics learning problems at high school using mathematics.	1. Students are able to identify various coordinates. 2. Students are able to understand coordinate transformation. 3. Students are able to use the concept of coordinate transformation to find solution for simple physical model.	Criteria: quantitative Type: test	Type: assignment Method; discussion Assignment: independent Time: 3 x 50 minutes	Type: Course Method: Lecture and discussion Time: 6 x 50 minutes	Coordinate transformations 1. Cartesian coordinate 2D 2. Polar coordinate 3. Cartesian coordinate 3D 4. Cylindrical coordinate 5. Spherical coordinate	Sub CLO 3 (10%) and 4 (20%)

16	**Final Semester Evaluation / Final Exam**	Sub CLO 2(10%), 3(30%) and 4(50%)

Notes:

1. **Program Learning Outcome (PLO)** is the ability possessed by each study program graduate which is the internalization of attitudes, mastery of knowledge and skills according to the level of study program obtained through the learning process.
2. **PLO in course** is some learning outcomes of study program graduate (PLO) to form/develop a course which consists of attitudes, public skills, particular skills and knowledge.
3. **Course learning outcome (CLO)** is the ability which described specifically from PLO in course and is specific to the course content or learning material.
4. **Sub-course learning outcome (Sub-CLO)** is the ability described specifically from CLO that can be measured or observed and is the final ability planned at each learning stage, also is specific to the learning material of the course.
5. **Indicator of ability assessment** in the students learning process and learning outcome is specific and measurable statement that identifying the capability or performance of students learning outcome accompanied by evidence.
6. **Assessment criteria** is the standard used as measures or benchmarks for learning achievement in assessment based on predetermined indicators. Assessment criteria is guidelines for assessor so as the assessment is consistent and unbiased. The criteria can be quantitative or qualitative.
7. **Assessment types:** test and non-test.
8. **Learning types:** Lecture, Response, Tutorial, Seminar or else, Practicum, Studio Activity, Workshop Activity, Field Study, Research, Community Services and/or other equivalent learning types.
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 method.
10. **Learning Material** is details or descriptions from course content that can be presented in the form of several subjects and sub-topics.
11. **Assessment percentage** is the percentage of assessment toward every sub-CLO achievement which is proportional to the difficulty level of sub-CLO achievement and its total is 100%.