Semester Lesson Plan (SLP)

	UNIVERSITAS NEGERI SURABAYA, FACULTY OF MATHEMATICS AND NATURAL SCIENCE PHYSICS PROGRAM STUDY	**Document code**

SEMESTER LESSON PLAN

COURSE	CODE	DISCIPLINE	CREDIT UNIT		SEMESTER	CREATED DATE
MATHEMATICAL PHYSICS 2			**T=3**	**P=0**	2	5 September 2020

AUTHORISATION	AUTHOR	COURSE COORDINATOR	HEAD OF STUDY PROGRAM
PHYSICS DEPARTMENT FMNS UNESA	Nugrahani Primary Putri, M.Si	**Dr. Z.A. Imam Supardi, M.Si**	**Prof. Dr. Munasir, M.Si.**

Learning Achievement	**Program Learning Outcome (PLO)**	
	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 classical and modern physics knowledges to identify the properties of a simple physical systems
	CLO2	Students are able to formulate problems of a simple physical systems into mathematics models using relevant symbolic/numeric languages
	CLO3	Students are able to use high level thinking process to form solutions of the simple physical models
	CLO4	Students are able to use scientific attitude, critical thinking, and innovation skills to study problems of physics learning using mathematics supports
	Final competencies for each learning stage (Sub-CLO)	
	Sub-CLO1	Students master knowledges of electrics, magnet, modern physics, and waves to identify the properties of a simple relevant physical systems
	Sub-CLO2	Students are able to formulate problems of simple physical systems related to electrics, magnet, modern physics and waves into mathematics models using relevant symbolic/numeric languages
	Sub-CLO3	Students are able to use high level thinking process to form solutions of the simple physical models related to electrics, magnet, modern physics and waves
	Sub-CLO4	Students are able to use scientific attitude, critical thinking, and innovation skills to study problems of electrics, magnet, modern physics and waves learning in high school using mathematics supports
Course Description	This course study about: complex numbers, Fourier series, special functions, solutions of differential equations, and partial differential equations using active learning with combination of discussion methods, question and answer (Q&A) and IT supported assignments	
Topic Discussion: Learning Materials	• Complex numbers • Fourier series • Special functions	

	• Solutions of differential equations • Partial differential equations
References	**Primary:**
	[1] Boas, M.L. 2006. *Mathematical Methods in the Physical Science*, edisi 3, John Wiley & Sons, New York.
	Secondary:
	[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*, edisi 3, Cambridge Univ. Press. [4] Hassani, Sadri. 2009. *Mathematical methods for students of physics and related fields*, 2nd ed. Springer, Illinois.
Lecturer	Dr. Z.A. Imam Supardi, M.Si Drs. Supardiyono, M.Si Nugrahani Primary Putri, M.Si Dzulkiflih, S.Si., M.T
Pre-requisites	Mathematics Physics 1

Week	**Final competence in each learning step (Sub-CLO)**	**Assessment**		**Aids Learning, Learning Methods, Student Assignments, [Time Estimate]**		**Learning Material [reference]**	**Assessment Weight (%)**
		Indicator	**Criteria & Format**	**Offline**	**Online**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1-2	a. Students master knowledges of electrics, magnet, modern physics, and waves to identify the properties of a simple relevant physical systems, b. Students are able to formulate problems of simple physical systems related to electrics, magnet, modern physics and waves into mathematics models using relevant symbolic/numeric languages.	1. Students are able to do complex algebraic operation, 2. Students are able to solve questions that related to complex series, functions of exponential, logarithm, trigonometry, and hyperbolic complex, 3. Students are able to apply complex numbers to solve problems of physics.	Criteria: Quantitative Format: test	Format: Assignment Methods: Discussion Assignment: independent Time: 3 x 50 Minutes	Format: Lecture Methods: Lecture and discussion Time: 3 x 50 Minutes	1. Real part and imaginary part of complex numbers 2. Algebraic of complex numbers 3. Complex planes 4. Complex equations 5. Complex series 6. Square complex series 7. Exponential functions and Euler formula 8. Logarithm complex functions 9. Square and root complex 10. Trigonometry and hyperbolic functions 11. Applications of complex number in physics References: [1] ch.2 [3] ch.3	**10%**

						[4] ch.20	
3-4	a. Students master knowledges of electrics, magnet, modern physics, and waves to identify the properties of a simple relevant physical systems, b. Students are able to formulate problems of simple physical systems related to electrics, magnet, modern physics and waves into mathematics models using relevant symbolic/numeric languages.	1. Students are able to determine mean values of a function, 2. Students are able to identify periodic functions and periodicity of a function, 3. Students are able to determine coefficient values of Fourier series, 4. Students are able to identify odd and even functions, 5. Students can change Fourier series into complex forms, 6. Students can solve Fourier series with difference interval	Criteria: Quantitative Format: test	Format: Assignment Methods: Discussion Assignment: independent Time: 3 x 50 Minutes	Format: Lecture Methods: Lecture and discussion Time: 3 x 50 Minutes	1. Fourier series dan Fourier transformations 2. Periodic functions 3. Mean value in a function. 4. Fourier coefficients 5. complex valued of Fourier series. 6. Interval change 7. Even and odd functions References: [1] ch.7 [2] ch.3 [3] ch.12	**10%**
5-7	a. Students master knowledges of electrics, magnet, modern physics, and waves to identify the properties of a simple relevant physical systems, b. Students are able to formulate problems of simple physical systems related to electrics, magnet, modern physics and waves into mathematics models using relevant symbolic/numeric languages, c. Students are able to use high level thinking process to form solutions of the simple physical models related to electrics, magnet, modern physics and waves.	1. Students are able to do integral solutions by using gamma and beta functions, 2. Students are able to do integral solutions by using elliptic functions, 3. Students are able to apply concept of gamma, beta, error dan elliptic functions to solve physics problems	Criteria: Quantitative Format: test	Format: Assignment Methods: Discussion Assignment: independent Time: 3 x 50 Minutes	Format: Lecture Methods: Lecture and discussion Time: 3 x 50 Minutes	1. Factorial functions 2. Gamma functions 3. Recursion relation 4. Gamma functions for negative numbers 5. Beta functions 6. Error functions 7. Asymptotic series 8. Elliptic integral 9. Elliptic functions 10. Mathematical pendulum References: [1] Ch. 11 [3] Ch.18	**10%**
8	**Mid Semester Evaluation / Mid Semester Exam**						**20%**
9-10	a. Students are able to formulate problems of simple physical systems	1. Students are able to solve differential equations	Criteria: Quantitative Format: test	Format: Assignment	Format: Lecture	1. Legendre equations 2. Leibniz rule 3. Rodrique formula	**10%**

	related to electrics, magnet, modern physics and waves into mathematics models using relevant symbolic/ numeric languages, b. Students are able to use high level thinking process to form solutions of the simple physical models related to electrics, magnet, modern physics and waves.	related to physics concept using polynomial Legendre		Methods: Discussion Assignment: independent Time: 3 x 50 Minutes	Methods: Lecture and discussion Time: 3 x 50 Minutes	4. Generating functions for polynomial Legendre 5. Legendre series 6. Associated Legendre function 7. Frobenius method References: [1] Ch.12 [3] Ch.18	
11-12	a. Students are able to formulate problems of simple physical systems related to electrics, magnet, modern physics and waves into mathematics models using relevant symbolic/ numeric languages, b. Students are able to use high level thinking process to form solutions of the simple physical models related to electrics, magnet, modern physics and waves.	1. Students are able to solve differential equations related to physics concepts using polynomial Bessel, 2. Students are able to solve differential equations related to physics concepts using Hermite dan Laguerre	Criteria: Quantitative Format: test	Format: Assignment Methods: Discussion Assignment: independent Time: 3 x 50 Minutes	Format: Lecture Methods: Lecture and discussion Time: 3 x 50 Minutes	1. Bessel equations 2. Recursion relation 3. Differential equation with Bessel function solutions 4. Lengthening pendulum 5. Hermite function 6. Laguerre function 7. Ladder Operator References: [1] Ch.12 [3] Ch.18	**10%**
13-15	a. Students are able to formulate problems of simple physical systems related to electrics, magnet, modern physics and waves into mathematics models using relevant symbolic/numeric languages, b. Students are able to use high level thinking process to form solutions of the simple physical models related to electrics,	1. Students are able to explain types of partial differential equations, 2. Students are able to solve two dimensions (2D) Laplace equations, 3. Students are able to solve one dimension (1D) wave equations, 4. Students are able to solve temperature distribution steady-state in cylinder bar, 5. Students are able to explain Circle membrane vibrations (gendang),	Criteria: Quantitative Format: test	Format: Assignment Methods: Discussion Assignment: independent Time: 3 x 50 Minutes	Format: Lecture Methods: Lecture and discussion Time: 6 x 50 Minutes	Partial differential equations: 1. The type of partial differential equations 2. Two dimensions (2D) Laplace equations 3. One dimension (1D) Diffused equations 4. Temperature distribution *steady-state* in cylinder bar 5. Circle membrane vibrations (gendang) 6. Temperature distribution *steady-state* in solid ball	**10%**

	magnet, modern physics and waves, c. Students are able to use scientific attitude, critical thinking, and innovation skills to study problems of electrics, magnet, modern physics and waves learning in high school using mathematics supports	6. Students are able to solve temperature distribution steady-state in solid ball.				References: [1] Ch.13	
16	**Final Semester Evaluation / Final Semester Exam**						**30%**

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 study program** 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 format:** test and non-test.
8. **Aid Learning:** 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 weight** 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%.