# SEMESTER LEARNING ACTIVITY PLANS (SLAP)

## SEMESTER EVEN 2022/2023

Physics Undergraduate Study Program

Physics Department

Mathematical and Theoretical Physics II

MFF 3030/ 2 Credits

Lecturer Coordinator:

Dr.rer.nat. Muhammad Farchani Rosyid, M.Si.

**UNIVERSITAS GADJAH MADA**

**FACULTY OF MATHEMATICS AND NATURAL SCIENCE**

**2022**

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| | **Universitas Gadjah Mada**<br>Faculty of Mathematics and Natural Science<br>Physics Department / Physics Undergraduate Study Program<br>Semester EVEN 2022/2023 | **Document Number :**<br>…… |

**SEMESTER LEARNING ACTIVITY PLANS (SLAP)**

| Code | Course Name | Credits (Credits) | | Semester | Status | Prerequisite |
|---|---|---|---|---|---|---|
| *MFF 3030* | *Mathematical and Theoretical Physics II* | *T: 2* | *P: …* | *EVEN* | *Elective* | *None* |

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| **Short Description** | "There are two main topics in this lecture: topology and differential geometry. A detailed description of these topics is as follows: Topology: general topological concepts, open sets concepts, and their properties, closed sets concepts, natural topologies in precise lines, planes, and spaces, interior and closure concepts, density sets, continuous mapping, and homeomorphism. Differential Geometry: maps and atlases, diversity, differentiable mappings, differentiable functions and curves, tangent vectors, tangents, companion tangents, tensors, vector fields, tensor fields, Lie derivative, metric tensor and semi-Riemannian diversity, connections, geodesics, covariance derivative, curvature, and torque". | |
| **Program Learning Outcomes (PLO) Imposed on the Course** | ***PLO 2*** | Knowledge. Able to explain theoretical concepts and principles of classical and modern physics and able to apply basic concepts of physics and related mathematical methods in finding solutions to physical problems. |
| | ***PLO 3*** | General Skills. Able to communicate the results of problem studies and physical behavior both in writing and verbally, as well as being able to lead and collaborate at various levels of roles in a team. |
| | ***PLO 5*** | Long Life Learning. Able to analyze various alternative solutions to physical problems and conclude them for appropriate decision-making, both in familiar and new problems. |
| **Course Outcomes (CO)** | **After completing this course, students are expected to be able to:** | |
| | ***CO1*** | Mastering and applying the concepts and properties of general topology, the concept of open sets and their properties, the concept of closed sets, the natural topology on lines, planes, and real spaces |
| | ***CO2*** | Mastering and applying the concepts and properties of interior and closure, density sets, continuous mapping, and homeomorphism |
| | ***CO3*** | Mastering and applying the concepts and properties of maps and atlases, diversity, differentiable mapping, differentiable functions and curves, tangent vectors, tangent spaces, and companion tangents. |
| | ***CO4*** | Mastering and applying the concepts and properties of tensor, vector field, tensor field integral curve, and Lie derivative. |
| | ***CO5*** | Mastering and applying the concepts and properties of metric tensors and semi-Riemannan diversity, connections, geodesic, covariance derivatives, curvature, and torsion. |

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| **The Correlation of CO to Learning Materials and** | | **Learning Materials** | **Learning Methods** | **Time Allocation** |
| | ***CO 1*** | Examples are general topological concepts and properties, open and closed-set concepts and their properties. | TCL-SCL mixed | ***2X50 minutes*** |

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| **Methods, and Time Allocation** | ***CO 1*** | Natural topology on lines, planes, and real spaces. | TCL-SCL mixed | ***4X50 minutes*** |
| | ***CO 2*** | Mastering and applying the concepts and properties of interior and closing, density sets, continuous mapping, and homeomorphism examples. | TCL-SCL mixed | ***4X50 minutes*** |
| | ***CO 3*** | Mastering and applying the concepts and properties of maps and atlases, diversity, and examples. | TCL-SCL mixed | ***2X50 minutes*** |
| | ***CO 3*** | Mastering and applying differential mapping, differential functions and curves, tangent vectors, tangent spaces, companion tangent spaces, and examples. | TCL-SCL mixed | ***2X50 minutes*** |
| | **Midterm exam/Project Task Results/Case Analysis Results** | | | |
| | ***CO 4*** | Mastering and applying the concepts and properties of tensor, vector field, integral curve, Lie derivative, examples. | TCL-SCL mixed | ***3X50 minutes*** |
| | ***CO 4*** | Mastering and applying the concepts and properties of tensor fields, examples. | TCL-SCL mixed | ***4X50 minutes*** |
| | ***CO 5*** | Examples include mastering and applying the concepts and properties of semi-Riemananan metric and multiplicity tensors. | TCL-SCL mixed | ***3X50 minutes*** |
| | ***CO 5*** | Examples include mastering and applying the concepts and properties of the connection, geodesic, covariance derivative, curvature, and torsion. | TCL-SCL mixed | ***4X50 minutes*** |
| | **Final exams/ Project Task Results/Case Analysis Results** | | | |
| **Learning Methods** | **SCL (Student Centered Learning): Project-based learning (Team-based Project)/Case-based learning/PBL/other SCL methods** | | | |
| **Student Learning Experience** | **Students get an overview and simultaneously carry out axiomatic ways of thinking, making mathematical inferences, and their application in the formulation of physical theories.** | | | |
| **Access to Learning Media/ LMS and Offline and Online Percentage** | Offline (LCD, PPT Slide, Whiteboard, Laptop) and Online (Zoom Meeting, Google Meet, Google Classroom) | | | |

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| **Assessment Methods and** | **Assessment Methods** | **Assessment Percentage** | **Criteria/ Indicators** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |

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| **Synchronization with CO** | **Participatory Activity*** | | | | | | | |
| | **Project Results/ Case Study Results/ PBL Results*** | | | | | | | |
| | **Cognitive** | | | | | | | |
| | **Assignment** | **10** | | √ | | | | √ |
| | **Quiz** | **10** | | | √ | | √ | |
| | **Midterm Exam** | **40** | | √ | √ | √ | | |
| | **Final Exam** | **40** | | | | | √ | √ |
| | **Total** | **100** | | | | | | |
| | *) 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%. | | | | | | | |

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| **References** | **Main References;**<br>1. J M. Lee, 2011, Introcduction to Topological Manifolds, Springer, Berlin.. |
| **Lecturers (*Team Teaching*)** | 1. Dr.rer.nat. Muhammad Farchani Rosyid, M.Si. |

| **Authorization** | **Date of Drafting** | **Lecturer Coordinator** | **Head of Curriculum Committee** | **Head of Study Program** |
|---|---|---|---|---|
| | | *Dr.rer.nat. Muhammad Farchani Rosyid, M.Si.* | | *Dr. Eng. Ahmad Kusumaatmaja, S.Si., M.Sc.* |