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

Computation of Celestial Body Mechanics

MFF5032 / 2 Credits

Lecturer Coordinator:

Dr. Eng. Rinto Anugraha NQZ, S.Si., M.Si.

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
MFF5032	*Computation of Celestial Body Mechanics*	*2*	*Even*	*Elective*	*None*

Short Description

Computation of Celestial Body Mechanics course is Elective course 2 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:
Time and calendar. Earth and spherical coordinates, ecliptic coordinates, equator, and horizon. Sun position algorithm: low accuracy, Meeus and VSOP, application on prayer times and day duration. Moon position algorithm: Brown, Meeus, and ELP. Meeus algorithm for moon phases. Algorithm of lunar and solar eclipses: Meeus and VSOP.

The courses are held in class for 14 weeks, each week's session last for 2 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.

<table>
<tr><td rowspan="9">Course Outcomes (CO)</td><td colspan="4">Upon completion of this course, students should be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Understand Julian Time and Day, Gregorian Calendar and Hijri Calendar, Earth and Spherical Triangle.</td></tr>
<tr><td>CO2</td><td colspan="3">Understand Spherical Coordinate System, Coordinate System Transformation, Low Accuracy Algorithm of Sun Position.</td></tr>
<tr><td>CO3</td><td colspan="3">Understand the Sun Position with Jean Meeus Algorithm, Moon Position with Browne Algorithm, and Moon Position with Jean Meeus Algorithm.</td></tr>
<tr><td>CO4</td><td colspan="3">Understand the Moon Phases with Jean Meeus Algorithm, Moon Phase with Moon-Sun Position Algorithm, Calendar, and Moon Phases.</td></tr>
<tr><td>CO5</td><td colspan="3">Understand Lunar Eclipses and Solar Eclipses.</td></tr>
<tr><td>CO6</td><td colspan="3"></td></tr>
<tr><td>CO7</td><td colspan="3"></td></tr>
<tr><td>CO8</td><td colspan="3"></td></tr>
<tr><td rowspan="19">The Correlation of CO to Learning Materials and Methods, and Time Allocation</td><td></td><td>Learning Materials</td><td>Learning Methods</td><td>Time Allocation</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>CO1</td><td>Time and Julian Day</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO1</td><td>Gregorian Calendar and Hijri Calendar.</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO1</td><td>Earth and Spheric Triangle.</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO2</td><td>Spherical Coordinate System</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO2</td><td>Coordinate System Transform</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO2</td><td>Sun Position Low Accuracy Algorithm.</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO2</td><td>Sun Position Jean Meeus Algorithm.</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>CO3</td><td>Brown's Algorithm Moon Position.</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO3</td><td>Moon Position Jean Meuus Algorithm.</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO3</td><td>The Moon Phases of the Jean Meuus Algorithm.</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO4</td><td>Moon Phase Algorithm Moon-Sun Position.</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO4</td><td>Calendar and Moon Phases.</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO4</td><td>Lunar eclipse</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td>CO4</td><td>Solar eclipse</td><td>Lecture, discussion</td><td>2 x 50 minutes</td></tr>
<tr><td colspan="4">Final Exam/ Project Task Results/ Case Analysis Results</td></tr>
<tr><td colspan="4" style="display:none"></td></tr>
<tr><td>Learning Methods</td><td colspan="4">Lecture, discussion</td></tr>
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<tr><td>Student Learning Experience</td><td>Learn to analyze and review: Time and Julian Day, Gregorian Calendar and Hijri Calendar., Earth and Spheric Triangle., Spherical Coordinate System, Coordinate System Transform, Sun Position Low Accuracy Algorithm., Sun Position Jean Meeus Algorithm., Brown's Algorithm Moon Position., Moon Position Jean Meuus Algorithm., The Moon Phases of the Jean Meuus Algorithm., Moon Phase Algorithm Moon-Sun Position., Calendar and Moon Phases., Lunar eclipse, Solar eclipse.</td></tr>
<tr><td>Access to Learning Media/ LMS and Offline and Online Percentage</td><td>Sync (google meet), Asynchronous (google classroom, video)</td></tr>
<tr><td>Assessment Methods and Synchronization with CO</td><td>
<table>
<tr><th>Assessment Methods</th><th>Assessment Percentage</th><th>Criteria/Indicators</th><th>CO1</th><th>CO2</th><th>CO3</th><th>CO4</th></tr>
<tr><td>Participatory Activity*</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Project Results/ Case Study Results/ PBL Results*</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Cognitive</td></tr>
<tr><td>Assignment</td><td>30%</td><td></td><td>7,5%</td><td>7,5%</td><td>7,5%</td><td>7,5%</td></tr>
<tr><td>Quiz</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Midterm Exam</td><td>35%</td><td></td><td>17,5%</td><td>17,5%</td><td></td><td></td></tr>
<tr><td>Final Exam</td><td>35%</td><td></td><td></td><td></td><td>17,5%</td><td>17,5%</td></tr>
<tr><td colspan="7">*) 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%.</td></tr>
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</td></tr>
<tr><td>References</td><td>Main references:
1. Meeus, J., 1998, Astronomical Algorithm, 2nd edition, Willmann-Bell, USA.
2. Anugraha R., 2012, Celestial Mechanics, Department of Physics UGM.</td></tr>
<tr><td>Lecturers (Team Teaching)</td><td>1. Dr. Eng. Rinto Anugraha NQZ, S.Si., M.Si.
2.
3.
4.</td></tr>
<tr><td>Authorization</td><td>
<table>
<tr><th>Date of Drafting</th><th>Lecturer Coordinator</th><th>Head of Curriculum Committee</th><th>Head of Study Program</th></tr>
<tr><td></td><td>Dr. Eng. Rinto Anugraha NQZ, S.Si., M.Si.</td><td>Dr.Ing. Ari Setiawan</td><td>Mirza Satriawan, M.Si., Ph.D</td></tr>
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