Classical Mechanics

Module Name :	Clasical Mechanics	
Module Level :	Undergraduate	
Code :	32255014	
Sub-heading, if applicable :		
Classes, if applicable :		
Semester :	3rd	
Module coordinator :	Dr.rer.nat. Bambang Heru Iswanto, M.Si	
Lecturer(s) :	Dr.rer.nat. Bambang Heru Iswanto, M.Si Dr. Hadi Nasbey, S.Pd., M.Si Dewi Muliyati, S.Pd., M.Si, M.Sc Riser Fahdiran, M.Si. Dr.Firmanul Catur Wibowo, M.Pd. Upik Rahma Fitri, M.Pd.	
Language :	Indonesian	
Classification within the curriculum :	Compulsory course	
Type of Teaching	Contact hours per week during the semester	Class Size
Lecture (Expository, discussion, exercise)	200 minutes	40
Workload	Total workload of this course 181,3 hours (6 ECTS) per semester which consist of 53,4 hours (1.76ECTS) classroom activity, 64 hours (2,12 ECTS) structured task, and 64 hours (2,12 ECTS) per semester.	
Credit points :	6 ECTS	
Prerequisite course(s) :	-	
Course Outcomes :	After taking this course the student have ability to : CLO93. Describe the concepts of fundamental concepts of vectors and apply them to explain particle motion CLO94. Apply basic concepts of Newtonian mechanics to explain particle motion Newtonian mechanics to explain straight motion of particles CLO95. Analyze oscillatory motion and the energy that accompanies it CLO96. Analyze general motion in three CLO97. Analyze the motion of bodies by the in planetary orbital systems CLO98. Analyze the dynamics of particle systems CLO99. Identify the motion of bodies in non-inertial reference systems CLO100. Mechanics of Objects CLO101. Apply the concepts of fundamental concepts of Lagrangian mechanics to particle dynamics	
Content :	1. Vectors and Kinematics	

	• Vectors and their derivatives • Vector and scalar products • Particle position vectors • Velocity and acceleration in cartesian and polar coordinate systems • Velocity and acceleration in cylindrical and spherical coordinate systems 2. Newtonian Mechanics • Newtonian Mechanics and its scope • Newton's Laws of Motion • Straight motion by a constant force • Position-dependent force • Velocity-dependent force • Terminal velocity 3. Oscillatory Motion • Harmonic motion • Energy in harmonic motion • Damped oscillatory motion • Resonance • Mechanical analogy to the electric oscillator 4. General motion of particles • General principles of motion • Principle of effort • Conservative force • Split-type forces: bullet motion • Harmonic oscillator in three dimensions 5. Central Force • Gravitational force • Potential energy in a gravitational field • Conservation theorem • Equation of motion of particles in the central force • Planetary orbits in the central force • Kepler's laws of plane motion 6. Dynamics of Particle Systems • Linear momentum of systems • Angular momentum and kinetic energy of systems • Motion of two interacting bodies • Collisions 7. Non-Inertial Reference Systems • Motion of bodies in accelerated coordinate systems

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Particle dynamics in coordinate systems rotating coordinate system

8. Mechanics of Rigid Bodies

Center of mass of rigid bodies
Moment of inertia of a body
Angular momentum of a rigid body

9. Lagrangian Mechanics

Variational principle
Generalized coordinate system
Lagrange equation of motion and the law of conservation conservation
Application of Lagrange formalism to coupled motion problems
Constrained forces: the concept of Lagrange multipliersFree harmonic oscillation, damped oscillation, forced oscillation and coupled oscillation.

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<tr><td>Study/exam achievements:</td><td>Examination are conducted as unit test, as following
<table>
<tr><th>No</th><th>Assesment Object</th><th>Assesment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>Individual Assignment/Quiz</td><td>Written test</td><td>30%</td></tr>
<tr><td>2</td><td>Seminar</td><td>Presentation</td><td>35%</td></tr>
<tr><td>3</td><td>Final Test</td><td>Written test</td><td>35%</td></tr>
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<tr><td>Media :</td><td>Laptop/Computer, Epsilon (Study Program E-Learning), University LMS, Projector, Video Conference Software: Zoom Meeting, Software according to the topic simulation</td></tr>
<tr><td>Literatures :</td><td>

Fowles G.R. dan Cassiday, G.L. (2005) Analytical Mechanics, 2nd Ed., Thomson Brooks Cole. Sumber Lainnya
Kleppner dan Kolenkow (2014) An Introduction to Mechanics, 2nd Ed., Cambridge University Press.
Thornton, S.T., dan Marion, J. B. (2004): Classical Dynamics of Particles & Systems, 5th Edition, Thomson Brooks Cole

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