Module Description of Calculus of Variations

Module Name	:	Calculus of Variations
Module Level	:	Bachelor
Code, if applicable	:	23H01121803
Subtitle, if applicable	:	-
Courses, if applicable	:	Calculus of Variations
Semester(s) in which the module is taught	:	4 (Fourth Semester)
Module coordinator(s)	:	Prof. Dr. Eng. Mawardi, S.Si., M.Si.
Lecturer(s)	:	Dr. Firman, S.Si.,M.Si., Prof. Dr. Eng. Mawardi, S.Si., M.Si.
Language	:	Bahasa (Indonesian language)
Relation to curriculum	:	Elective course in second year for Bachelor degree in Mathematics and Set Theory
Type of teaching/teaching method	:	Lecturing, Small Group Discussion, Cooperative Learning, Self-Directed Learning
Contact hours	:	150 minutes lectures per week, 180 minutes structured activities per week, and 180 minutes independent study per week
Workload	:	Total workload is 135 hours per semester which consists of 40 hours per semester for Learning and Teaching, 47.5 hours per semester for Self-Study, and 47.5 hours per semester for Structured Works
Credit points	:	3 (4.8 ECTS)
Requirements according to the examination regulations	:	Students are required to attend at least 80% of the total meetings which is recorded via the attendance menu at https://sikola-v2.unhas.ac.id/, complete all mandatory assignments, and obtain permission from the lecturer to participate in the written examination.
Recommended prerequisites	:	Students have completed and taken the exams for Basic Mathematics I and Basic Mathematics II
Module objectives/intended learning outcomes	:	After the completion of this module, the student will be able to: CLO 1. Obtain extreme values in functional calculus; CLO 2. derive the Euler–Lagrange equation and determine its relationship with the extremal function in elementary calculus; CLO 3. determine the canonical form of the Euler equation and quadratic functions. The following is the mapping of the ILO and the CLO of this course:

	ILO 1	ILO 2	ILO 3
CLO 1	X		
CLO 2		X	
CLO 3			X

<table>
<tr><td>Content</td><td>:</td><td>Calculus of Variations is a course that introduces the study of functional and variational problems, including the first variation and the search for optimal paths. The topics also cover endpoint and derivative problems, functionals with higher-order derivatives, and the canonical form of Euler’s equation. In addition, the course explores quadratic functionals and other topics related to functionals with applications in mathematics and applied sciences.</td></tr>
<tr><td>Study and examination requirements</td><td>:</td><td>Study and examination requirements:
Students must attend 15 minutes before the class starts.
Students must switch off all electronic devices.
Students must inform the lecturer if they will not attend the class due to sickness, etc.
Students must submit all class assignments before the deadline.
Students must attend the exam to get final grade.</td></tr>
<tr><td>Exams and assessment formats</td><td>:</td><td>Participants are marked based on their performance in theory: Assignments (20%), Report (60%), Written test (20%).

Assignments assess student's ability to apply concepts independently, while Reports measure analytical and writing skills. The Written Exam assess comprehension and synthesis of all materials discussed during the semester. Altogether, these components account for 100% of the final grade.
Students are marked based on their percentage of points obtained and based on the following grade scale:
<table>
<tr><th>Percentage of Achievement</th><th>Grade</th><th>Conversion Value</th></tr>
<tr><td>85 – 100</td><td>A</td><td>4.00</td></tr>
<tr><td>80 - <85</td><td>A-</td><td>3.75</td></tr>
<tr><td>75 - < 80</td><td>B+</td><td>3.5</td></tr>
<tr><td>70 - < 75</td><td>B</td><td>3.0</td></tr>
<tr><td>65 - < 70</td><td>B-</td><td>2.75</td></tr>
<tr><td>60 - < 65</td><td>C+</td><td>2.5</td></tr>
<tr><td>50 - < 60</td><td>C</td><td>2.00</td></tr>
<tr><td>40 - < 50</td><td>D</td><td>1.00</td></tr>
<tr><td>< 40</td><td>E</td><td>0.00</td></tr>
</table></td></tr>
<tr><td>Reading list</td><td>:</td><td>I. M. Gelfand, S. V. Fomin, Calculus of Variations, Prentice-Hall, New Jersey, 1963.
Lewis, F.L. dan Symros, V.L. Optimal Control. Canada: John Wiley and Sons, Inc., 1995.
Chiang, A.C. Elements of Dynamics Optimization. USA: Waveland Press, Inc., 1992.</td></tr>
<tr><td>Last revision date</td><td>:</td><td>February 5th, 2025</td></tr>
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