



**UNIVERSITAS NEGERI PADANG**  
FACULTY OF MATHEMATICS AND NATURAL SCIENCES  
MATHEMATICS DEPARTMENT, MATHEMATICS STUDY PROGRAM  
Main Campus Universitas Negeri Padang.  
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**Bachelor of Science in Mathematics****MODULE HANDBOOK**

Module name:	Calculus of Variation
Module level, if applicable:	Bachelor
Code:	MAT2.62.8002
Subheading, if applicable:	-
Classes, if applicable:	Calculus of Variation
Semester:	8 <sup>th</sup> (eighth)
Module coordinator:	Head of Analysis Expertise Group
Lecturer(s):	Dr. Arnellis, M.Si. and Defri Ahmad, S.Si., M.Si.
Language:	Indonesian Language and English
Classification within the curriculum:	Compulsory course in the fourth year (8 <sup>th</sup> semester) Bachelor Degree
Teaching format / class hours per week during the semester:	<ol style="list-style-type: none"><li>Lectures : Cooperative learning with methods such as expository, drill, and discussion. (3 x 50 minutes = 150 minutes).</li><li>Structured assignment : Weekly individual written assignment. (3 x 60 minutes = 180 minutes).</li><li>Individual study (3 x 60 minutes = 180 minutes).</li></ol>
Workload:	The total workload is 136 hours per semester, which consists of 150 minute lectures, 180 minute structured activities, and 180 minutes of self-study. In total, there are 16 weeks per semester, including midterm and final exams.
Credit points:	3 sks = 4.53 ECTS
Prerequisites course(s):	Students have taken the course on Partial Differential Equations and have participated in the final exam.

Course Outcomes:	<p>After completing this course the students have ability to:</p> <p>CO1. Apply fixed boundary problems: Weak variations, Strong variations, Initial conditions,</p> <p>CO2. Analyze indefinite boundary points (Special forms of transversal conditions)</p> <p>CO3. Evaluate looking for minimizing curves (Weak variation type 1, weak variation type 2, weak variation type 3)</p> <p>CO4. Interpret the Isoperimetric</p> <p>CO5. Justify the sufficient requirements.</p> <p>CO6. Generalize the brachistochrone problem</p>
Content:	<ol style="list-style-type: none"> <li>1. Introduction to Variation Calculus,</li> <li>2. Fixed boundary problems: Weak variations, Strong variations,</li> <li>3. Initial conditions,</li> <li>4. Indefinite boundary points (Special forms of transversal conditions),</li> <li>5. Looking for minimizing curves (Weak variation type 1, Weak variation type 2, weak variation type 3),</li> <li>6. Isoperimetric, sufficient requirements,</li> <li>7. Brachistochrone problem.</li> </ol>
Study / Exam Achievement	<p>The final grade will be weighted as follows:</p> <p>The assessment consists of a final exam (45%), a midterm exam (30%), assignment (20%), and class activities (5%)</p> <p>The final and midterm exams are essay tests with a closed book (120 minutes).</p> <p>Weekly assignments (solving selected problems) are given in two forms; group or individual assignments.</p> <p>Class activities include discussion, exercise, and attendance.</p>
Forms of media:	<p>White Board, laptop, Projector, e-learning via <a href="http://elearning2.unp.ac.id">elearning2.unp.ac.id</a>, and zoom meeting.</p>
Literature:	<ol style="list-style-type: none"> <li>1. Pinch, E.R, (1995), Optimal Control and Calculus of Variations, First Edition, Oxford University Press, Oxford.</li> <li>2. Yan, F.Y.M, (1995), Introduction to the Calculus of Variation and its Application, First Edition, International Thomson Publishing Inc, New York.</li> </ol>

### PLO and CO Mapping

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CO1						√				
CO2										√
CO3										√
CO4						√				
CO5						√				
CO6						√				