Module Description/Course Syllabi

Study Programme: Bachelor of Mathematics
Faculty of Mathematics and Natural Sciences
Universitas Andalas

1. *Course number and name*

MAT61244 Nonlinear Programming

2. *Credits and contact hours/Number of ECTS credits allocated*

3 sks / 4,53 ECTS

3. *Instructors and course coordinator*

1. Dr. Noverina Alfiany; 2. Riri Lestari, M.Si

4. *Text book, title, author, and year*

1. S.Bazaara, dkk., Nonlinier Programming Theory and Algorithms Third Edition, (John Wiley & Sons, 2009).
2. D. G Luenberger, Linier and Nonlinier Programming Fourth Edition, (Springer, 2008).

5. *Recommended reading and other learning resources/tools*

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6. *Specific course information*

A. Brief description of the content of the course (catalog description)

In this course, the initial concept of nonlinear problems and simple examples are discussed. The basic concepts of convex sets as well as convex functions and concave functions are given at the beginning of the lecture. Likewise, gradient vectors and Hessian matrices are also introduced in this lecture. This material is introductory material for understanding nonlinear problems. In this course, optimal conditions are discussed for understanding and solving nonlinear problems in the form of necessary and sufficient conditions, both first order and

second order. The optimal conditions discussed are optimal conditions for nonlinear problems without constraints, with similarity constraints and with inequality constraints. This course also discusses numerical solutions for nonlinear problems, both without constraints and those with equality and inequality constraints. Convergence with the method used is also a concern. The methods discussed are Newton's Method, Steepest Descent Method, Conjugate Gradient Method, Penalty Method, Barrier Method, and Augmented Lagrangian Method. This course is implemented using the PjBL learning method which allows students to apply the material they have obtained in lectures to daily problems.
B. Prerequisites or co-requisites
MAT61122 Calculus 3 MAT61141 Linear Programming
C. Indicate whether a required or elective course in the program
Elective
D. Level of course unit (according to EQF: first cycle Bachelor, second cycle Master)
First Cycle Bachelor
E. Year of study when the course unit is delivered (if applicable)
4^{th} Year
F. Semester when the course unit is delivered
Odd Semester
G. Mode of delivery (face-to-face, distance learning)
Face to face

7. *Intended Learning Outcomes*
ILO-4: An ability to use concept and fundamental technique of mathematics in solving simple mathematical problems PI-1: An ability to illustrate simple mathematical problems based on appropriate basic mathematical concepts and techniques PI-2: An ability to illustrate simple mathematical problems based on appropriate basic mathematical concepts and techniques PI-3: An ability to solve simple mathematical problems using the proper concept and mathematical fundamental techniques
ILO-6: Have ability data literacy and technology and can apply them in solving simple mathematical problems or other relevant fields PI-1: Able to identify the right data and technology to solve simple mathematical problems or other fields PI-2: Able to use data and technology and apply them to solve simple mathematical statements or other areas PI-3: Able to process data using available technology in simple mathematical problems or other fields PI-4: Able to conclude and interpret data processing results for simple mathematical problems or other fields PI-5: Able to design an algorithm to solve simple mathematical problems or other fields
ILO-7: An ability to communicate effectively especially in the area of mathematics in with diverse communities PI-1: Able to convey ideas or study results orally, especially in the field of mathematics PI-2: Able to present ideas or study results in writing, especially in the field of mathematics PI-3: Able to respond to feedback given
ILO 8: An ability to work in team PI-1: Able to actively participate in a team with full responsibility PI-2: Able to respond well to any feedback within the team PI-3: Able to complete tasks according to the set schedule PI-4: Able to adapt in a team
8. *Course Learning Outcomes*
1. Students will have an understanding of the basic concepts of nonlinear problems.
2. Students will have an understanding of convex sets, convex and concave functions, gradient vectors, and Hessian matrices.

3. Students will have an understanding of optimal conditions for nonlinear problems without constraints or with constraints.
4. Students will have an understanding and skills in using methods in solving nonlinear problems without or with constraints.
5. Students will have the understanding to apply daily problems to the solution methods provided
9. ***Brief list of topics to be covered***
1. Introduction of nonlinear programming; 2. Concave and convex function; 3. Gradient vectors and Hessian matrices; 4. Newton's Method; 5. Steepest Descent Method; 6. Conjugate Gradient Method; 7. Penalty Method; 8. Barrier Method; 9. Augmented Lagrangian Method.
10. Learning and teaching methods
Project-Based Learning, Student Center Learning
11. Language of instruction
Bahasa

12. Assessment methods and criteria
Summative Assessment : 1. Mid-term exam: 20% 2. Final exam: 20% 3. Homework: 10% 4. Project: 50% **Formative Assessment**: