

SATUAN ACARA PERKULIAHAN
KOMPUTASI LUNAK UNTUK AGROINDUSTRI

Oleh :

Dr. Eng. Ir. Taufik Djatna, MSi

Prof. Dr. Ir. Marimin , MSc

Dr. Ir. Yandra Arkeman, M.Eng



PROGRAM STUDI PASCASARJANA
DEPARTEMEN TEKNOLOGI INDUSTRI PERTANIAN
FAKULTAS TEKNOLOGI PERTANIAN
INSTITUT PERTANIAN BOGOR
2016

Course Syllabus

Soft Computing for Agroindustry

Course title	Soft Computing for Agroindustry		
Course code: TIN61A	Credits: 3(2-2)	Semester: 2	Compulsory/optional: Compulsory
Coordinator's name	Dr. Eng. Ir. Taufik Djatna, M.Si	Instructor's name	Dr.Ir. Yandra Arkeman, M.Eng Prof.Dr.Ir. Marimin, MSc
Main reference (Title, author, year) (maximum 3 references)	<ol style="list-style-type: none"> 1. Azar AT, S.Vaidyanathan (eds.) 2015. Computational Intelligence Applications in Modeling and Control 2. Kacprzyk J, W Pedrycz (eds.) 2015. Springer Handbook of Computational Intelligence. Springer Dordrecht 3. Keller J, D Liu and DB Fogel. 2016. Fundamentals of Computational Intelligence. IEEE Press John Wiley & Sons. New York. 4. Yung C.S, C. Xu 2009. Intelligent Systems: Modeling, Optimization, and Control (Automation and Control Engineering). CRC Press Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742 © 2009 by Taylor & Francis Group, LLC 5. Wang F-Y, D Liu 2006. Advances in computational intelligence: theory & applications. World Scientific Publishing Co. Pte. Ltd. 		
Additional reference (Supplemental materials)	<ol style="list-style-type: none"> 1. Kacprzyk and Pedrycz. 2015. Handbook of Computational Intelligence. Berlin: Springer Verlag 2. Huang Xiaoxia. 2010. Portfolio Analysis Studies in Fuzziness and Soft Computing. Springer Verlag Berlin Heidelberg 3. Mandal Kumar Jyotsna, Mukhopadhyay, and Pal Tandra. 2016. Handbook of Research on Natural Computing for Optimization Problems. IGI Global 		
Brief description	<p>The objective of this course is to provide a thorough introduction to the field of soft computing techniques to modeling, optimization, and control. It highlights current topics and applications, addresses issues encountered in the development of applied systems, and describes a wide range of intelligent systems techniques, including neural networks, fuzzy logic, evolutionary strategy, and genetic algorithms. Recent progress in soft computing support adoption of nature inspired computing such as Particle Swarm Optimization and Artificial Immune System and Ant Colony are included with analysis and design concept. The course also demonstrates concepts through simulation examples and practical experimental results. Case studies are also presented from each field to facilitate understanding</p>		
Prerequisite	None		
Course outcome	<ol style="list-style-type: none"> 1. Able to analyze and synthesize a structural component of the problem as well as the formulation of soft computing and formulate appropriate solutions for the agroindustry operations 2. Able to implement the concepts and techniques of neural networks in operation agroindustry innovation 3. Able to adapt and analyze solutions to problems on swarm intelligence 		

	optimization solutions for the agroindustry 4. Able to analyze and draw up the solution of problems related to evolutionary algorithms and genetic solutions to the agroindustry 5. Able to analyze problems related to the structure of the fuzzy system solutions and variants on the operation agroindustry 6. Able to analyze and synthesize solutions to problems for the application of artificial immune system agroindustry in order to improve the operating performance of agroindustry				
Offered to	Study Program of Agroindustrial Technology-IPB and other study programs as elective course				
Topics to be covered	1. Definition, scope and problems in Agroindustry with Computing Software with one method GA 2. Applications GA in Minitab 3. The introduction, principles and techniques in a Neural Network 4. The introduction, principles and techniques in Swarm Optimization 5. The introduction, principles and techniques in AIS 6. The introduction, principles and techniques in Fuzzy System and the combination of GA-FS, FS-NN, and NN-GA. 7. The introduction, principles and techniques in Fuzzy Type 2 8. Definition, scope and problems in Agroindustry with Computing Software with one method GA				
Percentage	Knowledge	40 %	Facility/media	x	White board
	Skill	40 %		x	LCD projector
	Attitude	20 %		x	Computer
Activity, contact hours (hour/week)	Lecture	2 hours/week		x	Wifi
	Lab work	2 hours/week	x	Sound system	
	Tutorial	-		Courseware	
	Others	40 %		Other:	
Assessment	Assignment	50% (paper, critical review, practical report)			
	Examination	50% (midterm and final exams)			
	Quiz	-			

MAIN REFERENCE:

1. Azar AT, S Vaidyanathan (ed.). 2015. Computational Intelligence Applications in Modeling and Control. Springer
2. Kacprzyk J, W Pedrycz (eds). 2015. Springer Handbook of Computational Intelligence. Springer Dordrecht. Springer
3. Keller J, D Liu and DB Fogel. 2016. Fundamentals of Computational Intelligence. New York: IEEE Press John Wiley & Sons
4. Yung CS, C Xu. 2009. Intelligent Systems: Modeling, Optimization, and Control (Automation and Control Engineering). CRC Press Taylor & Francis

5. Wang FY, D Liu 2006. Advances in computational intelligence: theory & applications. World Scientific Publishing Co. Pte. Ltd

JADWAL DAN MATERI PERKULIAHAN

Week	Course Learning	Topic	Detail	Reference	Lecturer
1. 2.	Mampu melakukan analisis dan sintesis terhadap teknik Neural Network terhadap kasus masing-masing individu	Intelligent Neural Modeling	<ul style="list-style-type: none"> ✓ Introduction of soft computing techniques ✓ Neural Networks-1(Introduction & Architecture) ✓ Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions ✓ Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule ✓ Auto-associative and hetero-associative memory 	2,3,4	Taufik
3. 4.		Neural Networks-II (Back propagation networks)	<ul style="list-style-type: none"> ✓ Architecture: perceptron model, solution, single layer artificial neural network, multilayer ✓ Perception model; back propagation learning methods, effect of learning rule coefficient: back ✓ Propagation algorithm, factors affecting backpropagation training, applications---Neuro Fuzzy and Genetic Neuro Fuzzy Systems 	2,3,4	Taufik
5.	Mampu melakukan analisis dan sintesis terhadap teknik Fuzzy	Intelligent Fuzzy Modeling	<ul style="list-style-type: none"> ✓ Fuzzy Logic-I (Introduction) ✓ Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, 	3,4	Marimin

			Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.		
6. 7.	Mampu melakukan analisis dan sintesis terhadap teknik Fuzzy Type 2	Fuzzy Membership, Rules and Control	<ul style="list-style-type: none"> ✓ Fuzzy Logic –II Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfication & Defuzzification, Fuzzy Controller, Industrial applications: <ul style="list-style-type: none"> 1. Fuzzy logic systems; fuzzy sets, inferencing, fuzzy relation models, Tagaki-Sugeno models 2. Rule-based fuzzy control 3. Model-based fuzzy control 4. Stability analysis 5. Fuzzy control for SISO nonlinear systems 6. Fuzzy control application to practical problems 	3,4	Marimin
<i>Midterm Exam</i>					
8. 9.	Mampu melakukan analisis dan sintesis untuk menyelesaikan permasalahan dalam komputasi perangkat lunak dengan metode Genetic Algorithm (GA) dalam agroidustri	Optimization Model building Genetic Algorithm (GA)	Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations,(encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle	1,2,4	Yandra
10.	Mampu melaksanakan analisis, sintesis dan membuat aplikasi sederhana Genetic Algorithm (GA) dalam minitab	Applications GA modeling	<ul style="list-style-type: none"> ✓ Model-based forward optimization ✓ Application of model-based optimization to numerical 	1,3,4	Yandra

			<ul style="list-style-type: none"> examples ✓ Application of model-based optimization scheme to practical problems 		
11.	<ul style="list-style-type: none"> ✓ Mampu melakukan analisis dan sintesis terhadap teknik Swarm Optimization terhadap kasus masing-masing individu ✓ Mampu melakukan analisis dan sintesis terhadap teknik Artificial Immune System (AIS) terhadap kasus masing-masing individu 	Intelligent Natural Inspired Soft Computing	<ul style="list-style-type: none"> Concept and Theory of Particle Swarm Optimization (PSO), Artificial Immune System (AIS) and Ant Colony 	2,3	Taufik
12.	Mampu melakukan analisis dan sintesis terhadap teknik Fuzzy System dan kombinasi antara GA-FS, FS-NN, dan NN-GA	Intelligent Natural Inspired Soft Computing Recent Progress	<ul style="list-style-type: none"> ✓ Perception Computing with Type 2 Fuzzy Systems ✓ Intuitionistic Fuzzy Hedge Systems 	4	Taufik
13.	Mampu melakukan analisis dan sintesis terhadap teknik Fuzzy Type 2	Multivariate Systems and Applications	<ul style="list-style-type: none"> ✓ Intelligent control for MISO nonlinear systems ✓ Knowledge-based multivariable fuzzy control ✓ Model-based multivariate fuzzy control 	4	Taufik
14.	Final Term Exam and Report				Taufik
<i>Final Exam</i>					

JADWAL DAN MATERI RESPONSI

Week	Course Learning	Topic	Detail	Reference	Reference
1. 2.	Mampu melakukan analisis dan sintesis terhadap teknik Neural Network terhadap kasus masing-masing individu	Intelligent Neural Modeling	<ul style="list-style-type: none"> ✓ Introduction of soft computing techniques ✓ Neural Networks-1(Introduction & Architecture) ✓ Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions ✓ Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule ✓ Auto-associative and hetero-associative memory 	2,3,4	Taufik
3. 4.		Neural Networks-II (Back propagation networks)	<ul style="list-style-type: none"> ✓ Architecture: perceptron model, solution, single layer artificial neural network, multilayer ✓ Perception model; back propagation learning methods, effect of learning rule coefficient: back ✓ Propagation algorithm, factors affecting backpropagation training, applications---Neuro Fuzzy and Genetic Neuro Fuzzy Systems 	2,3,4	Taufik
5.	Mampu melakukan analisis dan sintesis terhadap teknik Fuzzy	Intelligent Fuzzy Modeling	<ul style="list-style-type: none"> ✓ Fuzzy Logic-I (Introduction) ✓ Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, 	3,4	Marimin

			Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.		
6. 7.	Mampu melakukan analisis dan sintesis terhadap teknik Fuzzy Type 2	Fuzzy Membership, Rules and Control	<ul style="list-style-type: none"> ✓ Fuzzy Logic –II Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfication & Defuzzification, Fuzzy Controller, Industrial applications: <ul style="list-style-type: none"> 7. Fuzzy logic systems; fuzzy sets, inferencing, fuzzy relation models, Tagaki-Sugeno models 8. Rule-based fuzzy control 9. Model-based fuzzy control 10. Stability analysis 11. Fuzzy control for SISO nonlinear systems 12. Fuzzy control application to practical problems 	3,4	Marimin
<i>Midterm Exam</i>					
8. 9.	Mampu melakukan analisis dan sintesis untuk menyelesaikan permasalahan dalam komputasi perangkat lunak dengan metode Genetic Algorithm (GA) dalam agroidustri	Optimization Model building Genetic Algorithm (GA)	Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations,(encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle	1,2,4	Yandra
10.	Mampu melaksanakan analisis, sintesis dan membuat aplikasi sederhana Genetic Algorithm (GA) dalam minitab	Applications GA modeling	<ul style="list-style-type: none"> ✓ Model-based forward optimization ✓ Application of model-based optimization to numerical 	1,3,4	Yandra

			<ul style="list-style-type: none"> examples ✓ Application of model-based optimization scheme to practical problems 		
11.	<ul style="list-style-type: none"> ✓ Mampu melakukan analisis dan sintesis terhadap teknik Swarm Optimization terhadap kasus masing-masing individu ✓ Mampu melakukan analisis dan sintesis terhadap teknik Artificial Immune System (AIS) terhadap kasus masing-masing individu 	Intelligent Natural Inspired Soft Computing	Concept and Theory of Particle Swarm Optimization (PSO), Artificial Immune System (AIS) and Ant Colony	2,3	Taufik
12.	Mampu melakukan analisis dan sintesis terhadap teknik Fuzzy System dan kombinasi antara GA-FS, FS-NN, dan NN-GA	Intelligent Natural Inspired Soft Computing Recent Progress	<ul style="list-style-type: none"> ✓ Perception Computing with Type 2 Fuzzy Systems ✓ Intuitionistic Fuzzy Hedge Systems 	4	Taufik
13.	Mampu melakukan analisis dan sintesis terhadap teknik Fuzzy Type 2	Multivariate Systems and Applications	<ul style="list-style-type: none"> ✓ Intelligent control for MISO nonlinear systems ✓ Knowledge-based multivariable fuzzy control ✓ Model-based multivariate fuzzy control 	4	Taufik
14.	Final Term Exam and Report				Taufik
<i>Final Exam</i>					