



Description of individual educational component (module)	
شبکه‌های عصبی مصنوعی <i>Artificial Neural Networks (ANN)</i>	
کارشناسی ارشد <i>Master</i>	
Organisation	Sari Agricultural Sciences and Natural Resources University (SANRU)
Faculty	Agricultural engineering
Department	Mechanics of Biosystems engineering
Responsible person	Assoc. Prof. Dr. –Ing. Davood Kalantari
Type of course unit	Elective Course
Level of course unit	Second cycle
Year of study (if applicable), semester/trimester when the individual educational component is delivered	3 <sup>rd</sup> semester
Number of ECTS credits allocated	3 Iranian Credits (Theoretical Credits: 3) (Equal to 6.9 ECTS)
Total hours	--
Contact hours	48
Self-study hours	Not specified
Mode of delivery	Face-to-face
Maximum attendance	20
Name of lecturer(s)	Dr. Ph.D Sajad Kiani
Prerequisites and co-requisites	Prerequisites: Linear Algebra (vectors, matrices, derivatives), Basic Probability Theory Co-requisite: Computer Programming Language (MATLAB)
Course contents	<ul style="list-style-type: none"> <li>• Basic neuron models: McCulloch-Pitts model and the generalized one, distance or similarity based neuron model, radial basis function model, etc.</li> <li>• Basic neural network models: multilayer perceptron, distance or similarity based neural networks, associative memory and self-organizing feature map, radial basis function based multilayer perceptron, neural network decision trees, etc.</li> <li>• Basic learning algorithms: the delta learning rule, the back propagation algorithm, self-organization learning, and etc.</li> <li>• Applications: pattern recognition, function approximation, information visualization, etc.</li> </ul>
Recommended or required reading and other learning resources/tools	<ul style="list-style-type: none"> <li>• M.B. Menhaj. Fundamentals of Artificial Neural Networks. 3rd ed. 2017 (in Persian).</li> <li>• M. Kia. Application of Artificial Neural Networks using Matlab. 2nd ed. 2017 (in Persian).</li> </ul>
Language of instruction	<ul style="list-style-type: none"> <li>• Persian/English</li> </ul>

Learning outcomes of the course unit
This course introduces the basic models, learning algorithms, and some applications of neural networks. After this course, we should be able to know how to use neural networks for solving different problems related to pattern recognition, function approximation, data visualization, and so on.



Planned learning activities and teaching methods
lectures, practical classes, group practical (practice sessions supervised by lecturer)
Assessment methods and criteria
The final grade is based on a three-point system. It may consist of the results of a final written assignment for the final exam (70%), Literature review (20%), and Report quality (10%) according the «Assessment criteria table».

Mapping Programme Key Learning Outcomes to Module Learning Outcomes	
Programme Key Learning Outcomes	Module Learning Outcomes
<p>LO1: describe the structure and function of the most common artificial neural network (ANN) types, e.g. multi-layer perceptron, recurrent network, self-organizing maps, and provide examples of their applications.</p> <p>LO2: explain mechanisms of supervised/unsupervised learning from data and information processing in different ANN architectures.</p> <p>LO3: quantitatively analyze the process and outcomes of learning in ANNs, and account for their shortcomings, limitations.</p> <p>LO4: apply, validate and evaluate suggested types of ANNs in typical small problems in the realm of regression, prediction, pattern recognition, scheduling and optimization.</p> <p>LO5: devise and implement ANN approaches to selected problems in pattern recognition, system identification or predictive analytics using commonly available development tools, and critically examine their applicability.</p>	<p><b>On successful completion of this module students should be able to:</b></p> <ol style="list-style-type: none"> <li>1. Implement common learning algorithms using an existing package.</li> <li>2. Apply neural networks to classification and recognition problems.</li> </ol>

Attribute	Assessment criteria table				
	Grade A (18-20 out of 20) (Excellent)	Grade B (16-18 out of 20) (Very good)	Grade C (14-16 out of 20) (Good)	Grade D/E (12-16 out of 20) (Satisfactory)	Grade F/FX (<12 out of 20) Failed / Insufficient
<b>Final Exam-written part (70%)</b>	The complete solution of the task without serious flaws is given. The correct answer is provided.	The roughly complete solution of the task is provided. The correct answer with some minor mistakes in interim steps is received.	The content of the solution is good. The answer with some weaknesses in interim steps is received.	The content of the task is satisfactory but with several weaknesses regarding evidence and/or some lack of clarity.	The task of the work fell short of that required to pass due to lack of evidence base/or very poor clarity.
<b>Literature review (20%)</b>	The literature library assembled by the student was outstanding with no serious missing articles.	The literature library assembled by the student was very good with only a few missing key articles.	The literature library assembled had a number of missing key articles and lacked breadth.	The literature library lacked breadth to a great degree and was missing many key articles.	The literature library was lacking in breadth and key articles to an extent that fell short of a passing grade.
<b>Report quality (10%)</b>	The style and clarity of the report was excellent.	The style and/or clarity of the report were very good.	The style and/or clarity of the report were good.	The style and/or clarity of the report were adequate.	The style and/or clarity of the report fell short of a passing grade.