**Table 5.1** Course specification to doctoral study programs

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| **Course name: Artificial neural networks and hydrological applications** |
| **Teacher or teachers:** [**Kisi S. Ozgur**](../P%209.3%20Knjiga%20Nastavnika%20DOS%20He/13.%20Ozgur%20S.%20Kisi%2C%20redovni%20profesor.xlsx)**, [Todorović T. Branimir](../P%209.3%20Knjiga%20Nastavnika%20DOS%20He/44.%20Branimir%20T.%20Todorovic%2C%20vanredni%20profesor.xlsx)** |
| **Course status:** Elective |
| **Number of ECTS:** 10 |
| **Precondition courses:** None |
| **Educational goal**The purpose of this course is to provide the student the theory and application of the artificial neural networks (ANNs) and to develop students’ ability to analyze hydrological problems based on the understanding of its basic concepts, such as the construction of neural networks, selection of appropriate ANN methods, structures and learning algorithms. |
| **Educational outcomes** The students acquire the abilities, know basic concepts of different neural network techniques, make up applications of multi-layer perceptrons, radial basis neural networks and generalized regression neural networks to solve related hydrological problems. |
| **Course content**Introduction to artificial neural networks (ANNs)Multi-layer perceptrons, training algorithmsRadial basis neural networksThe advantages and disadvantages of the ANNs methodsGeneralized regression neural networksHydrological applications of different ANNs methods |
| **Literature**1. Graupe, D. (2007). Principles Of Artificial Neural Networks, 2nd Edition, World Scientific Publishing Co. Pte. Ltd., Singapure, USA, UK.2. Krose, B., van der Smagt, P. (1996). An Introduction to Neural Networks, 8th edition, University of Armsterdam, Netherlands.3. Freeman, J.A., Skapura, D.M. (1991). Neural Networks Algorithms, Applications, and Programming Techniques, Addison-Wesley Publishing Company, Inc.4. MATLAB User’s Guide, Neural Network Toolbox, The MathWorks, Inc. |
| **Number of active teaching classes (weekly)** | Lectures: 4 | Study research work: 0 |
| **Teaching methods**Lectures. Consultations with students. Homework. Preparation and defense of a term paper related to solution of a hydrological problem |
| **Knowledge evaluation (maximum 100 points)****Pre-examination obligations Points Final exam Points**Lecture attendance **10**  Oral part of the exam **30**Term paper **40** Homework **20** |