1. *Course number and name*: CSCI 4520 Machine Learning

2. *Credits and contact hours*: 3 credit, 3 contact

3. *Instructor's or course coordinator's name*: Mehdi Allahyari, PhD

4. *Textbook, title, author and year*: Network Management: Introduction to Machine Learning with Python, *Andres Muller and Sara Guido*
   a. *Other supplemental materials:* None

5. *Specific course information*
   a. *Brief description of the content of the course (Catalog Description)*
   Developing advanced applications using diverse machine learning and computational intelligence algorithms for pattern recognition, classification and decision-making, including decision trees, neural networks, Bayesian learning, clustering, and kernel-based techniques. Multiple projects and a term project encompassing some or all of these concepts.
   b. *Prerequisites*: A minimum grade of "C" in CSCI 2490 or CSCI 3232 and MATH 2130
   c. *Indicate whether a required, elective, or selected elective course in the program*
   Elective course for BS-CS.

6. *Specific goals for the course*
   a. *Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.*

Course Learning Outcomes	Student Outcomes
understand basic issues in machine learning	1a, 1i, 2a
understand concept learning and decision tree learning	1a, 1b, 1i
understand and develop an application based on the backpropagation neural network algorithm	1a, 1b, 1i
understand and develop an application based on Bayesian learning	1a, 1b, 1i
understand and implement applications using clustering algorithms, such k-means and k-nearest neighbour.	1a, 1b, 1i
understand the concept of kernel based learning methods and apply it to support vector machines for supervised learning problems	1a, 1b, 1i

appreciate future trends in machine learning and computational intelligence	1f, 1g, 1h

b. Student Outcomes:

- 1a: An ability to apply knowledge of computing and mathematics appropriate to the discipline
- 1b: An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
- 1f: An ability to communicate effectively with a range of audiences
- 1g: An ability to analyze the local and global impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues
- 1h: Recognition of the need for, and an ability to engage in, continuing professional development
- 1i: An ability to use current techniques, skills, and tools necessary for computing practice
- 2a: An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices

1. *Brief list of topics to be covered*

- Classification algorithms, e.g. logistic regression, decision trees, random forest, etc.
- Regression techniques such as linear and polynomial regressions
- Unsupervised methods such as K-means clustering
- Dimensionality reduction
- Bayesian methods
- Neural networks