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.**

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