Instructor: Prof. Fakhri Karray, Office: E5 Office #5029, ext 35584, email: karray@uwaterloo.ca

Time: Winter 2014, Tuesdays and Thursdays (lectures), Wednesdays (tutorials)

Course Description:
The course introduces recent developments in computational intelligence based on soft computing techniques, which include knowledge based reasoning, fuzzy inferencing systems and connectionist modeling based on artificial neural networks. The course material is self-contained but could be used as a good complement for concepts introduced in ECE457A. The course focuses mainly on the use of soft computing approaches to deal with real world complex systems for which the mathematical models may be difficult to obtain because of structural complexities and/or mathematical intractability and inherent uncertain behaviour. The main thrust will be on designing computationally intelligent systems with human like capabilities in terms of reasoning, learning and adaptation to possibly changing environments. Tools of computational intelligence could be used in a wide range of engineering applications involving real world problems such as in: intelligent control systems, intelligent transportation systems, autonomous robotics/devices, smart mechatronics, speech understanding, pattern analysis, intelligent network design, face recognition, communication systems to name a few. It is neither a pre-req nor an anti-req of ECE457A. It actually complements it.

Prerequisite:
Linear algebra, advanced calculus, discrete mathematics, Boolean algebra or equivalent.

Course Textbook:
Other readings will be posted regularly on the course web site.

Material for the Course:
All updated info related to the course material will be posted on Learn

Major Topics:
1. Introduction to soft computing: overview on fuzzy logic systems, neural networks, genetic algorithms, probabilistic reasoning, approximation and intelligence
2. Fuzzy Logic systems: Notion of fuzzy set, generalized fuzzy operations, fuzzy relations
3. Composition and inferencing, fuzzy logic decision based systems
4. Fundamentals of connectionist modelling: learning and acquisition of knowledge, features of neurocomputing; supervised vs unsupervised, reinforcement learning
5. Major classes of Neural Networks: MultiLayer Perceptron, Radial Basis Functions based Networks, Self organizing Map, Hopfield Neural Networks, Auto associative memory
6. Engineering applications of tools of computational intelligence

Course Marking Scheme:
Assignments (20%): Four marked assignments
Design Project (25%): Report and Presentation. Due around the last two weeks of the term. Details will be posted
Final (55%): Assigned by Registrar office sometime during April, 2014