Course Title: Genetic Algorithms
Course Code: ETEG 428
Credit Hours: 3

Course Description:
The aim of the course is to make the students learn the fundamental concepts of GA and practical programming on GA in solving optimization problems in engineering.

Course Contents:

Unit 1: Introduction to Genetic Algorithms in Optimization and Search
Introduction to optimization and search methods, Genetic Algorithm, simple Genetic Algorithm, Robustness of Genetic Algorithm, comparison of Genetic Algorithm with traditional methods, The schemata, Schemata theorem, The building block hypothesis

Unit 2: Computer Implementation of Genetic Algorithms
Data structures of GA implementation, Reproduction, Crossover, and mutation, Reproduction and crossover strategies, Mapping of objective functions, Fitness scaling, Coding, Discretization, and constraints, Computer exercises

Unit 3: Applications of Genetic Algorithms
Genetic Algorithm applications of historical interest, Function optimization, Improvements in basic techniques, Current applications of Genetic Algorithms

Unit 4: Advanced Operators and Techniques
Dominance, Diploidy, and abeyance, Inversion and other reordering operators, Micro-operators, Niche and speciation, Multiobjective optimization, Knowledge based techniques

Unit 5: Introduction to Genetic Based Machine Learning
The classifier system, Rule and message system, Simple classifier system implementation using GA

Unit 6: Other Popular Optimization and Classification Techniques
Introduction to tabu search, Simulated annealing, and neural networks, Computer exercises.

References:
1. David E. Goldberg, *Genetic Algorithms in Search, Optimization & Machine Learning*, Addison-Wesley, 2000
2. Koza, J.R., *Genetic Programming: On the Programming of Computers by means of Natural Selection,* Cambridge, MA: MIT Press, 1992.
3. Fausett, L., *Fundamentals of Neural Networks: Architectures, Algorithms, and Applications,* Englewood Cliffs, NJ: Prentice Hall, 1994.
4. Colin R. Reeves, *Modern Heuristic Techniques for Combinatorial Problems,* John Wiley & Sons Inc, 1993.
5. A Hertz, E. Taillard, D. Werra, *A Tutorial on Tabu Search,* http://citeseer.nj.nec.com/

6. S. Kirkpatrick, C. D. Gelatt, M. P. Vecchi, *Optimization by Simulated Annealing*, Science, Volume 220, page 4598, 1983, http://citeseer.nj.nec.com/
7. S. Haykin, *Neural Networks A Comprehensive Foundation*, Pearson Education, 2002.

Evaluation:
In-Semester Evaluation: 50%
End-Semester Evaluation: 50%