In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : BITS F312
Course Title : Neural Networks and Fuzzy Logic
Instructor-in charge : Surekha Bhanot
Team of Instructors : Ashish Patel

1. Course Description: This course aims to introduce basic concepts, mathematics, application of AI techniques mainly neural networks, fuzzy logic, expert systems, evolutionary algorithms in modeling, control, classification, clustering, prediction problems.

2. Scope and Objectives

- Understand concept, techniques, applications, future of the field of “Artificial Intelligence”
- Understand the concepts, mathematics, techniques to implement fuzzy logic in various engineering applications
- Understand basic concepts, mathematic, different learning algorithms in ANNs
- Understand hardware and software of Expert Systems
- Understand Evolutionary algorithms for optimization like GA, PSO etc.

3. Prescribed Text/Reference Books

1. Introduction to Soft Computing, Samir Roy, Udit Chakraborty, Pearson
3. Fuzzy Logic with engineering application, Timothy J Ross
4. Intelligent Systems and Control Laxmidhar behera, Indrani Kar
5. Nature-inspired metaheuristic algorithms, Xin-She Yang, Luniver Press
7. A first course in Fuzzy and Neural Control, By Hung T Nguyen, N R Prasad, C L Walker, E A Walker Chapman & Hall/CRC Press Company
8. Fundamentals of Neural networks, architecture, algorithms and applications, Laurene Fausett, Pearson Education
### 5. Course Plan

<table>
<thead>
<tr>
<th>Module Number</th>
<th>Lecture session/Tutorial Session.</th>
<th>Reference</th>
<th>Learning Outcome</th>
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</thead>
<tbody>
<tr>
<td>1. Introduction to AI, intelligent systems, soft computing</td>
<td>L1.1. Machine learning, Intelligent Systems, soft computing, achievements, future directions</td>
<td></td>
<td>Get an overview of field of artificial intelligence and the techniques for implementing AI, future implications</td>
</tr>
<tr>
<td>2. Need, design, application of Expert systems</td>
<td>L2.1 Expert Systems : Structure, Search strategies, Applications</td>
<td>R2 : Ch16+class notes</td>
<td>Understand Need, Structure, search strategies used in expert systems</td>
</tr>
<tr>
<td>3. Fuzzy Logic,</td>
<td>L3.1 Fuzzy Set theory, fuzzy set operations, fuzzy relations,</td>
<td>R1: Ch2,3 &amp;4 R3: part of Ch1,2,3, 4,11,13+ Class notes</td>
<td>Understanding of mathematics behind Fuzzy Logic, sets, operations, relations. Classification using C means, Fuzzy C means</td>
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<tr>
<td></td>
<td></td>
<td>R6: Ch3&amp;4+Class Notes</td>
<td>Design of fuzzy logic control system and its implementation in Matlab</td>
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<td>L3.2 Fuzzy applications in classification, pattern recognition,</td>
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<td></td>
<td>L3.3 Fuzzy applications in control, Matlab implementation</td>
<td>R2: Ch18+ Class notes</td>
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</tbody>
</table>
| 4 Artificial neural networks, learning algorithms, ANN for modeling, control, function approximation, prediction | L4.1 model of artificial neuron, Architecture, Learning methods: Supervised, Unsupervised, Reinforcement, | R1: Ch6 & 10  
R2: Ch17 + Class notes | Get an understanding of different learning algorithms in ANNs, applications of ANNs for modeling, control, classification, prediction etc, Matlab implementation |
|---|---|---|---|
| | L4.2 Perceptron, Back propagation, Hebbian, Hopfield, dynamic, competitive, RBF networks, | R1: Ch6 & 10  
R2: Ch17  
R5: part of Ch2,3,4,7,11,14,15,16,17,21,23-27 + Class notes |  |
| | L4.3 ANN applications in function approximation, modeling, pattern recognition, prediction, modeling & control, Matlab implementation | R6: Ch5 &6  
R7: Ch1,2,3,45,6 + Class Notes |  |
| 5. Expert Systems and Hybrid techniques  
Evolutionary Algorithms | L5.1 Structure of Expert System, Search techniques, Examples | R2:Ch15, R9: ch 1,2, 7 +Class Notes |  |
| | L5.2. Neuro Fuzzy implementation | R1: Ch11,12 & 13 + Class notes |  |
| | L5.3 Genetic algorithm, Differential evolution, particle swarm, firefly and applications, Matlab implementation | R4:Ch5,6,8,10  
R6: Ch7 +Class Notes |  |
6. Evaluation Scheme:

<table>
<thead>
<tr>
<th>Evaluation Component</th>
<th>Weightage (Marks)</th>
<th>Date &amp; Time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-Sem.</td>
<td>75M</td>
<td>10/3 9:00 - 10:30 AM</td>
<td>Closed Book</td>
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<tr>
<td>Comprehensive</td>
<td>120M</td>
<td>12/5 FN</td>
<td>Closed Book+Open Book</td>
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<td>on-line tests</td>
<td>40</td>
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<td>As per the schedule to be announced</td>
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<tr>
<td>Project Assignment</td>
<td>50</td>
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<tr>
<td>Total</td>
<td>300 M</td>
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After completing this course the students will be able to

1) Understand the techniques used, application, impact of this new emerging area called “AI”, “soft computing”
2) Design of Expert Systems
3) Implement different learning algorithms used in Artificial neural networks to apply in applications such as modeling, control, prediction etc.
4) Understand mathematics behind fuzzy sets, implement fuzzy logic systems for decision making, control, classification etc.
5) Design Hybrid AI techniques and evolutionary optimization techniques.

**Closed Book Test:** No reference material of any kind will be permitted inside the exam hall.

**Open Book Exam:** Use of any printed / written reference material (books and notebooks) will be permitted inside the exam hall. Loose sheets of paper will not be permitted. Computers of any kind will not be allowed inside the exam hall. Use of calculators will be allowed in all exams. No exchange of any material will be allowed.

**Note:**

It shall be the responsibility of the individual student to be regular in maintaining the self study schedule as given in the course handout, attend lectures and assignment submission as per the schedule announced in Nalanda. Mid Semester Test and Comprehensive Examination are according to the Evaluation Scheme given in the respective Course Handout. If the student is unable to appear for the
Regular Test/Examination due to genuine exigencies, the student must refer to the procedure for applying for Make-up Test/Examination. No make up for the tutorials.

(Surekha Bhanot)
Instructor In charge
BITSF312