NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B.Tech. in Electrical Engineering**
Semester:	**VII**
Course Code:	**2EEDE61**
Course Title:	**Artificial Intelligence in Electrical Engineering**
Course Type:	(□ Core/ □ Value Added Course / √ **Department Elective**/ □ Institute Elective/ □ University Elective/ □ Open Elective/ □ Any other)
Year of Introduction:	**2021 – 22**

Credit Scheme

L	T	Practical component				C
		LPW	PW	W	S	
2	0	2	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to-

1. demonstrate understanding about ANN and fuzzy logic
2. select appropriate AI technique for applications related to electrical engineering
3. apply meta-heuristic technique for solving optimization problems
4. implement AI techniques for electrical engineering applications

Syllabus: **Total Teaching hours: 30**

Unit	Syllabus	Teaching hours
Unit-I	**Introduction** Overview and historical perspective, advantages and disadvantages of AI, need for human intervention, data analytics and present trends.	**03**
Unit-II	**Artificial Neural Network** Introduction to artificial neural networks, basic models and activation functions, learning in neural networks, single layer and multi-layer feed-forward and feedback neural networks, backpropagation algorithm, factors affecting the performance of artificial neural network.	**06**
Unit-III	**Fuzzy Logic** Introduction, fuzzy Sets, operations and properties of fuzzy sets, membership functions, fuzzy relations, fuzzy logic and rule based system, defuzzification methods, fuzzy logic modeling and controller design.	**06**
Unit-IV	**Meta-heuristic Techniques** Genetic Algorithm (GA) - Introduction, fitness function, reproduction, crossover, mutation, Particle Swarm Optimization (PSO) - Introduction, principle, velocity updating, parameter selection, binary version, recent techniques.	**06**
Unit-V	**AI Applications in Electrical Engineering** Forecasting, economic load dispatch, fault identification and classification, fault diagnosis, load frequency control, reactive power control, MPPT algorithms, motor drive applications, power quality	**09**

improvement devices, design optimization of electrical machines, condition monitoring etc.

Self-Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
This shall consist of at least 10 laboratory experiments / simulations based on the syllabus.

Suggested Readings/ References:

1. S. Rajasekaran and G.A.V. Pai, Neural Networks, Fuzzy logic, Genetic Algorithm: Synthesis and applications, PHI Publication.
2. N.P. Padhy, Artificial Intelligence and Intelligent System, Oxford University Press.
3. D K Chaturvedi, Soft Computing Techniques and its Applications in Electrical Engineering, Springer
4. S. Chakraverty, D.M. Sahoo, N. R. Mahato, Concepts of Soft Computing: Fuzzy and ANN with Programming, Springer
5. B Kosko. Neural Networks and Fuzzy Systems; Prentice-Hall
6. M.T. Hagan, H.B. Demuth, M.H Beale, Orlando De Jesús, Neural Network Design, Martin Hagan
7. Relevant recent literature, journal articles

Suggested List of Experiments:

1. To learn ANN implementation using software.
2. To learn fuzzy logic implementation using software.
3. To perform load forecasting using ANN.
4. To carry out load frequency control using fuzzy logic.
5. To execute fault identification and classification using ANN.
6. To carry out economic load dispatch using soft computing techniques.
7. To perform fuzzy logic based control of induction motor drive.
8. To perform soft computing technique based MPPT.
9. To optimize efficiency of induction motor using soft computing technique.
10. To analyse performance of ANN controlled power quality improvement devices.

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2021-22 and onwards