Subject Description Form

<table>
<tr><td>Subject Code</td><td>EE4014 / EE4014A / EE4014B</td></tr>
<tr><td>Subject Title</td><td>Intelligent Systems Applications in Electrical Engineering</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>4</td></tr>
<tr><td>Pre-requisite/
Co-requisite/
Exclusion</td><td>Nil</td></tr>
<tr><td>Objectives</td><td>To introduce students to the fundamentals of intelligent systems and their applications in Electrical Engineering.</td></tr>
<tr><td>Subject Intended Learning Outcomes</td><td>Upon completion of the subject, students will:
a. Have acquired a good understanding of the fundamental concepts, characteristics, methodologies and usefulness of intelligent systems.
b. Be able to understand and design various intelligent system techniques such as neural networks, supervised learning, unsupervised learning, and evolutionary computation.
c. Be able to integrate the intelligent system approaches in real-life problems.
d. Have acquired skills in presentation and interpretation of mini-project results and communicate in written form.</td></tr>
<tr><td>Subject Synopsis/
Indicative Syllabus</td><td>1. Artificial neural network: Concepts. Neuron and perceptron. Multi-layer neural network. Supervised learning. Forward and backward propagation. Training of neural networks. Recurrent and convolutional neural network.
2. Unsupervised learning: Concepts. K-means. Agglomerative nesting. Competitive learning and self-organizing map.
3. Evolutionary computation: Concepts. Genetic algorithm. Particle swarm optimization.
4. Applications of intelligent systems and introduction to AI tools
Mini-project:
Apply the introduced intelligent system techniques to solve an engineering problem.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on system analysis, design and practical applications are given through mini-projects, in which the students are expected to solve the engineering problems using AI techniques with critical and analytical thinking. Mini-projects are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information.
<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="4">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>Lectures</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Tutorials</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Mini-projects</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
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Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	✓	✓	✓	
2. Class Test	15%	✓	✓		
3. Mini-project	15%	✓	✓	✓	✓
4. Exercises	10%	✓	✓		
Total	100%				

The outcomes on concepts, design and applications are assessed by the usual means of examination, test and exercises. Mini-projects and written report assess those on analytical skills, problem-solving techniques and practical considerations of intelligent system applications, as well as technical reporting, teamwork and presentation skills.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	36 Hrs.
▪ Mini-project presentation	3 Hrs.
Other student study effort:	
▪ Mini-project preparation/report	26 Hrs.
▪ Self-study	50 Hrs.
Total student study effort	115 Hrs.

Reading List and References

Reference books:

1. Management Association, Information Resources, ed. Deep Learning and Neural Networks: Concepts, Methodologies, Tools, and Applications. Hershey, PA: IGI Global, 2020
2. E. Alpaydin, Machine Learning, The MIT Press, 2021
3. A. Ye, Modern Deep Learning Design and Application Development: Versatile Tools to Solve Deep Learning Problems, Apress, 2022
4. M. Negnevitsky, Artificial Intelligence - A Guide to Intelligent Systems, Addison-Wesley, 2011
5. K.Y. Lee and M.A. El-Sharkawi, Modern Heuristic Optimization Techniques: Theory and Applications to Power Systems, Wiley-IEEE Press, 2008
6. Articles from IEEE Transactions on Artificial Intelligence