COURSE OUTLINE

1. Title: **Soft Computing Lab**

2. Code: **CSE4238**

3. Credit hours: **0.75**

4. Level: **Level 4, Term 2**

5. Faculty: **Engineering**

6. Department: **Computer Science and Engineering (CSE)**

7. Programme: **Bachelor of Science in Computer Science and Engineering (B.Sc. in CSE)**

8. Synopsis from the Approved Curriculum:

Laboratory works based on CSE4237.

Aims and constituents of soft computing. Fuzzy sets and logic: Concepts and properties of fuzzy sets; Mathematical & logical implications of fuzzy sets; Fuzzy relations; Applications of fuzzy sets in information processing, decision making and control systems. Artificial neural networks: Underlying ideas and concepts of artificial neural networks; Feed-Forward, Recurrent and other types of artificial neural networks; Rules and methodologies of training artificial neural networks; Error backpropagation, recurrent backpropagation and other learning algorithms for neural networks. Probabilistic reasoning: Bayesian inference models and Bayesian networks; Dempster – Shafer theory; Probabilistic decision support systems. Genetic algorithms: Underlying principles and fundamental operators of genetic algorithms; Searching based on genetic algorithms; Genetic algorithm based optimization, learning and control. Introduction to various neuro-fuzzy-probabilistic-genetic combined approaches to computing applications.

9. Type of course (core/elective): **Elective**

10. Prerequisite(s) (if any): **Nil**

11. Name of the instructor(s) with contact details and office hours:

H M Zabir Haque
Room: 7A01/K
Phone: NA
E-mail: zabir.haque.cse@aust.edu
Office hour:

Nibir Chandra Mandal
Room: 7A01/K
Phone: NA
E-mail: nibir.cse@aust.edu
Office hour: TUE 10:30 AM – 11:15 PM, SUN 1:00 PM - 1:45PM

12. Semester Offered: Spring 2021

13. Mapping of Course Outcomes with Bloom's Taxonomy and Programme Outcomes

Sl. No.	COs	POs	Bloom's Taxonomy		
			C	A	P
1	**Prepare fundamental concepts used in Soft computing. The concepts of Fuzzy logic (FL), major technology trends driving Deep Learning and optimization techniques using Genetic Algorithm (GA).**	**2**			**2**
2	**Develop fully connected deep neural networks: key parameters in a neural network's architecture**	**3**			**2, 3**
3	**Implement a variety of optimization algorithms, such as mini-batch gradient descent, Momentum, RMSprop and Adam, and check for their convergence. Be able to implement a neural network in PyTorch.**	**5**			**3**

4	Adaptation of Recurrent Neural Networks (RNNs), and commonly-used variants such as GRUs and LSTMs to sequence modeling problems.	4			4

14. Percentages of Assessment Methods

Method	Percentage
Attendance and Class Performance	20
Online & Assignments	20-30

Final Quiz	15-25
Final Project Presentation and Report	20-30

15. Week wise distribution of contents and assessment methods

Week	Topics	Assessment Method(s)
1	*Python Basics with Numpy.* *Introduction to ML Tools- PyTorch, Tensorflow.* *Basic Knowledge about Google Colab and Kaggle.*	
2	*Online assessment on Python Basics.* *Introduction to Fully Connected Layer.* *Implementation of Fully Connected Layer.*	Online
3	*Introduction to CNN.* *Implementation of CNN.* *Assignment declaration on CNN and Fully Connected Layer.*	
4	*Evaluation of Assignment #1* *Introduction to RNN, GRU, and LSTM.* *Implementation of RNN, GRU, and LSTM.* *Assignment Declaration #2.*	Assignment #1
5	*Evaluation of Assignment #2.* *Introduction to Natural Language Processing.* *Implementation of Skip-Gram, Word2Vec, etc.*	Assignment #2

	Final Project Selection.	
6	*Project updates.* *Evaluation of Lab Performances.*	**Lab Final Quiz**
7	**Final Project Presentation & Report.**	**Group Presentation & Report**

16. References

16.1. Required (if any)

1. *Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence (1st Edition)*
   Authored by: *Jyh-Shing Roger Jang, Chuen-Tsai Sun and Eiji Mizutani*
   Publisher: *Pearson*
2. *Dive into Deep Learning*
   Authored by: *Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola*

3. *Fuzzy Logic with Engineering Applications, Third Edition*

   Authored by: *Timothy J. Ross*
   Publisher: *Wiley*

16.2. Recommended (if any)

Prepared by:	Checked by:	Approved by:
Signature: _____ Name: **Nibir Chandra Mandal** Department: **CSE** Date:	Signature: _____ Name: **Dr. Mohammad Shafiul Alam** **OBE Program Coordinator, CSE** Date:	Signature: _____ Name: **Dr. Mohammad Shafiul Alam** HOD, **CSE** Date:

Annex-1: PEO of CSE

PEO1 - Professionalism

Graduates will demonstrate sound professionalism in computer science and engineering or related fields.

PEO2 – Continuous Personal Development
Graduates will engage in life-long learning in multi-disciplinary fields for industrial and academic careers.

PEO3 – Sustainable Development
Graduates will promote sustainable development at local and international levels.

Annex-2: Mapping of PEO-PO

	PEO1	PEO2	PEO3
PO1 - Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	√		
PO2 - Problem analysis: Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.	√		
PO3 - Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.	√		
PO4 – Investigation: Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.	√		
PO5 - Modern tool usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	√		
PO6 - The engineer and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.	√		√
PO7 - Environment and sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.	√		√

PO8 – Ethics: Apply ethical principles and commit to professional ethics, responsibilities and the norms of engineering practice.	√		

PO9 - Individual work and teamwork: Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.	√	√	
PO10 – Communication: Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.	√		
PO11 - Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.	√		
PO12 - Life-long learning: Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.		√	

Annex-3: Blooms Taxonomy – Revised Version*

Level	Cognitive Domain (C)	Affective Domain (A)	Psychomotor Domain (P)
1	Remember	Receive	Imitate
2	Comprehend	Respond	Execute
3	Apply	Value	Perform
4	Analyze	Conceptualize Values	Adaption
5	Evaluate	Intermalize Values	Neturalize
6	Create		

* References: Dyjur, P. (2018). Writing Course Outcomes