INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

COMPUTER SCEINCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**SOFT COMPUTING**				
Course Code	BCS208				
Programme	M.Tech				
Semester	II	CSE			
Course Type	Open Elective-I				
Regulation	IARE – R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	2	2
Chief Coordinator	Ms. K. Saisaranya, Assistant Professor, CSE.				
Course Faculty	Ms. K. Saisaranya, Assistant Professor, CSE.				

I. COURSE OVERVIEW:

Soft Computing, or better known by the individual constituents of Neural Networks, Evolutionary Algorithms and Fuzzy Logic, is arguably every student/research project's success and cheat sheet. And the increasing pressures on producing novel systems, often confused with more complicated systems, brings in plenty of ways of combine these techniques in any manner naturally or forcefully. Immense problem solving capabilities, technology behind every tough looking application title, lots of possibilities to create minor/major variants to quote novelty and lots of areas to research. Find out more about the technology and use it for your problem of choice.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
PG	BCS208	II	Artificial Intelligence, Fuzzy Systems

III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Soft Computing	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✔	MOOCs
✔	LCD / PPT	✔	Seminars	✔	Mini Project	✘	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each module carries equal weight age in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	**Theory**			**Total Marks**
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination:
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT):

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.
The AAT chosen for this course is given in section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems **(Engineering Knowledge)**.	3	Assignment, Tutorials
PO2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences (**Problem Analysis**).	2	Assignments
PO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/Development of Solutions).**	3	Project
PO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions **(Conduct Investigations of Complex Problems).**	2	Project
PO5	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 **(Modern Tool Usage).**	3	Project
PO12	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change **(Life-long learning)**.	2	Project

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithme,system software, multimedia ,web design, big data analytics, and networking for efficient analysis and design of computer based systems for varying complexity	3	Lectures,Assignments
PSO 2	**Problem-Solving Skills:**The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success	2	Projects

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies.	2	Guest lectures

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Familiarize with soft computing concepts.
II	Understand supervised learning and unsupervised learning networks.
III	Introduce the ideas of neural networks, fuzzy logic.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
BCS208.1	CLO 1	**Understand** literature of neural networks.	PO 1	3
BCS208.2	CLO 2	**Understand and develop** learning techniques	PO 1 ;PO 3	2
BCS208.3	CLO 3	**Retrieve** linearequations and **Understand** back propagation	PO 1;PO 2	2
BCS208.4	CLO 4	**Understand** associative memory types.	PO 2;PO 3	2
BCS208.5	CLO 5	**Understand** the concept of regression analysis to find the hidden relations in data.	PO 1;PO 3	2
BCS208.6	CLO 6	**Understand** the concepts of unsupervised learning	PO 1;PO 4	2
BCS208.7	CLO 7	**Understand** the concepts of fuzzy sets and relations	PO 1;PO 4	3
BCS208.8	CLO 8	**Identify** iterative and non-iterative fuzzy sets.	PO 2	3
BCS208.9	CLO 9	**Understand** methods of defuzzification.	PO 1;PO 2	2
BCS208.10	CLO 10	**Develop** truth tables of fuzzy logic.	PO 4	3
BCS208.11	CLO11	**Understand** formation rules and aggregation rules	PO 4	1
BCS208.12	CLO12	**Develop** fuzzyinterface system and fuzzy expert system	PO 3	3
BCS208.13	CLO13	**Understand** genetic algorithms, constraints and classifications.	PO1;PO 5	2
BCS208.14	CLO14	**Understand** the fusion approach.	PO 3;PO 12	2

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3												3		
CLO 2	3		2										2		
CLO 3	2	3													
CLO 4		2	3											2	
CLO 5	3		2										2		
CLO 6	3			2										1	
CLO 7	3			2									3		
CLO 8		3													
CLO 9	3	2												1	
CLO 10				3											
CLO 11				2										1	
CLO 12			3												
CLO 13	2				3								3		
CLO 14			3									2			2

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES-DIRECT

CIE Exams	PO3	SEE Exams	PO 2	Assignments	PO 3	Seminars	PO 1,PO 2
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	-						

XII. ASSESSMENT METHODOLOGIES-INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✔	Assessment of Mini Projects by Experts		

XIII. SYLLABUS:

UNIT-I	**INTRODUCTION TO NEURAL NETWORKS**
Introduction: Fundamental concept, evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron, linear separability, Hebb network; Supervised learning network: Perception networks, adaptive linear neuron, multiple adaptive linear neurons, back propagation network, radial basis function network.	
UNIT-II	**ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS**
Associative memory networks: Training algorithms for pattern association, auto associative memory network, hetero associative memory network, bidirectional associative memory, Hopfield networks, iterative auto associative memory network, temporal associative memory network; Unsupervised learning networks: Kohonenself-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.	
UNIT-III	**FUZZY LOGIC**
Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets.Membership functions: Fuzzification, methods of membership value assignments, defuzzification, Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.	
UNIT-IV	**FUZZY ARITHMETIC**
Fuzzy arithmetic and fuzzy measures: Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic, fuzzy propositions, formation of rules, decomposition and aggregation of rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making, fuzzy logic control systems, fuzzy expert systems.	
UNIT-V	**GENETIC ALGORITHMS**
Genetic algorithm and search space, general genetic algorithm, operators, generational cycle, stopping condition, constraints, classification, genetic programming, multilevel optimization; Applications: A fusion approach of multispectral images with SAR image for flood area analysis, optimization of travelling salesman problem using genetic algorithm approach, and genetic algorithm based internet search technique, soft computing based hybrid fuzzy controllers.	
Text Books:	
1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro, "Fuzzy and Soft Computing", PHI, Pearson Education, 1stEdition, 2004. 2. S. N. Sivanandan, S. N. Deepa, "Principles of Soft Computing", Wiley India, 2nd Edition,	

2007.
Reference Books:
1. S. Rajasekaran, G. A. V. Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 1st Edition, 2003. 2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 3rd Edition, 1997. 3. Stamatios V. Kartalopoulos "Understanding Neural Networks and Fuzzy Logic Basic Concepts and Applications", IEEE Press, PHI, New Delhi, 2004.

XIV. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topic's to be covered	Course Learning Outcomes (CLOs)	Reference
1-3	Introduction: Fundamental concept, evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron.	CLO 1	T2:1.1-1.2
4-6	Linear separability, Hebb network; Supervised learning network: Perception networks, adaptive linear neuron.	CLO 2	T1:2
7-9	Multiple adaptive linear neurons, back propagation network, radial basis function network.	CLO 3	T2:2.1-2.2
10-12	Associative memory networks: Training algorithms for pattern association, auto associative memory network, hetero associative memory network	CLO 4	T1:4
13-16	bidirectional associative memory, Hopfield networks, iterative auto associative memory network, temporal associative memory network;	CLO 5	T1:4
17-19	Unsupervised learning networks: Kohonen self organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.	CLO 6	T1: 6
20-22	Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy Relations	CLO 7	T1: 5
23-25	Tolerance and equivalence relations, non-iterative fuzzy sets. Membership functions: Fuzzification	CLO 8	T1:7
26-28	Methods of membership value assignments, defuzzification, Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.	CLO 9	T1:10
29-31	Fuzzy arithmetic and fuzzy measures: Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic,	CLO 10	T1:8
32-34	fuzzy propositions, formation of rules,decomposition and aggregation of rules, fuzzy reasoning	CLO 11	T1:13
35-37	fuzzy inference systems, fuzzy decision making, fuzzy logic control systems, fuzzy expert systems.	CLO 12	T1:9 T1:14 T1: 17

38-40	Genetic algorithm and search space, general genetic algorithm, operators, generational cycle, stopping condition, constraints, classification	CLO 13	T1:17
41-45	genetic programming, multilevel optimization; Applications: A fusion approach of multispectral images with SAR image for flood area analysis, optimization of travelling salesman problem using genetic algorithm approach, and genetic algorithm based internet search technique, soft computing based hybrid fuzzy controllers.	CLO 14	T1:16

Prepared by:

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