15MH304	Data Structures and Soft Computing			L	T	P	C
				3	0	0	3
Co-requisite:	Nil						
Prerequisite:	Nil						
Data Book / Codes/Standards	Nil						
Course Category	P	Professional Core	Electronics Engineering				
Course designed by	Department of Mechatronics Engineering						
Approval	32nd Academic Council Meeting held on 23.07.2016.						

Purpose	To impart the knowledge of systems which are computationally intelligent and possess human-like expertise in a particular domain.							
Instructional Objectives		**Student Outcomes**						
At the end of the course, student will be able to								
1.	Recognize the feasibility of applying a soft computing methodology for a particular problem.	a		k				
2.	Solve engineering problems by applying fuzzy logic.	a	e	k				
3.	Apply genetic algorithms to combinatorial optimization problems.	a	e	k				
4.	Apply neural networks to pattern classification and regression problems.	a	e	k				
5.	Effectively use existing software tools to solve real problems using a soft computing approach.	a	e	k				

Session	Description of Topics	Contact hours	C-D-I-O	IOs	Reference
	Unit I: Data Structures	**10**			
1.	Introduction to data structures: Arrays and strings, linear data structure operation: Stack, queue.	2	C	1	1
2.	Linked list: Creation, insertion, deletion, circular list and doubly linked list.	2	C	1	1
3.	Insertion sort algorithm.	1	C	1	1
4.	Merge sort algorithm.	1	C	1	1
5.	Quick sort algorithm.	1	C	1	1
6.	Hashing technique.	1	C	1	1
7.	Binary tree representation, operation and traversal.	1	C	1	1
8.	Shortest path algorithm.	1	C	1	1
	Unit II: Search Techniques	**6**			
9.	Introduction to agent and state space search.	1	C	1	4
10.	Breadth-first search, depth-first search, uniform cost search, bidirectional search.	2	C	1	4
11.	Depth limited search, depth first iterative deepening search.	1	C	1	4
12.	Best-first Search, Greedy search, A* search.	2	C	1	4
	Unit III: Neural Networks	**7**			
13.	Activation functions, neural network architecture: Single layer feed forward network, multi layer feed forward network.	2	C	4	2,7
14.	Supervised and unsupervised learning, least mean square algorithm, Hebbian learning.	2	C	4	2,7
15.	Back propagation algorithm.	1	C	4	2,7
16.	Software tool for neural networks.	1	C	5	2,7
17.	Tutorial on software tool for neural networks.	1	C	5	2,7
	Unit IV: Fuzzy Logic and Genetic Algorithm	**11**			
18.	Basic concepts of fuzzy logic, fuzzy sets and crisp sets.	2	C	2	2,6
19.	Fuzzy set theory and operations, properties of fuzzy sets.	2	C	2	2,6
20.	Fuzzy and crisp relations and rules.	1	C	2	2,6
21.	Software tool for fuzzy.	1	C	2,5	2,6
22.	Tutorial on software tool for fuzzy.	1	C	2,5	2,6
23.	Basic concepts of genetic algorithms, operators of genetic algorithms.	2	C	3	2,5
24.	Genetic encoding.	1	C	3	2,5
25.	Genetic modeling.	1	C	3	2,5
	Unit V: Knowledge Representation and Expert System	**7**			
26.	Knowledge and its general concepts.	1	C	1	3

Session	Description of Topics	Contact hours	C-D-I-O	IOs	Reference
27.	Propositional logic truth valuation, resolution for propositional logic.	2	C	1	3
28.	Predicate logic truth valuation and resolution.	2	C	1	3
29.	Phases in building expert system, expert system architecture.	2	C	1	4
	Assessment	**4**			
30.	Cycle test-I	1			
31.	Cycle test-II	2			
32.	Surprise test / Assignment and Quiz	1			
	Total contact hours	**45**			

Learning Resources	
Sl. No.	**Text Books**
1.	Mark Allen Weiss, "*Data Structures and Algorithm Analysis in C*", 2nd edition, Pearson Education, 1997.
2.	S. Rajasekaran and G. A. Vijayalakshmi Pai, "*Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications*", Prentice Hall of India, 2003.
3.	G.Metakides, A.Nerode , "*Principles of Logic Programming*", Elsevier Science B.V.,1996.
4.	Dan W. Patterson, "*Introduction to Artificial Intelligence and Expert Systems*", Prentice Hall of India, 1992.
	Reference Books/Other Reading Materials
5.	Melaine Mitchell,"*An Introduction to Genetic Algorithms*", MIT Press, 1998.
6.	George J.Klir and BoYuan, "*Fuzzy Sets and Fuzzy Logic: Theory and Applications*", Prentice Hall of India, 1995.
7.	Simon Haykins, "*Neural Networks–A Comprehensive Foundation*", MacMillan College, Proc Con Inc New York, 1994.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination weightage:							**50%**