NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF COMPUTER APPLICATIONS

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Sc. Computer Science**		
Course Title	**Computational Intelligence**		
Course Code	**CAS7A2**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	-		
Session	**January 2019**	**Section (if, applicable)**	**A**
Name of Faculty	**Dr. R. Eswari**	**Department**	**Computer Applications**
Official Email	eswari@nitt.edu	**Telephone No.**	**0431-2503744**
Name of Course Coordinator(s) (if, applicable)	**Dr. Michael Arock**		
Official E-mail	michael@nitt.edu	**Telephone No.**	**0431-2503736**
Course Type (please tick appropriately)	☐ **Core course**	☑ **Elective course**	

Syllabus (approved in BoS)

Introduction to Computational Intelligence - Intelligence machines - Computational Intelligence paradigms – Fuzzy logic - Fuzzy relationships - Fuzzy Sets - Operations on Fuzzy sets - Fuzzy rules - Fuzzy inference systems - Fuzzy expert systems - Applications of Fuzzy Set Theory to different branches of Science and Engineering

Neural Network - Biological foundation of Neural Network - Neural Model - Network Architectures - Perceptron Learning - Supervised and unsupervised learning neural networks - Hebbian Learning - Back-propagation - Associative Learning - Competitive Networks - Hopfield Network - Deep neural networks and learning algorithms - Applications - Case studies

Neuro Fuzzy Systems - Adaptive Neuro - Fuzzy Inference Systems - Architecture - Hybrid Learning Algorithm - Learning Methods that Cross-fertilize ANFIS and RBFN - Coactive Neuro Fuzzy Modelling - Framework Neuron Functions for Adaptive Networks - Neuro Fuzzy Spectrum

Evolutionary computation – Chromosomes - Fitness functions - Selection mechanisms - Genetic algorithms - Crossover - mutation – Convergence – Applications - Genetic programming - Evolution strategies - Evolutionary neural network - Case studies

Swarm Intelligence - Foundations - Examples – Metaheuristics - ACO method - Ant System – Birds – PSO – Firefly Algorithm - Applications - Case Studies

References:

1. Eberhart and Shi, "Computational Intelligence - Concepts to Implementations" Morgan Kaufmann, 2007
2. S. Haykin, "Neural Networks – A Comprehensive Foundation", Prentice Hall, 1999
3. N. Sivanandam, S. N. Deepa," Principals of soft Computing", Wiley India, 2nd ed., 2011.
4. A.P. Engelbrecht, "Computational Intelligence: An Introduction", 2nd Edition, John Wiley & Sons, 2012.
5. H.K. Lam, S.S.H. Ling, and H.T. Nguyen, "Computational Intelligence and Its Applications: Evolutionary Computation, Fuzzy Logic, Neural Network and Support Vector Machine", Imperial College Press, 2011.
6. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004
7. J. Freeman and D. Skapura, "Neural Networks: Algorithms, Applications, and Programming Techniques", Addison-Wesley, 1991
8. G. J. Klir, and B. Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Prentice-Hall, 1995
9. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003

COURSE OBJECTIVES

- To introduce the fundamentals of key intelligent systems technologies including neural networks, fuzzy systems, evolutionary computation and swarm intelligence
- To explain the integration of intelligent systems technologies

MAPPING OF COs with POs

Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
1. Implement typical computational intelligence algorithms	**1, 5**
2. Apply intelligent systems technologies in a variety of engineering applications	**1,2,4**
3. Model global optimization solutions for various real life problems	**1,2,3,4,5**

COURSE PLAN – PART II

COURSE OVERVIEW

This course deals with approximate models and gives solution to complex real-life problems. The concepts, paradigms, algorithms and implementation of computational intelligence and its consituent methodologies - fuzzy logic, neural networks, neuro-fuzzy, evolutionary computation, swarm intelligence are the focus of this course. On Successful completion of this course, students should be able to solve complex problems using these techniques.

COURSE TEACHING AND LEARNING ACTIVITIES (Add more rows)

S.No.	Week	Topic	Mode of Delivery
1	1	Introduction to Computational Intelligence - Intelligence machines - Computational Intelligence paradigms	Chalk and Talk , Power Point Presentation

2	2	Fuzzy logic - Fuzzy relationships - Fuzzy Sets - Operations on Fuzzy sets - Fuzzy rules	-do-
3	3	Fuzzy inference systems - Fuzzy expert systems - Applications	-do-
4	4	Neural Network - Biological foundation of Neural Network - Neural Model - Network Architectures	-do-
5	5	Perceptron Learning - Supervised and unsupervised learning neural networks - Hebbian Learning - Back-propagation	-do-
6	6	Associative Learning - Competitive Networks - Hopfield Network - Deep neural networks and learning algorithms - Applications - Case studies	-do-
7	7	Neuro Fuzzy Systems - Adaptive Neuro - Fuzzy Inference Systems - Architecture - Hybrid Learning Algorithm	-do-
8	8	Learning Methods that Cross-fertilize ANFIS and RBFN - Coactive Neuro Fuzzy Modelling - Framework Neuron Functions for Adaptive Networks - Neuro Fuzzy Spectrum	-do-
9	9	Evolutionary computation – Chromosomes - Fitness functions - Selection mechanisms - Genetic algorithms	-do-
10	10	Crossover - mutation – Convergence – Applications - Genetic programming - Evolution strategies - Evolutionary neural network - Case studies	-do-
11	11	Swarm Intelligence - Foundations - Examples – Metaheuristics - ACO method - Ant System	-do-
12	12	PSO – Firefly Algorithm - Applications - Case Studies	-do-

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle test1	**Week 7**	**1 Hr**	15
2	Cycle test2	**Week 11**	**1 Hr**	15
3	Problem solving	**Week 4, Week7, Week 11**		20
CPA	Compensation Assessment	**Week 12**	**1 Hr**	15
5	Final Assessment	**At the end of course**	**3 hrs**	50

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

- The students through the class representative may give their feedback at any time to the course faculty which will be duly addressed.
- The students may also give their feedback during Class Committee meeting

COURSE POLICY (including compensation assessment to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)

The students can get the availability of faculty member over phone and email. They can get their doubts clarified at any time with their faculty member with prior appointment.

COMPENSATION ASSESSMENT

One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and

award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL

Course Faculty _____ **CC- Chairperson** _____ **HOD** _____