NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF INSTRUMENTATION & CONTROL ENGG

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Tech. in Process control & Instrumentation Engg**		
Course Title	**APPLIED SOFTCOMPUTING**		
Course Code	**CL 664**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)			
Session	**September 2021**	**Section (if, applicable)**	**NA**
Name of Faculty	Dr. K. Srinivasan	**Department**	ICE Department
Official Email	**srinikkn@nitt.edu**	**Telephone No.**	**0431-2503363**
Course Type (please tick appropriately**)**	☐ **Core course**	☑ **Elective course**	

Syllabus (approved in BoS)

Review of fundamentals - Biological neuron, Artificial neuron, Activation function, Single Layer Perceptron - Limitations - Multi Layer Perceptron - Back propagation algorithm (BPA); Fuzzy set theory - Fuzzy sets - Operation on Fuzzy sets - Scalar cardinality, fuzzy cardinality, union and intersection, complement, equilibrium points, aggregation, projection, composition, decomposition, cylindrical extension, fuzzy relation - Fuzzy membership functions. Neural Networks for Modeling and Control Modeling of nonlinear systems using ANN- NARX,NNSS,NARMAX - Generation of training data - optimal architecture - Model validation- Control of nonlinear system using ANN- Direct and Indirect neuro control schemes- Adaptive neuro controller - Familiarization of Neural Network Control Tool Box. ANN Structures and Online Training Algorithms Recurrent neural network (RNN) - Adaptive resonance theory (ART) based network- Radial basis function network- Online learning algorithms: BP through time - RTRL algorithms - Least Mean square algorithm - Reinforcement learning. Fuzzy Logic for Modeling and Control Modeling of nonlinear systems using fuzzy models - TSK model - Fuzzy Logic controller - Fuzzification - Knowledge base - Decision making logic - Defuzzification - Adaptive fuzzy systems - Familiarization of Fuzzy Logic Tool Box. Hybrid Control Schemes Fuzzification and rule base using ANN- Neuro fuzzy systems - ANFIS - Fuzzy Neuron - Introduction to GA - Optimization of membership function and rule base using Genetic Algorithm - Introduction to Support Vector Machine- Particle Swarm Optimization

COURSE OBJECTIVES

1. This course is designed to expose students to ANN, fuzzy methods of analyzing problems which involve incomplete or vague criteria rather than complete data sets. The course investigates requirements analysis, logical design, and technical design of components for fuzzy systems

development.
2. The subject is primarily concerned with the definitions and concepts associated with a fuzzy set, Fuzzy reasoning, Fuzzy design and Fuzzy logic applications. The course also introduces Neuro-Fuzzy systems, Fuzzy Genetic Algorithms

MAPPING OF COs with POs

Course Outcomes	Programme Outcomes (PO)
1. Understand the overview of ANN and Fuzzy logic theory.	**1,2,5,7**
2. Solve and design various ANN models.	**1,5,6,10**
3. Apply and analyze the concept to existing systems.	**1,2,5,7**
4. Design of hybrid systems for engineering applications.	**1,2,5,6,7**

COURSE PLAN – PART II

COURSE OVERVIEW:

The detailed study of different fuzzy and neural algorithms. The effective utilization of algorithm's for modelling and control application.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	First Week	Introduction to soft computing Techniques and application. Comparison between Fuzzy logic Vs Neural network.	Smart board
2.	Second – Sixth Week	Introduction to neural networks, Activation function, Supervised Neural network: Hebb, Perceptron, Back Propagation etc. algorithm, derivation and applications. Neural network based modeling, Controller with case study.	Smart board/ Power point presentation / Group Discussion
3	End of seventh Week	***Assessment-1 : NN based problem solving – simulation with presentation (Continuous assessment from Third week onwards)***	***15 % Weightage***
4	Seventh and Eigth week	Un Supervised Neural networks. Recurrent and reinforcement neural networks.	Smart board/ Power point presentation / Group Discussion

5	Ninth –Eleventh week	Introduction to fuzzy logic Fuzzy logic principles (Fuzzification, rule base evaluation, defuzzification etc.) with tutorials. Fuzzy logic for control applications.	Smart board/ Power point presentation / Group Discussion
6	End of Eleventh week	***Assessment-2 : Unsupervised Neural and Fuzzy based problem solving-simulation (This assessment starts from end of Seventh week)***	***15% Weightage***
7	Twelfth - Fourteenth week	Hybrid network: ANFIS, Genetic algorithm, support vector machine and particle swarm optimization	Power point presentation.
8	End of Fourteenth Week	***Assessment-3 : Seminar (This assessment starts from sixth week onwards)***	***10% Weightage***
9	Fifteenth week	***Assessment–4 : Mini project-presentation***	***15% Weightage***
10	Fifteenth week	***Assessment-5 : Viva-Voce***	***15% Weightage***
11	End of Fifteenth week	***End Semester – Written Exam as per the Institute regulation***	***30% Weightage***

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	***NN based problem solving – simulation with presentation (Continuous assessment from Third week onwards)***	End of Sixth week	---	15%
2	***Unsupervised Neural and Fuzzy based problem solving-simulation (This assessment starts from end of Seventh week)***	End of Eleventh week	---	15%
3	Seminar ***(This assessment starts from sixth week onwards)***	End of Fourteenth week	---	10%
CPA	Compensation Assessment*	End of Fifteenth week	---	15%

4	Mini project-presentation	Fifteenth week	---	15%
5	Viva-voce	Fifteenth week	---	15%
6	End semester– ***Written Exam as per the Institute regulation***	End of Fifteenth week	Two hour	30%

***mandatory: refer to guidelines on page 4**

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. Laurence Fausett, Fundamentals of Neural Networks, Prentice Hall, Englewood cliffs, N.J.,1992.
2. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw Hill Inc., 1997.
3. Goldberg, Genetic Algorithm in Search, Optimization and Machine Learning, Addison Wesley Publishing Company, Inc. 1989.
4. Millon W.T., Sutton R.S., and Webrose P.J., Neural Networks for Control, MIT Press, 1992.
5. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning Series), MIT Press, 2004.
6. Corinna Cortes and V. Vapnik, Support - Vector Networks, Machine Learning,12, 1995.
7. Zhang, Huaguang, Liu, Derong, Fuzzy Modeling and Fuzzy Control Series: Control Engineering, 2006.

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

1. Indirect feedback through questionnaire.
2. Direct feedback from the students.
3. Feedback from the students during the class committee meetings.

COURSE POLICY (including compensation assessment to be specified**)**

Due to Covid pandemic situation all the lecture delivered through online MS team.

Only one compensation will be conducted during **Fifteenth week** for the students absent for assessment due to medical, on-duty and other genuine reasons. The course faculty decision will be the final to decide about assessment. The exam will be conducted based on entire syllabus. The duration of the exam is 1 hours. If the student absents themselves for more than one assessment, other assessment marks will be awarded as zero. The students and course faculty are member in whatsapp Applied soft computing Official group. All the information as well as class update will be intimated through this group. Any common doubt will be clarified through this group. However if the student want any further clarification/doubt student can contact faculty advisor through any online mode depends on mutual convenience.

Retest / Re-examination:

If the student got less than 40% with satisfactory attendance requirement (Refer Attendance policy), he/she has to undergone retest / supplementary examination.
Retest / Supplementary examination will be conducted as per the institute norms.

Passing Criteria / Awarding Grades:

40% is the minimum passing criteria for this subject. If the student got less than 40% even after reexamination and absent for reexamination, he/ she should undergo formative assessment. Other grades are awarded based on relative grades as per institute norms.

ATTENDANCE POLICY (as per the institute norms)

- 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 (as per the institute norms)

- 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

1. Students can meet any time depends on their mutual availability through online mode.
2. Minor doubts will be clarified during the class hours. The student can initiate online discussion for further discussion/clarification.

Any suggestions, Queries and feedback can be emailed to the course faculty at srinikkn@nitt.edu

FOR APPROVAL

Course Faculty_____ **CC- Chairperson** Dr Kartikeya Shukla **HOD** _____

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

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

d) The passing minimum shall be as per the regulations.

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2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.