DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE OUTLINE			
Course Title	FUZZY SYSTEMS		
Course Code	EE618	No. of Credits	03
Department	EEE	Faculty	Dr. P.R. Venkateswaran
Pre-requisites Course Code	Control Systems		
Course Coordinator(s) (if, applicable)			
Other Course Teacher(s)/Tutor(s)E-mail	---	Telephone No.	0431-2503269
Course Type	☐ Core course	☑ Elective course	

COURSE OVERVIEW

This course presents fundamental knowledge of fuzzy sets, fuzzy logic, fuzzy decision making and fuzzy control systems. The aim is to equip graduate students with state-of-the-art fuzzy-logic technology and fuzzy system design methodologies, thereby better preparing them for the rapidly evolving high-tech information-based nd modern industry requirements.

COURSE OBJECTIVES

This course is designed to provide exposure to students to fuzzy methods of analyzing problems which involve incomplete or vague criteria rather than crisp values. The course investigates requirements analysis, logical design, and technical design of components for fuzzy systems development.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
Upon completion of the course, the students will be able to 1. Assimilate the uncertainty concept. 2. Apply and analyze fuzzy sets for existing systems. 3. Develop fuzzy logic theory for linear and non-linear systems.	

CO No.	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14
1	M	L	M	H	H	M	M	L	NA	NA	L	M	M	M
2	L	L	H	H	H	H	M	H	NA	M	M	H	M	L
3	M	L	M	H	M	M	H	M	M	H	M	M	M	L

COURSE TEACHING AND LEARNING ACTIVITIES

S.No	Week	Topic	Mode of Delivery
1	Weeks 1 to 2 (6 contact hours) **3rd and 4th week of August 2016**	Introduction to Fuzzy Systems - Coursework and syllabus identification, Different forms of uncertainty, differentiation between uncertainty, randomness, fuzziness, ambiguity	Lecture C&T/ PPT or any suitable mode
2	Weeks 3 to 4 (6 contact hours) **1st and 2nd week of September 2016**	Fuzzy sets representation, Operations on Fuzzy sets – Differentiation from classical set operations, Relevance of DE Morgan's laws. Fuzzy set operations – Invalid laws example with illustrations	Lecture C&T/ PPT or any suitable mode
3	Week 5 (3 contact hours) **3rd week of September 2016**	Fuzzy set operations – Invalid laws example with illustrations, Relations – Classical and fuzzy relations – Cartesian product – principle of cardinality – difference between set and relations – operations.	Group work (exercise)
4	Weeks 6 and 7 (6 contact hours) **1st and 2nd week of October 2016**	Operations on fuzzy relations – cardinality - composition operation, Speed control of DC motor using fuzzy operations – example Tolerance and equivalence relations.	Lecture C&T/ PPT or any suitable mode
5	Weeks 8 (3 contact hours) **3rd week of October 2016**	Features of Membership functions, Various forms Membership value assignments ,Fuzzification concepts Defuzzification to crisp sets – λ cuts Defuzzification to scalars – different methods, Graphical Defuzzification methods – explanation with example,	Lecture C&T/ PPT or any suitable mode
6	Weeks 9 (6 contact hours) **4th week of October 2016**	Logic and fuzzy systems – Natural language – Linguistic hedges. ,Fuzzy rule based systems – multiple conjunctive antecedents, Aggregation of fuzzy sets – graphical set of interpretations,	Lecture C&T/ PPT or any suitable mode
7	Weeks 10 to 11 (6 contact hours) **1st and 2nd week of November 2016**	Fuzzy Aggregation operations examples, Automated methods for fuzzy system - batch least squares algorithm, RLS algorithm.	Lecture C&T/ PPT or any suitable mode
8	Weeks 12 (3 contact hours) **3rd week of November 2016**	Fuzzy control system – design problem – decision surface – assumptions – basic schematic, Examples of FLC – rule base update –.	Lecture C&T/ PPT or any suitable mode
9	Weeks 13 (3 contact hours) **4th week of November 2016**	Matlab demonstration, MIMO fuzzy control systems, Adaptive fuzzy systems, Neuro fuzzy systems, Fuzzy genetic algorithms	Lecture C&T/ PPT or any suitable mode

Mode of Assessment

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	1st Mid Semester Examination (Written test) (1st and 2nd Units)	4th week of September 2016	60 Minutes	20
2	2nd Mid Semester Examination (Written test) (3rd and 4th Units)	1st week of November 2016	60 Minutes	20
3	Take Home / Team Task	Work will be carried out along with the course		10
4	Retest (Written Test) (1st to 4th Unit)	3rd week of November 2016	60 Minutes	20

5	End Semester Examination (Written test)	1st week of December 2016	180 Minutes	50

Note:

1. **Attending all the assessments (Assessment 1-3 and 5) are MANDATORY for every student.**
2. **If any student is not able to attend Assessment-1 (1st Mid Sem) / Assessment-2 (2nd Mid Sem) due to genuine reason, student is permitted to attend the Assessment- 4 (retest) with 20% weightage (20 marks).**
3. **In any case, retest will not be considered as an improvement test.**

ESSENTIAL READINGS :

Reference Books:

1. *Zimmermann H. J., 'Fuzzy set theory and its applications', Allied publishers limited, Madras, 4th Edition, 2001*
2. *Klir G. J. and Folger T., 'Fuzzy sets, uncertainty and information', Prentice Hall of India, New Delhi, 1991.*
3. *EarlCox, 'The Fuzzy Systems Handbook', AP professional Cambridge, 1999.*

COURSE EXIT SURVEY

- Feedback from the students during class committee meeting
- Anonymous feedback through questionnaire.

COURSE POLICY

ATTENDANCE

1. Attendance will be taken by the faculty in all the contact hours. Every student should maintain minimum 75 % physical attendance in these contact hours to attend the end semester examination.
2. Any student, who fails to maintain 75% attendance need to appear for the retest. Student who scores more than 50 % marks in the retest will be eligible for attending the end semester examination.
3. Students not having 75% minimum attendance at the end of the semester and also fail in retest (scoring less than 50%) will have to RE-DO the course.

ACADEMIC HONESTY & PLAGIARISM

1. Copying in any form during assessments is considered as academic dishonesty and will attract suitable penalty.

FOR APPROVAL

(Dr. P.R. Venkateswaran)
Course Faculty _____ **CC-Chairperson** _____ **HOD** _____

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