

PEI301: ADVANCED SOFT COMPUTING TECHNIQUES

L	T	P	Cr
3	1	0	3.5

Course Objectives: To understand the concepts of advanced soft computing, to enable to develop applications of advanced soft computing in instrumentation

Introduction to Soft Computing: Review of AI techniques and soft computing techniques and their applications in instrumentation engineering.

Multi-objective optimization: Comparison with single objective optimization, Dominance, Non-Dominated sorting, Multi-objective optimization using GA.

Advanced AI Techniques: Swarm Intelligence (SI), Particle swarm optimization (PSO), Ant-Colony Optimization, Petri-nets, Coloured-Petrinets, Entropy, Multi-agent and Hierarchical applications of advanced AI techniques in Control/ Signal processing/ Robotics.

Rough Set Theory: Introduction, Information system, Indiscernibility, Rough sets, Rough set theory, Set approximation, Rough membership, Attributes, Dependency of attributes, Rough equivalence, Reducts, Rough Reducts based on SVM, Hybrid set systems –Fuzzy rough sets, Topological structures of rough sets over fuzzy lattices, Fuzzy reasoning based on universal logic

Granular Computing: Soft sets to information systems, Uses and applications of granular computing in instrumentation engineering.

Hybrid AI Techniques: Introduction to Hybrid AI systems : Neuro- Fuzzy, Fuzzy-rough set systems, Neuro-Fuzzy-GA systems and case studies around Hybrid systems.

Minor Project:

1. Application of hybrid techniques for system identification and control.

Application of advanced soft computing techniques for pattern classification and recognition.

Application of multi-objective optimization algorithms for process control.

Course learning outcome (CLO): After the completion of the course the students will be able to

1. Use soft computing techniques.

Handle multi-objective optimization problems.

Use advanced AI techniques of swarm intelligence, particle swarm optimization, ant-colony optimization and petrinets

Use rough set theory and granular computing

Recommended Books:

1. *Duntsch, I and Gediga, G., Rough set data analysis: A Road to Non-invasive Knowledge Discovery, Methodos Publishers (2006).*
2. *Klir, G. J., Yuan, Bo, Fuzzy Sets and Fuzzy Logic, Theory and Applications, Prentice-Hall of India Private Limited (2007).*
3. *Ross, T.J., Fuzzy Logic with Engineering Applications, Wiley (2004) 2nd ed.*

Evaluation Scheme:

S.No	Evaluation Elements	Weightage (%)
1.	MST	30
	EST	45
	Sessionals (May include Assignments/ Projects/ Tutorials/ Quizes/ Lab Evaluations)	25