17CS31E4 – GENETIC ALGORITHMS AND APPLICATIONS

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| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-0-0 |
| **Prerequisite:** | Basic knowledge on design and analysis of algorithms and mathematical computing techniques. | **Sessional Evaluation:**  **Univ. Exam Evaluation:**  **Total Marks:** | 40  60  100 |
| **Objectives** | * Understanding the types of Genetic Operators and their usage * Learning various methods and their applicability * Gaining knowledge from genetic modeling and machine learning to develop various applications | | |

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| **Course Outcomes** | Upon the successful completion of the course, the students will be able to: | |
| CO1 | Familiar with the basics of Genetic Algorithms and machine learning |
| CO2 | Compare traditional methods and study various learning techniques |
| CO3 | Learn and analyze the mathematical foundations for GA |
| CO4 | Study various GA operators and their utilization for application development |
| CO5 | Study and solve various problems in different domains |
| CO6 | Understand the genetic based machine learning and supporting development of applications |
| **Course Content** | **UNIT – I**  **Introduction to Genetic Algorithms:** History – Basic concepts – Creation of Off-springs – Working principle - Encoding – binary encoding – octal encoding – hexadecimal encoding – permutation encoding- value encoding – tree encoding – fitness function.  **UNIT – II**  **GA Traditional methods:** Robustness of traditional optimization and search methods- goals of optimization-GA Vs. traditional methods-simple GA; machine learning explanation-ML Vs. AI-supervised and unsupervised machine learning-examples of machine learning.  **UNIT – III**  **Genetic Operators:** Reproduction- Roulette-wheel Selection – Boltzmann Selection – Tournament Selection-Rank Selection – Steady –state selection – Elitism – generation gap and steady-state selection - Inheritance operators - Crossover- Single-point crossover – Two-point cross over – Multi-point cross over – Uniform Cross over – Matrix Cross Over – Cross Over rate - Mutation operators – mutation – mutation rate.  **UNIT – IV**  **Genetic Modeling:** Inversion and deletion **:** Inversion – deletion and duplication - deletion and regeneration – segregation – cross over and inversion – Bit-wise operators – one’s complement operator – logical bit-wise operators – shift operators – bit-wise operators used in GA – generational cycle – convergence of GA - Differences and Similarities between GA and Other Traditional Methods.  **UNIT – V**  **Applications of GA:** The rise of GA – GA application of Historical Interaction. – Dejung & Function optimization – Current applications of GA.  **Techniques in genetic search:**Dominance, Diploidy & abeyance –Niche & Speciation – Multi objective optimization – Knowledge-Based Techniques. – GA & parallel processes- Real Life Problem.  **UNIT – VI**  **Genetic-Based Machine Learning:** Genetics – Based Machined learning – Classifier system – Rule & Message system – Apportionment of credit: The bucket brigade – Genetic Algorithm – A simple classifier system in Pascal. – Results using the simple classifier system-The Rise of GBMC – Development of CS-1, the first classifier system. – Smith’s Poker player–Current Applications. | |
| **Text Books and References** | **TEXT BOOKS:**   1. David *E.* Gold berg, “GeneticAlgorithms in Search, Optimization & Machinelearning”,PearsonEducation, 2001. 2. S.Rajasekaran, G.A.Vijayalakshmi Pai,*“Neural* Networks, Fuzzy Logic and GeneticAlgorithms”*,*Pearson Education, 2003.   **REFERENCE BOOKS:**   1. Kalyanmoy Deb,”Optimization for Engineering Design, Algorithms and examples” PHI 1995. | |
| **E-Resources** | 1. <https://nptel.ac.in/courses> 2. <https://freevideolectures.com/university/iitm> | |