

**CENTRAL UNIVERSITY OF KERALA  
DEPARTMENT OF COMPUTER SCIENCE  
M.Sc. COMPUTER SCIENCE**

ELECTIVE COURSE					
COURSE CODE	COURSE TITLE	CONTACT HRS/WEEK			CREDITS
		LEC	LAB	TUT	
CSC5005	Nature Inspired Computing	2	2	1	4

Lec = Lecture, Tut = Tutorial, Lab = Practical

This is a participatory and problem solving **skill development course**.

Course Objective:

The objective of the course is to provide theoretical and practical aspects of implementing nature inspired computing.

By completing this course, students will obtain the following course/learning outcomes:

1. Knowledge gained:
  - (i) fundamental concepts of nature inspired computing
2. Skill gained:
  - (ii) Skills in the development of algorithms for nature inspired computing
3. Competency gained:
  - (iii) optimization of real world problems using nature inspired computing

Prerequisites: Basic knowledge of programming

Grading:

Lab implementation	– 15%
Participatory based group Project	– 10%
Assignment/Quiz/presentation	– 5%
Class Test	– 10%
Final Exam	– 60%

### CSC5005 – Nature Inspired Computing

#### Module 1

Natural to Artificial Systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging - Division of Labor - Task Allocation – Cemetery Organization and Brood Sorting – Nest Building - Cooperative transport.

#### Module 2

Ant Colony Optimization: Ant Behavior - Towards Artificial Ants - Ant Colony Optimization – Problem solving using ACO - Extensions of Ant Systems - Applications.

#### Module 3

Swarm Intelligence: Introduction to Swarm Intelligence – Working of Swarm Intelligence - Optimization – Particle Swarms - Applications

#### Module 4

Introduction to Genetic Algorithms - population initialization - choosing a fitness function - selection - crossover - mutation - reinsertion - applications of genetic algorithms - evolutionary algorithms.

#### Module 5

Case studies in Immune System Algorithms, Simulated Annealing

#### Text Books

1. Stephan Olariu and Albert Zomaya, *Handbook of Bioinspired Algorithms and Appl.*, Chapman and Hall, 2006
2. Marco Dorigo, Thomas Stutzle, *Ant Colony Optimization*, MIT Press, 2004.
3. E. Bonabeau, Marco Dorigo, Guy Theraulaz, *Swarm Intelligence: From Natural to Artificial Systems*, Oxford Univ. press, 2000.
4. Mitchell, Melanie, *Introduction to genetic algorithms*, ISBN: 0262133164, MIT Press, 1996
5. Nunes de Castro, Leandro, *Fundamentals of Natural Computing: Basic Concepts, Algor., and Appl.*, Chapman & Hall, 2006

#### Reference Books

1. Nunes de Castro, Leandro, Fernando J. Von Zuben, *Recent Developments in Biologically Inspired Computing*, MIT Press, 2005
2. D. Floreano and C. Mattiussi, *Bio-Inspired Artificial Intelligence*, MIT Press, 2008
3. Camazine, Scott et al, *Self-organization in biological systems*, ISBN: 9780691116242, Princeton Univ. Press, 2001
4. Nancy Forbes, *Imitation of Life - How Biology Is Inspiring Computing*, MIT Press, 2004.
5. Christian Blum, Daniel Merkle (Eds.), *Swarm Intelligence: Introduction and Applications*, Springer Verlag, 2008.
6. Leandro N De Castro, Fernando J Von Zuben, *Recent Developments in Biologically Inspired Computing*, Idea Group Inc., 2005.