NIRMA UNIVERSITY
Institute of Technology
B. Tech. Computer Science and Engineering
Semester – VI
Department Elective-II

L	T	P	C
3	0	2	4

Course Code	2CSDE68
Course Title	Parallel Algorithms

Course Outcomes:

At the end of the course, students will be able to –

1. appraise various parallel algorithmic strategies and their comparison with traditional algorithmic strategies
2. simulate different parallel algorithms, techniques and architectures
3. analyze complexity of various parallel algorithms
4. improve the parallel algorithms through debugging and performance tuning.

Syllabus: Teaching Hours: 45

Unit I 08

Introduction and PRAM Algorithms: Parallel Algorithms: Introduction, Models, speedup and efficiency, Some basic techniques. Parallel algorithms and their parallel time and processors complexity. PRAM. Pointer Jumping and Parallel Prefix. Tree Contraction. Divide and Conquer. Randomized symmetry breaking. Maximal independent set.

Unit II 06

Models: Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

Unit III 10

Performance Measures of Parallel Algorithms: Cost-optimality, An example of illustrates Cost-optimal algorithms - such as summation, Min/Max on various models. Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC, Parallel Sorting Networks CREW/EREW/MCC, linear array.

Unit IV 08

Parallel Searching Algorithm: Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding. Matrix algorithms: striping and partitioning, matrix multiplication, linear equations, Eigen values, dense and sparse techniques, finite element and conjugate gradient methods.

Unit V 07

Graph Algorithms: Connected Graphs, search and traversal, Combinatorial Algorithms-Permutation, Combinations, De-arrangements.

Unit - VI **06**

Dynamic Programming: Dynamic programming, knapsack problems, scheduling. Element methods. Synthesis of parallel algorithms: algebraic methods, pipelines, homomorphism

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on the above syllabus with minimum 5 experiments to be incorporated.

Suggested Readings^:

1. M. J. Quinn, Parallel Computing, TMH
2. S. G. Akl, Parallel Computation: Models and Methods, Prentice Hall
3. J. Jaja, An Introduction to Parallel Algorithms, Addison Wesley
4. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar "Introduction to Parallel Computing", Addison Wesley,
5. F. T. Leighton, Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes, Morgan Kaufmann Publishers, San Mateo, California
6. J. H. Reif, Synthesis of Parallel Algorithms, Morgan Kaufmann Publishers, San Mateo, California
7. BehroozParhami, Introduction to Parallel Processing: Algorithms and Architecture, Kluwer Academic Publishers.

L=Lecture, T=Tutorial, P=Practical, C=Credit

^this is not an exhaustive list