B. Tech. (8th Sem) Computer Science & Engineering
BCSE-520 (Distributed Operating System)

L	T	P
3	0	0

Continuous evaluation	**40**
End semester exam	**60**
Total marks	**100**
Credits	**3.0**

Course Objectives:

i) To acquire the knowledge about the basic concepts about Distributed Operating System.
ii) To learn about phenomenon of mutual inclusion in distributed systems.
iii) To learn about deadlock detection techniques in distributed systems.
iv) To learn about distributed file system & distributed scheduling mechanism used in distributed systems.

Unit:-1 **(8 Hours)**

Architecture of Distributed Operating System: Introduction, Motivation, System architecture type, Issues in distributed operating system, Communication primitive.

Unit:-2 **(10 Hours)**

Distributed mutual Inclusion: Introduction, Classification preliminaries, Simple solution, Non token based algorithm, Lamport algorithm, Ricart algorithm, Mackawa's algorithm, A generalized Non token based algorithm, Token based algorithm, Broad caste algorithm, Heuristic algorithm, Tree based algorithm, Comparative performance analysis.

Unit:-3 **(9 Hours)**

Distributed Deadlock Detection: Introduction, Deadlock handling, Strategies, Issues in deadlock detection & resolution, Control organization, Centralized, Distributed & Hierarchical detection algorithm.

Unit:-4 **(9 Hours)**

Distributed File System: Introduction, Architecture mechanism for building, Design issues, Log Structured file system. **Distributed Scheduling:** Introduction, Motivation, Issues in load distribution, Component of load algorithm, Stabilizing load distribution algorithm, Performance comparison, Selection of a suitable load sharing algorithm, Requirement for load distribution, Task migration, Issues in task migration.

Course Outcomes: After completion of this course, student will be able to

i) Understand architecture of distributed operating system.
ii) Understand various characteristics, properties of distributed systems.
iii) Identify and solve deadlock related problems in distributed operating systems.
iv) Understand various concepts related to distributed file system.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text Books:

1. Mukesh Singhal & N.G. Shivaratri, "Advanced concepts in operating systems", TMH 2001.
2. A. S. Tanenbaum, "Modern Operating Systems", PHI.

Reference Books:

1. A. Silberschatz, P. Galving, G. Gahne, "Applied operating system concepts", Wiley.

B. Tech. (8th Sem) Computer Science & Engineering
BCSE-521 (High Performance Computing)

L	T	P		
3	0	0	Continuous evaluation	40
			End semester exam	60
			Total marks	100
			Credits	3.0

Course Objectives:

i) Provide a strong foundation on memory hierarchy design and trade offs in both uniprocessor and multiprocessors
ii) To learn about Modern Processors and concepts.
iii) To understand the concepts of Optimizations.
iv) To learn about Parallel Computers and Programming.
v) To study about Memory Parallel Programming using OpenMP.

Unit-1: Modern Processors (8 Hours)

Stored program computer architecture, General purpose cache-based microprocessor (Performance based metrics and benchmarks), Moore's Law, Pipelining, Super scalarity, SIMD, Memory Hierarchies, Cache (mapping, prefetch), Multicore processors, Multi-threaded processors, Vector Processors (Design Principles, Maximum performance estimates, Programming for vector architecture).

Unit-2: Basic Optimization Techniques For Serial Code (10 Hours)

Scalar profiling (Function and line based runtime profiling, Hardware performance counters), Common sense optimizations (Simple measures, large impact, Elimination of common sub-expressions, Avoiding branches, Using SIMD instruction sets), The role of compilers, General optimization options (Inlining, Aliasing, Computational accuracy, Register optimizations, Using compiler logs, C++ optimizations, Temporaries, Dynamic memory management, Loop kernels and iterators), Data Access Optimization (Balance analysis and light speed estimates, Storage order).

Unit-3: Parallel Computers (9 Hours)

Taxonomy of parallel computing paradigms, Shared memory computers, Cache coherence (UMA, ccNUMA), Distributed-memory computers, Hierarchical systems, Networks configuration (Basic performance characteristics, Buses, Switched and fattree networks, Mesh networks, Hybrids), Basics of parallelization (Why parallelize, Data parallelism, Function parallelism, Parallel scalability, Factors that limit parallel execution, Scalability metrics, Simple scalability laws), Parallel efficiency, serial performance vs Strong scalability, Refined performance models, Choosing the right scaling baseline.

Unit-4: Shared Memory Parallel Programming With OpenMP (9 Hours)

Introduction to OpenMP (Parallel execution, Data scoping, OpenMP work sharing for loops), Synchronization, Reductions, Loop scheduling, Tasking, Case Study (OpenMP, parallel Jacobi algorithm), Advanced OpenMP wavefront parallelization, Efficient Open MP programming (Profiling OpenMP programs, Performance pitfalls).

Course Outcomes:

i) Able to explore Modern Processors and concepts.
ii) Able to analyze and write optimized code for modern processors in real time scenarios.
iii) Able to analyze and perform different types of Parallel computers configurations.
iv) Able to analyze and write code under OpenMP for distributed computing.

Instructions for paper setter: All Questions are compulsory. The Question paper is divided in to four sections A, B, C and D. Section A is compulsory and comprises of 12 questions of one mark each, 3 from each unit. The questions shall be asked in such a manner that there are no direct answers including one word answer, fill in the blanks or multiple choice questions. Section B comprises of 4 questions of 2 marks each, one from each unit. Section C Comprises of 4 questions of 4 marks each, one from each unit. Section D Comprises of 4 questions of 6 marks each, one from each unit. There is no overall choice, however internal choice may be provided in section C and D, if paper setter so desires.

Text Books:

1. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.
2. Kai Hwang, Faye Alaye Briggs, "Computer Architecture and Parallel Processing", McGraw Hill, 1984.

Reference Books:

1. Charles Severance, Kevin Dowd, "High Performance Computing", O'Reilly Media, 2nd Edition, 1998.