SCHOOL OF DIPLOMA STUDIES
RK.UNIVERSITY

Syllabus

Course Code and Title	**DCE510| Parallel Processing**			
Course Introduction	Parallel processing refers to a computing technique where multiple tasks or parts of a single task are executed simultaneously. This approach aims to improve computational efficiency by dividing the workload among multiple processors or cores. Instead of executing tasks sequentially, parallel processing enables concurrent execution, thus potentially reducing the overall processing time.			
Prerequisite/Corequisite	Nil			
Course Credit	**L : 3**	**T : 0**	**P : 1**	**C : 4**

Course Learning Outcomes:

Upon successful completion of the course, a student will be able to:

1. Analyze the requirements for programming parallel systems and critically evaluate the strengths and weaknesses of parallel programming models and how they can be used to facilitate the programming of concurrent systems.
2. Discuss the difference between the major classes of parallel processing systems and design software solutions for a number of parallel processing models.
3. Design and implement a SIMD and MIMD parallel processing solution.
4. Analyze the efficiency of a parallel processing system and evaluate the types of application for which parallel programming is useful.

Detailed Syllabus

Section – I

Topic	Duration
1. Parallel Programming Platforms Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques	4 Hours
2. Principles of Parallel Algorithm Design algorithms Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models	5 Hours
3. Basic Communication Operations, algorithms One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations	5 Hours

4. Analytical Modeling of Parallel Programs Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, Effect of Granularity and Data Mapping on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics	4 Hours
5. Programming Using the Message Passing Paradigm Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators	5 Hours
Section – II	
6. Programming Shared Address Space Platforms Thread Basics Why Threads? The POSIX Thread Application Programmer Interface, Synchronization Primitives in POSIX, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs	4 Hours
7. Database Connection With SQLITE Introduction to SQLite browser, SQLiteOpenHelper and creating a database, Opening and closing a database Working with cursors Inserts, updates and deletes	5 Hours
8. Dense Matrix Algorithms Matrix-Vector Multiplication, Matrix-Matrix Multiplication	4 Hours
9. Sorting Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quick sort	4 Hours
10. Graph Algorithms Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths	5 Hours
Total theory contact hours	45 Hours
Suggested engagement hours outside the classroom	45 Hours
References	
1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar," Introduction to Parallel Computing", Pearson Publication. 2. M. Sasi Kumar, Dinesh Shikhare, P.Ravi prakash,"Introduction to Parallel Processing", PHI Publication. 3. Steven Brawer," Introduction to Parallel Programming", Academic Press Inc. 4. V. Rajaraman and C. Siva Ram Murthy," Parallel Computers – Architecture and Programming", PHI Publication.	