CO4	Evaluate the suitability of GPU computing for specific computational tasks.

S. NO	Contents	Contact Hours

UNIT 1	**Introduction to GPU Computing:** GPU Architecture: Comparison with CPUs, CUDA Cores, SMs, and Memory Hierarchy, GPU Programming Models: CUDA and OpenCL, Basic Concepts and Syntax Parallel Programming Paradigms: Data Parallelism, Task Parallelism , Hybrid Parallelism	**8**
UNIT 2	**CUDA Programming**: CUDA Programming Fundamentals: Kernels and Device Functions, Memory Management (Host and Device Memory), Thread and Block Hierarchies, CUDA Performance Optimization:, Memory Coalescing, Shared Memory Optimization, Texture, Memory Utilization, Occupancy and Warp Divergence, CUDA Examples:, Matrix Multiplication, Image Processing, Monte Carlo Simulations	**9**
UNIT 3	**OpenCL Programming:** OpenCL Basics: OpenCL Runtime and Host API, OpenCL Kernels and Work Items, Memory Management (Host and Device Memory), OpenCL Performance Optimization:, Work Group and Work Item Scheduling, Data Transfer Optimization, Kernel, Optimization Techniques, OpenCL Examples:, Image Filtering, Molecular Dynamics Simulations, Scientific Computing Applications	**9**
UNIT 4	**Advanced GPU Topics:** GPU Heterogeneous Computing: CPU-GPU Integration, GPU-GPU Communication, GPU Libraries and Frameworks:, CUDA Toolkit, OpenCL Runtime, cuBLAS, cuFFT, cuDNN, GPU Programming Patterns:, Reduction Operations, Scan Operations, Sorting Algorithms, GPU Debugging and Profiling Tools	**8**
UNIT 5	**GPU Applications and Case Studies:** GPU Applications in Various Domains:, Machine Learning and Deep Learning, Computational Fluid Dynamics, Bioinformatics, Financial Modeling, Scientific Visualization, GPU Case Studies:, Real-world examples of GPU-accelerated applications, Performance analysis and benchmarking, Future Trends in GPU Computing	**8**
	TOTAL	**42**