NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Technology**
Name of Programme:	**BTech CSE**
Course Code:	4CS507ME25
Course Title:	**Advances in Programming**
Course Type:	**Department Elective-IV**
Year of Introduction:	**2025-26**

L	T	Practical Component				C
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Course Learning Outcomes (CLO):

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

1. illustrates techniques for GPU- GPU-accelerating applications with CUDA (BL2)
2. analyse the Parallel Computing Platform and Programming Model (BL4)
3. develop the client-server model in networking applications (BL6)
4. develop scalable and high-performance applications using GO programming language. (BL6)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Introduction to advances in programming**: An overview of advanced programming paradigms. The importance of having current skills in the software development field.	02
Unit-II	**Socket Programming:** Introduction, TCP client, TCP server, creating and destroying sockets, specifying addresses, connecting socket, binding to an address, handling incoming connections, communication, UDP client, UDP server, sending and receiving with UDP sockets, connecting a UDP socket, sending and receiving data	08
Unit-III	**Basics of GO:** Introduction to GO programming, data types, variables, constants, decision making, looping, functions, arrays, pointers, structures, slice, maps, range, strings, basics of module and tools	09
Unit-IV	**Advanced features in GO:** Error handling - custom error types, error wrapping and handling, error propagation strategies, concurrency in GO - goroutines and channels, select statements, mutexes and synchronization, worker pools, fan-out, fan-in, contexts for cancellation and timeouts, buffered channels, channel directionality, timers, and tickers, writing effective unit tests, benchmarking Go code	10
Unit-V	**Parallel Computing Platform and Programming Model:** The Benefits of Using GPUs, A Scalable Programming Model, CUDA Programming Model: Kernels, Thread, Heterogeneous Programming, Asynchronous SIMT Programming Model, Asynchronous Operations, Compute Capability	06

Unit-VI	**CUDA Programming:** Introduction to CUDA C, querying devices, using device properties, parallel programming in CUDA C, Thread cooperation, managed memory, shared memory	10

Self-Study:

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

Suggested Readings/ References:

1. Alan A. A. Donovan and Brian W. Kernighan, *The Go Programming Language*, Addison-Wesley Professional
2. Katherine Cox-Buday, *Concurrency in Go: Tools and Techniques for Developers*, O'Reilly Media, Inc.
3. Lewis Van Winkle, *Hands-On Network Programming with C*, Packt Publishing
4. Michael J. Donahoo, Kenneth L. Calvert, *TCP/IP Sockets in C: Practical Guide for Programmers*, no starch press
5. Elliotte Harold, *Java Network Programming*, O'Reilly
6. *CUDA C++ Programming Guide*, NVIDIA
7. Jason Sander and Edward Kandrot, *CUDA by Example: An Introduction to General-Purpose GPU Programming*, NVIDIA
8. Shane Cook, *CUDA Programming*, Morgan, Kaufmann

Suggested List of Experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1	Write a client-server program using TCP where the client sends a string, and the server checks whether that string is palindrome or not and responds with an appropriate message.	02
2	Write a client-server program using a UDP socket. The client sends the list of N strings, and the server responds with the concatenation of those strings.	02
3	Create chat application using either TCP or UDP protocol	02
4	Write a GO program for the following: A. to create and display variables of different data types. B. to define functions for tasks such as calculating the factorial of a number, finding prime numbers, and generating Fibonacci sequences. C. that uses arrays and slices to perform operations like sorting, finding the maximum/minimum element, and reversing the elements.	04
5	A. Write a simple GO program to create a HTTP server that handles requests, demonstrating routing and basic request handling. B. Write GO programs that use goroutines and channels to perform concurrent activities, such as parallelizing work or building a concurrent web server.	04

6	Write GO programs that demonstrate error handling concepts, including creating custom error types and using the defer statement.	02
7	Write a simple CUDA program to create an array of 8388608 (which is 2^23) double values in the GPU's global memory using cudaMalloc. Initialize the array so index zero holds the value zero, index one holds the value one; index two holds the value two, and so on. Hint: You will need to initialize the values on the host first and copy them into GPU memory.	04
8	Perform Vector addition on the GPU with Nvidia CUDA	02
9	Perform Matrix-Matrix Multiplication on the GPU with Nvidia CUDA	02
10	**Case study:** Do a study of advanced programming for high-performance computing to solve complex problems.	04
11 *	Write a program to measure the time it takes for requests to finish in order to show the difference between UDP and TCP with regard to speed.	02