Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110
NAAC A++
Ph.: 07104-237919, 234623, 329249, 329250 Fax: 07104-232376, Website: www.ycce.edu

Department of Artificial Intelligence & Data Science

Vision of the Department

To be a well-known centre for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary area by developing Problem-solving skills through emerging technologies.

Session 2025-2026

Vision: Dream of where you want.	**Mission:** Means to achieve Vision

Program Educational Objectives of the program (PEO): (broad statements that describe the professional and career accomplishments)

PEO1	**Preparation**	**P: Preparation**	**Pep-CL abbreviation pronounce as Pep-si-lL easy to recall**
PEO2	**Core Competence**	**E: Environment (Learning Environment)**	
PEO3	**Breadth**	**P: Professionalism**	
PEO4	**Professionalism**	**C: Core Competence**	
PEO5	**Learning Environment**	**L: Breadth (Learning in diverse areas)**	

Program Outcomes (PO):

1. Understand and Apply Parallel Programming Concepts
2. Analyse and Improve Program Performance.
3. Demonstrate Practical Skills in HPC Tools and Environments.

Keywords of POs:
Engineering knowledge, Problem analysis, Design/development of solutions, Conduct Investigations of Complex Problems, Engineering Tool Usage, The Engineer and The World, Ethics, Individual and Collaborative Team work, Communication, Project Management and Finance, Life-Long Learning

PSO Keywords: Cutting edge technologies, Research

"I am an engineer, and I know how to apply engineering knowledge to investigate, analyse and design solutions to complex problems using tools for entire world following all ethics in a collaborative way with proper management skills throughout my life." *to contribute to the development of cutting-edge technologies and Research*.

Integrity: I will adhere to the Laboratory Code of Conduct and ethics in its entirety.

Name and Signature of Student and Date
Sakshi Gokhale
02/09/25

Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110
NAAC A++
Ph.: 07104-237919, 234623, 329249, 329250 Fax: 07104-232376, Website: www.ycce.edu

Department of Artificial Intelligence & Data Science

Vision of the Department

To be a well-known centre for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary area by developing Problem-solving skills through emerging technologies.

Session	2025-26 (ODD)	**Course Name**	HPC Lab
Semester	7 AIDS	**Course Code**	22ADS706
Roll No	16	**Name of Student**	Sakshi Gokhale

Practical Number	5
Course Outcome	1. Understand and Apply Parallel Programming Concepts 2. Analyse and Improve Program Performance
Aim	Basics of MPI Programming
Problem Definition	Basics of MPI Programming
Theory (100 words)	OpenMP, MPI is designed for high-performance computing environments where multiple processes run independently and communicate by exchanging messages. Each process has its own memory space and is identified by a unique rank within a communicator. MPI provides a set of communication mechanisms to coordinate these processes. The key concepts of MPI include processes, rank, communicators, point-to-point communication, and collective communication. Point-to-point communication is implemented using functions like MPI_Send and MPI_Recv, which allow direct data transfer between two processes. On the other hand, collective communication involves multiple processes and uses functions such as MPI_Bcast for broadcasting data, MPI_Reduce for reducing values, and MPI_Gather for collecting data from all processes into one. This practical helps in understanding how parallel programs can be developed for distributed systems using MPI. It highlights the difference between process-based communication and thread-based approaches, while also demonstrating how efficient coordination among processes can be achieved through message passing. MPI forms the foundation for building scalable parallel applications in scientific computing, simulations, and other computationally intensive tasks.

Vision of the Department

To be a well-known centre for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary area by developing Problem-solving skills through emerging technologies.

Procedure and Execution

(100 Words)

Code:

1. Point-to-Point Communication(Sen/Rece Example)

```
#include <stdio.h>
#include <mpi.h>

int main(int argc, char* argv[]) {
   int rank, size, data;

   MPI_Init(&argc, &argv);                  // Initialize MPI environment
   MPI_Comm_rank(MPI_COMM_WORLD, &rank);       // Get
process rank
   MPI_Comm_size(MPI_COMM_WORLD, &size);       // Get total
number of processes

   if (rank == 0) {
      data = 100;  // Process 0 prepares data
      MPI_Send(&data, 1, MPI_INT, 1, 0, MPI_COMM_WORLD);  //
Send to process 1
      printf("Process 0 sent data %d to process 1\n", data);
   }
   else if (rank == 1) {
      MPI_Recv(&data, 1, MPI_INT, 0, 0, MPI_COMM_WORLD,
MPI_STATUS_IGNORE); // Receive from process 0
      printf("Process 1 received data %d from process 0\n", data);
   }

   MPI_Finalize();  // Finalize MPI environment
   return 0;
}
```

2. Collective Communication (Broadcast Example)

```
#include <stdio.h>
#include <mpi.h>

int main(int argc, char* argv[]) {
   int rank, size, data;

   MPI_Init(&argc, &argv);                  // Initialize MPI environment
   MPI_Comm_rank(MPI_COMM_WORLD, &rank);       // Get
process rank
   MPI_Comm_size(MPI_COMM_WORLD, &size);       // Get total
number of processes
```

Vision of the Department

To be a well-known centre for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary area by developing Problem-solving skills through emerging technologies.

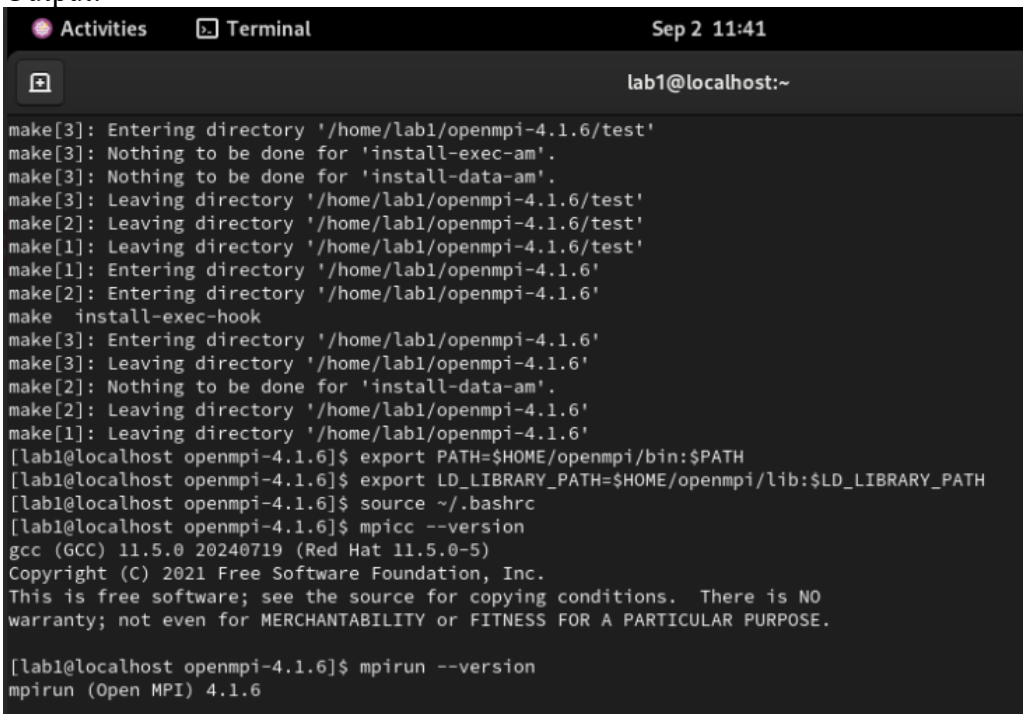
```
    if (rank == 0) {
        data = 42;  // Root process initializes data
    }

    // Broadcast data from process 0 to all processes
    MPI_Bcast(&data, 1, MPI_INT, 0, MPI_COMM_WORLD);

    printf("Process %d received data %d\n", rank, data);

    MPI_Finalize();  // Finalize MPI environment
    return 0;
}
```

Output:

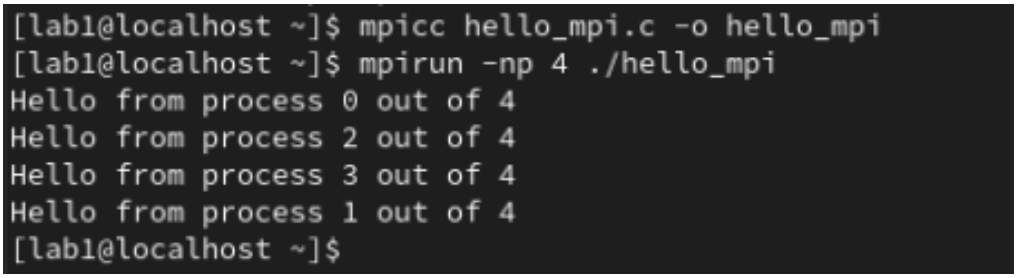


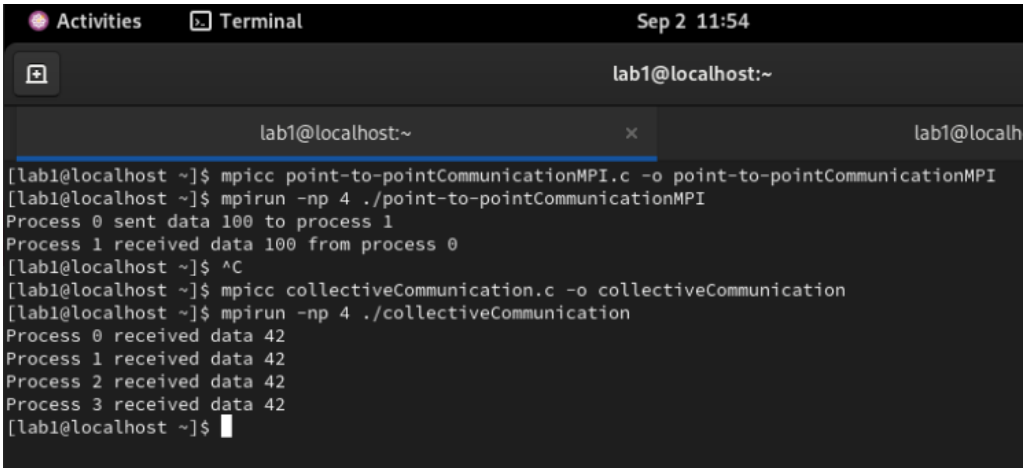
Vision of the Department

To be a well-known centre for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary area by developing Problem-solving skills through emerging technologies.





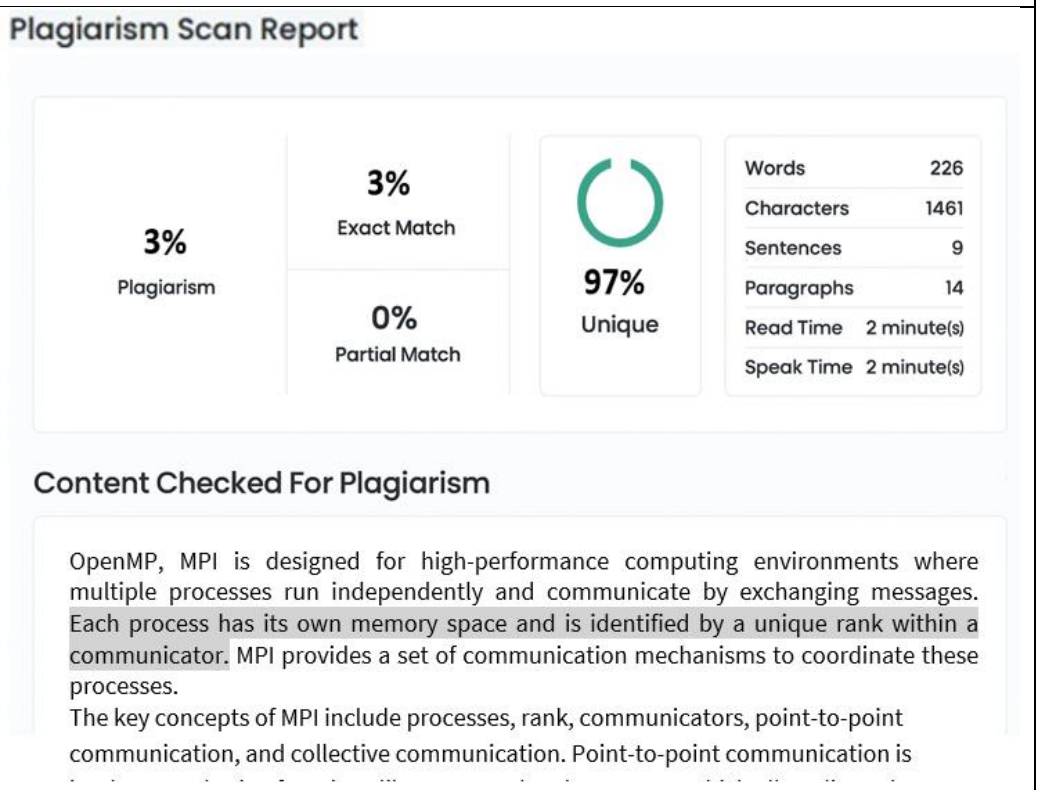
Output Analysis	In the Point-to-Point program, Process 0 sends the value 100 to Process 1, which successfully receives and displays it. In the Broadcast program, Process 0 initializes 42 and shares it with all processes using MPI_Bcast, and each process prints the same value.
Link of	https://github.com/sakshi-gokhale/Lab-HPC

Vision of the Department

To be a well-known centre for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary area by developing Problem-solving skills through emerging technologies.

student Github profile where lab assignment has been uploaded	
Conclusion	The practical shows that MPI enables both direct communication between two processes and efficient data sharing among all processes. This demonstrates the usefulness of MPI in building parallel programs for distributed memory systems.
Plag Report (Similarity index < 12%)	
Date	02/09/25