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
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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
05/08/25

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

Practical Number	1
Course Outcome	1. Understand and Apply Parallel Programming Concepts 2. Analyse and Improve Program Performance
Aim	Introduction to Linux and HPC Environment
Problem Definition	Introduction to Linux and HPC Environment
Theory (100 words)	Definition: High Performance Computing (HPC) refers to the use of supercomputers and parallel processing techniques to solve complex computational problems faster and more efficiently than traditional systems. Purpose: To Solve large-scale scientific, engineering, and data-intensive problems. To Reduce processing time. To Improve simulation accuracy. Key Components of HPC Systems: Compute Nodes (Processors/CPUs/GPUs) Memory (RAM) Storage (Disks/SSDs) Interconnect (High-speed Network) Software Stack (Compilers, Libraries, Tools) Parallel Computing – The Core of HPC Types of Parallelism: Data Parallelism: Same operation on different data Task Parallelism: Different tasks executed simultaneously Parallel Architectures: Shared Memory Architecture Multiple cores sharing the same RAM Easy

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	programming but limited scalability Distributed Memory Architecture Each processor has its own memory Requires message passing (MPI) Parallel Programming: It is a programming technique where multiple tasks or computations are performed simultaneously to solve a problem faster and more efficiently. Purpose: Speed up execution time Utilize multi-core and multi-processor hardware Handle large data sets Perform complex scientific simulations Why is Parallel Programming Needed in HPC? To Solve Large Problems Faster To Make Full Use of Modern Hardware To Handle Big Data and Complex Simulations To Achieve Better Performance and Scalability Energy and Cost Efficiency
Procedure and Execution (100 Words)	Code: ls cd Downloads pwd mkdir MyDocuments rm -rf MyDocuments top man dnf touch text.txt nano text.txt
	Output: [lab1@localhost ~]$ ls a.out job.sh prac.c [lab1@localhost ~]$ mkdir HPC [lab1@localhost ~]$ ls a.out HPC job.sh prac.c [lab1@localhost ~]$ touch first.txt [lab1@localhost ~]$ ls a.out first.txt HPC job.sh prac.c [lab1@localhost ~]$ vi first.txt [lab1@localhost ~]$ cat first.txt WElCOME TO HPC LEARNING !!

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```
[lab1@localhost ~]$ touch second.txt
[lab1@localhost ~]$ cp first.txt second.txt
[lab1@localhost ~]$ second.txt
bash: second.txt: command not found...
[lab1@localhost ~]$ cat second.txt
WElCOME TO HPC LEARNING !!
[lab1@localhost ~]$ cd HPC
[lab1@localhost HPC]$ mkdir YCCE
[lab1@localhost HPC]$ cd
[lab1@localhost ~]$ ls
a.out  first.txt  HPC  job.sh  prac.c  second.txt
```

```
top - 11:54:03 up  1:25,  2 users,  load average: 0.10, 0.12, 0.09
Tasks: 399 total,   1 running, 398 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.0 us,  0.0 sy,  0.0 ni, 99.9 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem :  15106.0 total,  10844.7 free,   3161.0 used,   1463.9 buff/cache
MiB Swap:   3814.0 total,   3814.0 free,      0.0 used.  11945.0 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
   9192 lab1      20   0  226140   4480   3456 R   0.3   0.0   0:00.05 top
      1 root      20   0  175044  17432  10752 S   0.0   0.1   0:01.80 systemd
      2 root      20   0       0      0      0 S   0.0   0.0   0:00.01 kthreadd
      3 root      20   0       0      0      0 S   0.0   0.0   0:00.00 pool_workqueue_
      4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-rcu_g
      5 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-sync_
      6 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-slub_
      7 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-netns
      9 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/0:0H-events_highpri
     11 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-mm_pe
     13 root      20   0       0      0      0 I   0.0   0.0   0:00.00 rcu_tasks_kthre
     14 root      20   0       0      0      0 I   0.0   0.0   0:00.00 rcu_tasks_rude_
     15 root      20   0       0      0      0 I   0.0   0.0   0:00.00 rcu_tasks_trace
     16 root      20   0       0      0      0 S   0.0   0.0   0:00.09 ksoftirqd/0
     17 root      20   0       0      0      0 I   0.0   0.0   0:00.53 rcu_preempt
     18 root      20   0       0      0      0 S   0.0   0.0   0:00.00 rcu_exp_par_gp_
     19 root      20   0       0      0      0 S   0.0   0.0   0:00.00 rcu_exp_gp_kthr
     20 root      rt   0       0      0      0 S   0.0   0.0   0:00.00 migration/0
     21 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/0
     23 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/0
     24 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/1
     25 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/1
     26 root      rt   0       0      0      0 S   0.0   0.0   0:00.18 migration/1
     27 root      20   0       0      0      0 S   0.0   0.0   0:00.01 ksoftirqd/1
     29 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/1:0H-events_highpri
     30 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/2
     31 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/2
     32 root      rt   0       0      0      0 S   0.0   0.0   0:00.19 migration/2
     33 root      20   0       0      0      0 S   0.0   0.0   0:00.00 ksoftirqd/2
     35 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/2:0H-events_highpri
     36 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/3
     37 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/3
     38 root      rt   0       0      0      0 S   0.0   0.0   0:00.19 migration/3
     39 root      20   0       0      0      0 S   0.0   0.0   0:00.00 ksoftirqd/3
     41 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/3:0H-events_highpri
     42 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/4
     43 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/4
     44 root      rt   0       0      0      0 S   0.0   0.0   0:00.00 migration/4
```

```
[lab1@localhost ~]$ lscpu
Architecture:             x86_64
  CPU op-mode(s):         32-bit, 64-bit
  Address sizes:          48 bits physical, 48 bits virtual
  Byte Order:             Little Endian
CPU(s):                   16
  On-line CPU(s) list:    0-15
Vendor ID:                AuthenticAMD
  Model name:             AMD Ryzen 7 4700G with Radeon Graphics
    CPU family:           23
    Model:                96
    Thread(s) per core:   2
    Core(s) per socket:   8
    Socket(s):            1
    Stepping:             1
    Frequency boost:      enabled
    CPU(s) scaling MHz:   95%
    CPU max MHz:          3600.0000
    CPU min MHz:          1400.0000
    BogoMIPS:             7186.86
    Flags:                fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pa
```

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	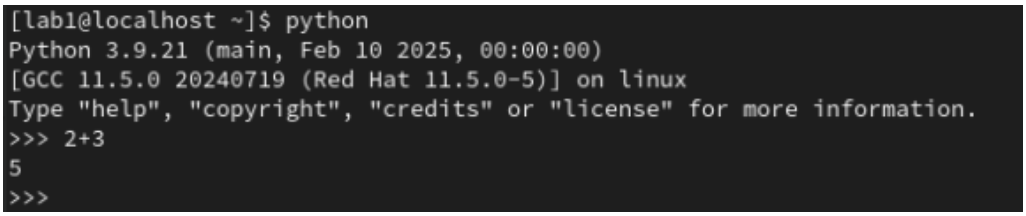 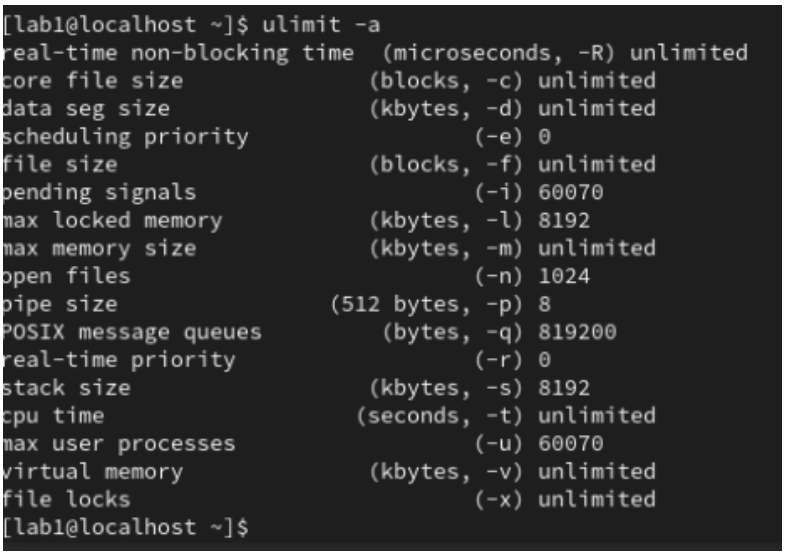
Output Analysis	We have taken a brief overview of the main concepts of HPC and have practices working on a live Linux environment running CentOS Stream 10.
Link of student Github profile where lab assignment has been uploaded	https://github.com/sakshi-gokhale/Lab-HPC
Conclusion	We have taken a brief overview of the main concepts of HPC and have practices working on a live Linux environment running CentOS Stream 10.
Plag Report (Similarity index < 12%)	

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	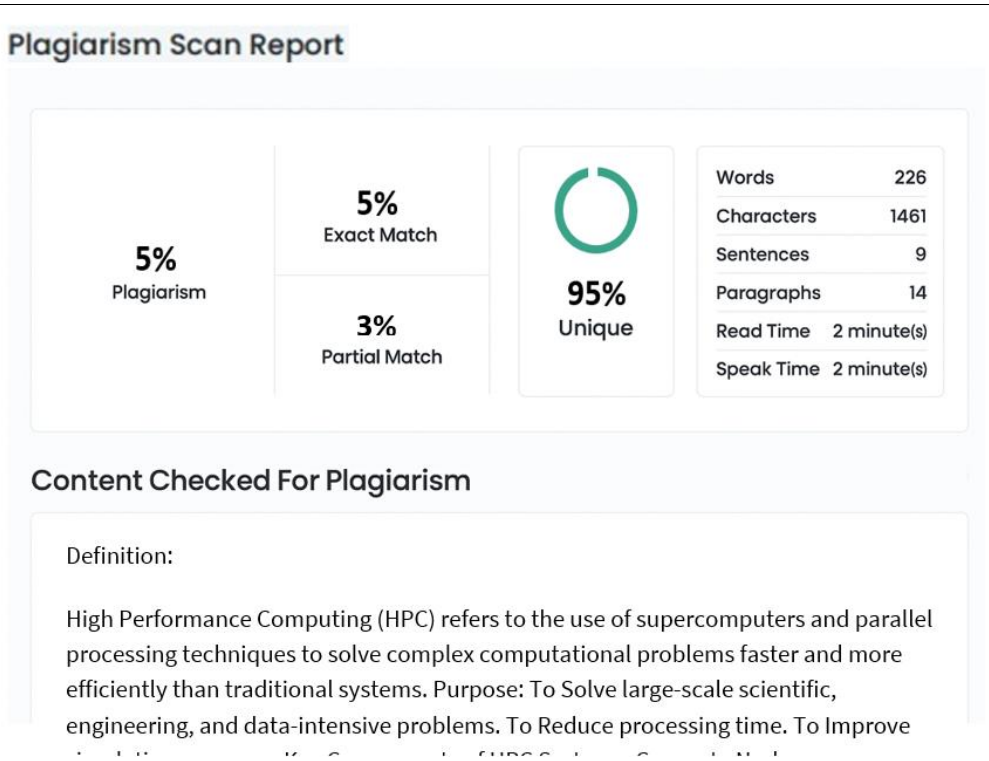
Date	05/08/25