# DepartmentofComputerTechnology

### VisionoftheDepartment

Tobeawell-knowncentreforpursuingcomputereducationthroughinnovativepedagogy,value-basededucationandindustrycollaboration.

### MissionoftheDepartment

Toestablishlearningambience forusheringincomputer engineeringprofessionalsincore andmultidisciplinary areaby developingProblem-solving skills through emerging technologies**.**

## Session2025-2026

|  |  |
| --- | --- |
| **Vision:**Tohelpbusinessesuncovercrucial insights | **Mission:**Tobeagooddatascientist |

**ProgramEducationalObjectivesoftheprogram(PEO):**(broadstatementsthatdescribethe professional and career accomplishments)

|  |  |  |  |
| --- | --- | --- | --- |
| PEO1 | **Preparation** | **P:Preparation** | **Pep-CL abbreviation pronounceasPep-si-lL easy to recall** |
| PEO2 | **CoreCompetence** | **E: Environment (LearningEnvironment)** |
| PEO3 | **Breadth** | **P: Professionalism** |
| PEO4 | **Professionalism** | **C:CoreCompetence** |
| PEO5 | **Learning**  **Environment** | **L:Breadth(Learningin**  **diverse areas)** |

**Program Outcomes(PO):**1.UnderstandandApplyParallelProgrammingConcepts

1. AnalyseandImprove Program Performance.
2. DemonstratePracticalSkillsinHPCToolsand Environments.

## Keywordsof 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

**PSOKeywords:** Cuttingedge technologies, Research

“Iaman engineer, and Iknow 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-edgetechnologies and Research*.

**Integrity:**Iwilladhere tothe LaboratoryCode ofConductandethicsinitsentirety.

## NameandSignature ofStudentand Date

Vaidehi Bisen

01/09/2025

# DepartmentofComputerTechnology

### VisionoftheDepartment

Tobeawell-knowncentreforpursuingcomputereducationthroughinnovativepedagogy,value-basededucationandindustrycollaboration.

### MissionoftheDepartment

Toestablishlearningambience forusheringincomputer engineeringprofessionalsincore andmultidisciplinary areaby developingProblem-solving skills through emerging technologies**.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Session** | **2025-26(ODD)** | | **CourseName** | **HPCLab** |
| **Semeste r** | **7** | | **CourseCode** | 22ADS706 |
| **RollNo** | 26 | | **Nameof Student** | Vaidehi Bisen |
|  | | | | |
| Practical Number | | 1 | | |
| Course Outcome | | 1. UnderstandandApplyParallelProgrammingConcepts 2. Analyseand ImproveProgram Performance | | |
| Aim | | IntroductiontoLinuxandHPC Environment | | |
| Problem Definition | | IntroductiontoLinuxandHPC Environment | | |
| Theory (100  words) | | **Definition:**  HighPerformanceComputing(HPC)referstotheuseof supercomputers and parallel processing techniques to solve complex computational problems faster and more efficiently than traditional systems.  **Purpose:**  ToSolvelarge-scalescientific,engineering,and data-intensive problems.  ToReduceprocessing time.  ToImprovesimulation accuracy.  **Key Components of HPC Systems:** ComputeNodes(Processors/CPUs/GPUs) Memory (RAM)  Storage(Disks/SSDs)  Interconnect (High-speed Network)SoftwareStack(Compilers,Libraries,Tools)  **ParallelComputing–TheCoreofHPC Types of Parallelism:**  **DataParallelism:**Sameoperationondifferentdata | | |

# DepartmentofComputerTechnology

### VisionoftheDepartment

Tobeawell-knowncentreforpursuingcomputereducationthroughinnovativepedagogy,value-basededucationandindustrycollaboration.

### MissionoftheDepartment

Toestablishlearningambience forusheringincomputer engineeringprofessionalsincore andmultidisciplinary areaby developingProblem-solving skills through emerging technologies**.**

|  |  |
| --- | --- |
|  | **TaskParallelism:**Differenttasksexecutedsimultaneously  **ParallelArchitectures:**  Shared Memory ArchitectureMultiplecoressharingthesameRAM  Easyprogrammingbutlimited scalability  **2.DistributedMemoryArchitecture** Each processor has its own memory Requires message passing (MPI) **Parallel Programming:**  Itisaprogrammingtechniquewheremultipletasks or computationsareperformedsimultaneouslytosolvea problem faster and more efficiently.  **Purpose:**  Speedupexecutiontime  Utilizemulti-coreandmulti-processorhardware Handle large data sets  Performcomplexscientificsimulations  **WhyisParallelProgrammingNeededinHPC?**  ToSolveLargeProblemsFaster  ToMakeFullUseofModern Hardware  To Handle Big Data and Complex Simulations ToAchieveBetterPerformanceandScalability |

# DepartmentofComputerTechnology

### VisionoftheDepartment

Tobeawell-knowncentreforpursuingcomputereducationthroughinnovativepedagogy,value-basededucationandindustrycollaboration.

### MissionoftheDepartment

Toestablishlearningambience forusheringincomputer engineeringprofessionalsincore andmultidisciplinary areaby developingProblem-solving skills through emerging technologies**.**

|  |  |
| --- | --- |
|  | EnergyandCostEfficiency  **WhyisParallelProgrammingNeededinHPC?**  ToSolveLargeProblemsFaster  ToMakeFullUseofModern Hardware  To Handle Big Data and Complex Simulations ToAchieveBetterPerformanceandScalability Energy and Cost Efficiency  **ParallelProgrammingModels:**  **SharedMemory(OpenMP,Threads):**Tasksshare the same memory space  **DistributedMemory(MPI):**Tasksrunondifferent machines and exchange messages  **Hybrid**:Mixofsharedanddistributed(usedin modern HPC)  **GPU-based(CUDA,OpenCL):**Thousandsof lightweight threads run in parallel on GPUs  **ProgrammingModelsinHPC:**  **Message Passing Interface (MPI)** Usedindistributedmemorysystems **OpenMP**  Sharedmemoryparallelismusingcompilerdirectives  **CUDA/OpenCL**  ProgrammingforGPUs |

# DepartmentofComputerTechnology

### VisionoftheDepartment

Tobeawell-knowncentreforpursuingcomputereducationthroughinnovativepedagogy,value-basededucationandindustrycollaboration.

### MissionoftheDepartment

Toestablishlearningambience forusheringincomputer engineeringprofessionalsincore andmultidisciplinary areaby developingProblem-solving skills through emerging technologies**.**

|  |  |
| --- | --- |
|  | **HybridModels**  MPI +OpenMPorMPI+CUDA  **WhyLinuxinHPC?**  LinuxisthestandardOSforHPCclusters Open-source, customizable, lightweight  Robustsupportfornetworking,processcontrol, and file systems  WidelysupportedbyHPCsoftwarelibrariesand tools |
| Code: | * ls * cd Downloads * pwd * mkdirMyDocuments * rm-rf MyDocuments * top * mandnf * touchtext.txt * nanotext.txt |
| Output |  |

# DepartmentofComputerTechnology

### VisionoftheDepartment

Tobeawell-knowncentreforpursuingcomputereducationthroughinnovativepedagogy,value-basededucationandindustrycollaboration.

### MissionoftheDepartment

Toestablishlearningambience forusheringincomputer engineeringprofessionalsincore andmultidisciplinary areaby developingProblem-solving skills through emerging technologies**.**

|  |  |
| --- | --- |
|  |  |

# DepartmentofComputerTechnology

### VisionoftheDepartment

Tobeawell-knowncentreforpursuingcomputereducationthroughinnovativepedagogy,value-basededucationandindustrycollaboration.

### MissionoftheDepartment

Toestablishlearningambience forusheringincomputer engineeringprofessionalsincore andmultidisciplinary areaby developingProblem-solving skills through emerging technologies**.**

|  |  |
| --- | --- |
|  |  |
| Output Analysis | We have taken a brief overview of the main concepts of HPC and have practicesworkingonaliveLinuxenvironmentrunningCentOSStream10. |
| Linkof | <https://github.com/VaidehiBisen14/HIGH-PERFORMANCE-COMPUTING> |

# DepartmentofComputerTechnology

### VisionoftheDepartment

Tobeawell-knowncentreforpursuingcomputereducationthroughinnovativepedagogy,value-basededucationandindustrycollaboration.

### MissionoftheDepartment

Toestablishlearningambience forusheringincomputer engineeringprofessionalsincore andmultidisciplinary areaby developingProblem-solving skills through emerging technologies**.**

|  |  |
| --- | --- |
| student Github profile where lab assignment has been  uploaded |  |
| Conclusion | We have taken a brief overview of the main concepts of HPC and have practicesworkingonaliveLinuxenvironmentrunningCentOSStream10. |
| PlagReport (Similarity index <12%) | A screenshot of a computer  AI-generated content may be incorrect. |
| Date | 01/09/2025 |