

**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-IL 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): (statements that describe what a student should be able to do and know by the end of a program)**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.

Sanskriti. Paunikar 28/08/2025

Name and Signature of Student and Date

(Signature and Date in Handwritten)



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Session	2025-26 (ODD)	Course Name	Deep Learning Lab
Semester	7 AIDS	Course Code	22ADS702
Roll No	21	Name of Student	Sanskriti. Paunikar

Practical Number	1
Course Outcome	CO1:- Understand and Apply Parallel Programming Concepts CO1:- Analyze and Improve Program Performance. CO3:- Demonstrate Practical Skills in HPC Tools and Environments.
Aim	Introduction to Linux and HPC Environment
Theory (100 words)	<p>High-Performance Computing (HPC) environments are sophisticated systems that use the power of multiple computers, called a cluster, to solve extremely complex problems. At its core, HPC relies on parallel processing, which means breaking down a large task into smaller pieces and having many different computers work on those pieces simultaneously.</p> <p>The Linux operating system is the universal foundation for these environments. Its open-source nature, robust command-line tools, and proven stability make it the ideal choice for managing the vast resources of an HPC cluster. By using Linux, system administrators can efficiently schedule tasks, allocate resources, and ensure the entire cluster operates at peak performance. This synergy between Linux and parallel processing allows for a level of computational power that is simply not achievable with a single machine, enabling breakthroughs in fields like scientific research, engineering simulations, and data analysis.</p>
Procedure and Execution (100 Words)	Steps of Implementation:- <ol style="list-style-type: none"> 1. Planning & Design 2. Hardware Setup 3. OS & Software Installation 4. Cluster Management 5. Testing & Optimization



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Code:

```
File Edit View Search Terminal Help
bash: module: command not found...
[lab1@localhost HPC]$ module load python/3.8
bash: module: command not found...
[lab1@localhost HPC]$ ulimit -a
real-time non-blocking time (microseconds, -R) unlimited
core file size (blocks, -c) unlimited
data seg size (kbytes, -d) unlimited
scheduling priority (-e) 0
file size (blocks, -f) unlimited
pending signals (-i) 65535
max locked memory (kbytes, -l) 8192
max memory size (kbytes, -m) unlimited
open files (-n) 1024
pipe size (512 bytes, -p) 8
POSIX message queues (bytes, -q) 819200
real-time priority (-r) 0
stack size (kbytes, -s) 8192
cpu time (seconds, -t) unlimited
max user processes (-u) 65535
virtual memory (kbytes, -v) unlimited
file locks (-x) unlimited
[lab1@localhost HPC]$ python
Python 3.8.11 (main, Feb 28 2025, 00:00:00)
[CC 11.5.0 20240719 (Red Hat 11.5.0-5)] on linux
Type "help", "copyright", "credits" or "license()" for more information.
>>> a=12
>>> b=6
>>> print(c)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'c' is not defined
>>> print(a+b)
18
>>> print(a*b)
72
>>> print(a/b)
2.0
>>>
[lab1@localhost HPC]$ cat job.sh
cat: job.sh: No such file or directory
[lab1@localhost HPC]$ cat first.sh
[lab1@localhost HPC]$ vi first.sh
[lab1@localhost HPC]$ vi first.sh
[lab1@localhost HPC]$
```

```
File Edit View Search Terminal Help
These shell commands are defined internally. Type 'help' to see this list.
Type 'help name' to find out more about the function 'name'.
Type 'info bash' to find out more about the shell in general.
Use 'man -k' or 'info' to find out more about commands not in this list.
A star (*) next to a name means that the command is disabled.

job_spec [A]
{ [expression]
  filename [arguments]
  :
  [arg...]
  [expression]
  alias [-p] [name=value] ...
  bg [job_spec]
  bind [-lpsvPX] [-m keymap] [-f filename] [-q name] [-u name] [-r keyseq] [-x key]
  break [n]
  builtin [shell-builtin [arg ...]]
  caller [expr]
  case WORD in (PATTERN) [PATTERN]... COMMANDS ;;)... esac
  cd [-L|-P] [-e] [-q] [dir]
  command [-pv] command [arg ...]
  compgen [-abdefgkxuv] [-o option] [-A action] [-G globpat] [-W wordlist] [-f func]
  complete [-abdefgkxuv] [opt] [-DEI] [-o option] [-A action] [-G globpat] [-W word]
  compopt [-o] [-o option] [-DEI] [name ...]
  continue [n]
  coproc [NAME] command [redirections]
  declare [-aAfgiIlrtux] [-p] [name=value] ...
  dirs [-clpv] [+N] [-N]
  dtest [-h] [-r] [jobspec ...] [pid ...]
  echo [-ne] [arg ...]
  enable [-a] [-dnps] [-f filename] [name ...]
  eval [arg ...]
  exec [-cl] [-a name] [command [argument ...]] [redirection ...]
  exit [n]
  export [-fn] [name=value] ... or export -p
  false
  fc [-e ename] [-lnr] [first] [last] or fc -s [patrep] [command]
  fg [job_spec]
  for NAME {in WORDS ...} ; do COMMANDS; done
  for (( exp1; exp2; exp3 )); do COMMANDS; done
  function name { COMMANDS ; } or name () { COMMANDS ; }
  getopts optstring name [arg ...]
  hash [-lr] [-p pathname] [-dt] [name ...]
  help [-me] [pattern ...]
[lab1@localhost HPC]$ touch p2.txt
[lab1@localhost HPC]$ vi p2.txt
[lab1@localhost HPC]$ 69*****
[lab1@localhost HPC]$ 396*****
[lab1@localhost HPC]$ 396*****
[lab1@localhost HPC]$ vi p2.txt
[lab1@localhost HPC]$ touch second.txt
[lab1@localhost HPC]$ vi second.txt
[lab1@localhost HPC]$ cp p2.txt second.txt
[lab1@localhost HPC]$ cp p2.txt second.txt
[lab1@localhost HPC]$ vi second.txt
[lab1@localhost HPC]$ vi p2.txt
[lab1@localhost HPC]$ rm second.txt
[lab1@localhost HPC]$ top
top - 11:20:39 up 1:09, 2 users, load average: 0.15, 0.07, 0.07
  PID Mem - 13168.7 total, 11891.4 free, 1391.3 used, 1382.2 buff/cache
  Wb Swap: 3814.0 total, 3814.0 free, 0.0 used, 13114.4 avail Mem

  PID USER PR NI VIRT RES SHR S CPU MEM TIME+ COMMAND
  6127 lab1 20 0 0.0t 0.0t 0.0t S 0.7 0.6 0:00.35 Web Content
  2841 lab1 20 0 0.0t 0.0t 0.0t S 0.3 1.9 0:27.00 gnome-shell
  6861 lab1 20 0 0.0t 0.0t 0.0t S 0.3 1.0 0:01.00 Isolated Web Co
  6778 lab1 20 0 0.0t 0.0t 0.0t R 0.3 0.0 0:01.34 top
```



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```
File Edit View Search Terminal Help

[lab1@localhost HPC]$ 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: 96%
CPU max MHz: 3600.0000
CPU min MHz: 1400.0000
BogoMIPS: 7186.27
Flags: fpu_vme_de_pse_tsc_msr_pae_mce_cx8_apic_sep_mtr_pge_mca_cmov_pat_pae3d_clflush_mmx_fxsr_sse2_ht_syscall_nx_mmxext_fxsr_opt_pdpbeigh_rdtscp
    constant_tsc_rep_good_nopl_xtopology_nopl_tsc_quad_extd_apicid_aperfperf_rapl_ppl_pcmulbq_monitor_ssos3_hm_cx16_sse41_sse42_monitor
    xop_tsc_errata_100_101_102_103_104_105_106_107_108_109_110_111_112_113_114_115_116_117_118_119_120_121_122_123_124_125_126_127_128_129_130_131_132_133_134_135_136_137_138_139_140_141_142_143_144_145_146_147_148_149_150_151_152_153_154_155_156_157_158_159_160_161_162_163_164_165_166_167_168_169_170_171_172_173_174_175_176_177_178_179_180_181_182_183_184_185_186_187_188_189_190_191_192_193_194_195_196_197_198_199_200_201_202_203_204_205_206_207_208_209_210_211_212_213_214_215_216_217_218_219_220_221_222_223_224_225_226_227_228_229_230_231_232_233_234_235_236_237_238_239_240_241_242_243_244_245_246_247_248_249_250_251_252_253_254_255_256_257_258_259_260_261_262_263_264_265_266_267_268_269_270_271_272_273_274_275_276_277_278_279_280_281_282_283_284_285_286_287_288_289_290_291_292_293_294_295_296_297_298_299_300_301_302_303_304_305_306_307_308_309_310_311_312_313_314_315_316_317_318_319_320_321_322_323_324_325_326_327_328_329_330_331_332_333_334_335_336_337_338_339_340_341_342_343_344_345_346_347_348_349_350_351_352_353_354_355_356_357_358_359_360_361_362_363_364_365_366_367_368_369_370_371_372_373_374_375_376_377_378_379_380_381_382_383_384_385_386_387_388_389_390_391_392_393_394_395_396_397_398_399_400_401_402_403_404_405_406_407_408_409_410_411_412_413_414_415_416_417_418_419_420_421_422_423_424_425_426_427_428_429_430_431_432_433_434_435_436_437_438_439_440_441_442_443_444_445_446_447_448_449_450_451_452_453_454_455_456_457_458_459_460_461_462_463_464_465_466_467_468_469_470_471_472_473_474_475_476_477_478_479_480_481_482_483_484_485_486_487_488_489_490_491_492_493_494_495_496_497_498_499_500_501_502_503_504_505_506_507_508_509_510_511_512_513_514_515_516_517_518_519_520_521_522_523_524_525_526_527_528_529_530_531_532_533_534_535_536_537_538_539_540_541_542_543_544_545_546_547_548_549_550_551_552_553_554_555_556_557_558_559_560_561_562_563_564_565_566_567_568_569_570_571_572_573_574_575_576_577_578_579_580_581_582_583_584_585_586_587_588_589_590_591_592_593_594_595_596_597_598_599_600_601_602_603_604_605_606_607_608_609_610_611_612_613_614_615_616_617_618_619_620_621_622_623_624_625_626_627_628_629_630_631_632_633_634_635_636_637_638_639_640_641_642_643_644_645_646_647_648_649_650_651_652_653_654_655_656_657_658_659_660_661_662_663_664_665_666_667_668_669_670_671_672_673_674_675_676_677_678_679_680_681_682_683_684_685_686_687_688_689_690_691_692_693_694_695_696_697_698_699_700_701_702_703_704_705_706_707_708_709_710_711_712_713_714_715_716_717_718_719_720_721_722_723_724_725_726_727_728_729_730_731_732_733_734_735_736_737_738_739_740_741_742_743_744_745_746_747_748_749_750_751_752_753_754_755_756_757_758_759_760_761_762_763_764_765_766_767_768_769_770_771_772_773_774_775_776_777_778_779_780_781_782_783_784_785_786_787_788_789_790_791_792_793_794_795_796_797_798_799_800_801_802_803_804_805_806_807_808_809_810_811_812_813_814_815_816_817_818_819_820_821_822_823_824_825_826_827_828_829_830_831_832_833_834_835_836_837_838_839_840_841_842_843_844_845_846_847_848_849_850_851_852_853_854_855_856_857_858_859_860_861_862_863_864_865_866_867_868_869_870_871_872_873_874_875_876_877_878_879_880_881_882_883_884_885_886_887_888_889_890_891_892_893_894_895_896_897_898_899_900_901_902_903_904_905_906_907_908_909_910_911_912_913_914_915_916_917_918_919_920_921_922_923_924_925_926_927_928_929_930_931_932_933_934_935_936_937_938_939_940_941_942_943_944_945_946_947_948_949_950_951_952_953_954_955_956_957_958_959_960_961_962_963_964_965_966_967_968_969_970_971_972_973_974_975_976_977_978_979_980_981_982_983_984_985_986_987_988_989_990_991_992_993_994_995_996_997_998_999_1000
    xop_tsc_errata_100_101_102_103_104_105_106_107_108_109_110_111_112_113_114_115_116_117_118_119_120_121_122_123_124_125_126_127_128_129_130_131_132_133_134_135
```

```
File Edit View Search Terminal Help
Virtualization:
Caches (sum of all):
  L1d: 256 MiB (8 instances)
  L1i: 256 MiB (8 instances)
  L2: 4 MiB (8 instances)
  L3: 8 MiB (2 instances)
NUMA:
  NUMA node(s): 1
  NUMA nodes CPU(s): 0-15
  Vulnerability:
    Gather data sampling: Not affected
    I1b multihit: Not affected
    L1rrf: Not affected
    Mds: Not affected
    Meltdown: Not affected
    Mmio stale data: Not affected
    Rax file data sampling: Not affected
    Retbleed: Mitigation: untrained return thunk; SMT enabled with STIBP protection
    Spec rstack overflow: Mitigation: Safe RET
    Spec store bypass: Mitigation: Speculative Store Bypass disabled via prctl
    Spectre v1: Mitigation: usercopy/swapgs barriers and __user pointer sanitization
    Spectre v2: Mitigation: Retpolines; IBPB conditional; STIBP always-on; RSB filling; PBSRS-EBRS Not affected; BHI Not affected
    Srbds: Not affected
    Task async abort: Not affected
[lab@localhost ~]$ module load python/3.8
bash: module: command not found...
[lab@localhost ~]$ module load python/3.8
bash: module: command not found...
[lab@localhost ~]$ module load python/3.8
bash: module: command not found...
[lab@localhost ~]$ module load python/3.8.10
bash: module: command not found...
[lab@localhost ~]$ module load python/3.8
bash: module: command not found...
[lab@localhost ~]$ ulimit -a
real-time non-blocking time (microseconds, -R) unlimited
core file size (blocks, -c) unlimited
data seg size (kbytes, -d) unlimited
scheduling priority (nice, -n) 0
file size (blocks, -f) unlimited
pending signals (-t) 65535
max locked memory (kbytes, -l) 8192
max memory size (kbytes, -m) unlimited
```

```

File Edit View Search Terminal Help
s53.sh

[labi@localhost ~]$ cd
[labi@localhost ~]$ cd hpc
hush: cd: hpc: No such file or directory
[labi@localhost ~]$ cd HPC
[labi@localhost HPC]$ cdmkdir first.sh
hush: cdmkdir: command not found.
[labi@localhost HPC]$ touch first.sh
[labi@localhost HPC]$ ls
first.sh
[labi@localhost HPC]$ mkdir YCCE
[labi@localhost HPC]$ ls
first.sh YCCE
[labi@localhost HPC]$ help
GNU bash, version 5.1.8(1)-release (x86_64-redhat-linux-gnu)
These shell commands are defined internally. Type help to see this list.
Type 'help name' to find out more about the function 'name'.
Use 'info bash' to find out more about the shell in general.
Use 'man -k' or 'info' to find out more about commands not in this list.

A star (*) next to a name means that the command is disabled.

job-spec [k]
  (expression)
  filename [arguments]

arg...
  [[ expression ]]
  alias [-p] [name=value] ... ]
  bg [job-spec ...]
  bind [-lspxyvZ] [= keymap] [-f filename] [-c name] [-u name] [-r keyseq] [-x ke
  break [n]
  builtin [shell-builtin [arg ...]]
  caller [expr]
  case WORD in [PATTERN] ... ) COMMANDS ;; ... esac
  cd [-L|-P] [-i] [-q] [dir]
  command [-p] command [arg ...]
  compgen [-abdeGfkvw] [-o option] [-A action] [-G globpat] [-W wordlist] [-f wo
  compopt [-o] [-o option] [-DEI] [-a action] [-G globpat] [-F func]
  compopt [-o] [-o option] [-DEI] [name ...]
  continue [n]
  source [NAME] command [redirections]
  declare [-aAfFiIlrtux] [-p] [name=value] ...

history [-c] [-d offset] [n] or history -anrw [filename] or history -ps arg [arg-
  IF COMMANDS: then COMMANDS; [ elif COMMANDS; then COMMANDS; ... ] else COMMANDS
  jobs [-lprq] [jobspec ...] or jobs -w command [args]
  kill [-s sigspec] [-n signum] [-sigspec] pid | jobspec ... or kill -l [sigspec]
  let arg [arg ...]
  local [option] name[=value] ...
  logout [n]
  mpdfile [-d delim] [-n count] [-O origin] [-s count] [-t] [-u fd] [-C callback] >
  popd [-n] [-k] [-H]
  printf [-v var] format [arguments]
  pushd [-n] [-N] [-d] dir
  pwd [-L|-P]
  read [-ers] [-a array] [-d delim] [-t text] [-n nchars] [-N nchars] [-p prompt] >
  readarray [-d delim] [-n count] [-O origin] [-s count] [-t] [-u fd] [-C callback]
  readonly [-aaf] [name=value] ... or readonly -p
  return [n]
  select NAME [in WORDS ... ] do COMMANDS; done
  readonly [-aaf] [name=value] ... do options-name [-] [arg ...]
  shift [n]
  shopt [-psau] [-q] [optname ...]
  source filename [arguments]

```





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	Output: 
Output Analysis	Checking the output files to ensure the job ran without errors and produced the correct results as expected. Analyzing metrics like execution time, CPU usage, and memory consumption to determine how efficiently the job used the cluster's resources. This helps in optimizing future runs.
Github link	https://github.com/sanskruti-1234/HPC.git
Conclusion	This project taught us how to use a supercomputer. We learned to write a simple list of instructions, send it to the computer's manager (the "scheduler"), and then check the results.
Plag Report (Similarity index < 12%)	
Date	28/08/2025