A screenshot of a cell phone

Description generated with very high confidence

**Course Plan**

|  |  |
| --- | --- |
| **Department :** | Department of Computer Science and Engineering |
| **Course Name & code :** | PARALLEL COMPUTER ARCHITECTURE AND PROGRAMMING & CSE 3202 |
| **Semester & branch :** | VI Sem. B.TECH. & CSE |
| **Name of the faculty :** | DR. N GOPALAKRISHNA KINI |
| **No of contact hours/week:** | 3 |

**ASSESSMENT PLAN:**

|  |  |
| --- | --- |
| 1. **In Semester Assessments** | 50% |
| * Written tests : | 2 SESSIONALS EACH OF 15 MARKS (TOTAL 30 MARKS) |
| * Assignment/Quiz/Seminar : | 3 ASSIGNMENTS (6 + 6 + 8 =TOTAL 20 MARKS) |
| 1. **End Semester Examination** | 50% |
| * Written examination of 3 hours duration (Max. Marks: 50) | |

|  |  |
| --- | --- |
| **Portions for Assignment/Quiz/Seminar etc.…** | |
| **Sl. no.** | **Topics/Lessons** |
| **1** | L1 – L9 |
| **2** | L10 – L18 |
| **3** | L19 – L 30 |
| **4** | L1 – L30 |
| **5** | Click or tap here to enter text. |
| **Portions for Sessional Test** | |
| **Test no.** | **Topics/Lessons** |
| **1** | L1 – L15 |
| **2** | L16 – L30 |

**Course Outcomes (COs)**

***At the end of this course, the student should be able to:***

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **No. of Contact Hours** | **Program Outcomes (POs) addressed** |
| CO1: | • Tell about the concepts related to parallel programming languages, architecture of GPU and parallel virtual machines. | 7 | PO2, PO12 |
|  |
| CO2: | • Write MPI programs using point-to-point and collective communication primitives. | 6 | PO3, PO4, PO5, PO6, PO10, PO12 |
| CO3: | • Solve parallel programming tasks using OpenCL. | 13 | PO3, PO4, PO5, PO6, PO10, PO12 |
| CO4: | • Analyze thread and memory organization in CUDA and writing kernel programs. | 10 | PO3, PO4, PO5, PO6, PO10, PO12 |
| CO5: | Click or tap here to enter text. | Hrs. | POs |
|  |  |  |  |

**Course Plan**

|  |  |  |
| --- | --- | --- |
| **L. No.** | **Topics** | **Course Outcome Addressed** |
| **L0** | INTRODUCTION TO THE COURSE | CO1 |
| **L1** | MESSAGE PASSING PROGRAMMING : Introduction, Message passing model | CO2 |
| **L2** | GPU ARCHITECTURE: Introduction, GPUs as parallel computers, Architecture of a modern GPU, Need for parallelism | CO1 |
| **L3** | Tutorial 1 on GPU Architecture | CO1 |
| **L4** | MPI basic data types and functions, Point-to-point communication- MPI\_Send, MPI\_Recv, MPI\_Ssend, MPI\_Bsend | CO2 |
| **L5** | Parallel programming languages and models | CO1 |
| **L6** | Tutorial 2 on MPI programming using point to point communication | CO2 |
| **L7** | Collective communication: MPI\_Bcast, MPI\_Scatter, MPI\_Gather, MPI\_Reduce, MPI\_Allgather, MPI\_Alltoall, MPI\_Scan | CO2 |
| **L8** | History of GPU Computing- Evolution of graphics pipelines, GPU computing | CO1 |
| **L9** | Tutorial 3 on MPI programs using Collective communication | CO2 |
| **L 10** | Benchmarking parallel performance, MPI error handling functions | CO2 |
| **L11** | OpenCL ARCHITECTURE : Introduction, OpenCL standard, OpenCL specification, Kernels and openCL execution model, Platform and Devices | CO3 |
| **L12** | Tutorial 4 on OpenCL functions | CO3 |
| **L. No.** | **Topics** | **Course Outcome Addressed** |
| **L 13** | Execution Environment- Context, Command Queues, Buffers | CO3 |
| **L 14** | Program Object and Kernel Object, Program layout, Memory model, Writing Kernels | CO3 |
| **L 15** | Tutorial 5 on OpenCL functions | CO3 |
| **L16** | OpenCL Device Architecture – Superscalar Execution, VLIW, Hardware Multithreading | CO3 |
| **L 17** | OpenCL PROGRAMMING : OpenCL APIs, OpenCL programs for vector-vector addition,Selection Sorting | CO3 |
| **L18** | Tutorial 6 on OpenCL functions, OpenCL programs | CO3 |
| **L19** | Merge Sorting | CO3 |
| **L 20** | Binary search, String search, Calculation of value of π | CO3 |
| **L 21** | Tutorial 7 on OpenCL programs | CO3 |
| **L 22** | Product of 2 matrices, Matrix-vector multiplication, Transpose of a matrix | CO3 |
| **L23** | INTRODUCTION TO CUDA: Introduction, Data Parallelism | CO4 |
| **L 24** | Tutorial 8 on OpenCL programs | CO4 |
| **L25** | CUDA Program Structure | CO4 |
| **L 26** | Matrix-Matrix Multiplication, Device memories and Data transfer | CO4 |
| **L27** | Tutorial 9 on CUDA programs | CO4 |
| **L 28** | Kernel functions and Threads | CO4 |
| **L29** | Runtime APIs and Error Handling, CUDA THREADS AND MEMORY ORGANIZATION: Introduction, CUDA Thread Organization | CO4 |
| **L 30** | Tutorial 10 on CUDA programs | CO4 |
| **L31** | CUDA Thread Organization (Contd..) | CO4 |
| **L32** | Importance of Memory Access Efficiency, CUDA Device Memory types | CO4 |
| **L33** | Tutorial 11 on CUDA programs | CO1 |
| **L 34** | PARALLEL VIRTUAL MACHINE : Introduction, Starting PVM | CO1 |
| **L 35** | Process Management, Communication functions, Comparison of parallel programming models | CO1 |
| **L 36** | Tutorial 12 on Parallel virtual machines | CO1 |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**References:**

|  |  |
| --- | --- |
| 1. | D. Kirk and W. Hwu , “Programming Massively Parallel Processors –A Hands-on approach”, Elsevier Inc., 1st Edition, 2010. |
| 2. | Michael J. Quinn, “Parallel Programming in C with MPI and OpenMP”, McGraw Hill Edition, 2003. |
| 3. | Benedict R. Gaster, Lee Howes, David R, Perhaad Mistry, Dana Schaa, “Heterogeneous Computing with OpenCL”, Elsevier Inc., 1st Edition, 2012. |
| 4. | V.Rajaraman, C. Siva Ram Murthy, “Parallel Computers Architecture and Programming” Prentice-Hall India, 2000. |
| 5. | Shane Cook, “CUDA Programming: A developer’s guide to parallel computing with GPUs”, Morgan Kaufman Publication, Elsevier, 2013. |
| 6. | Jason Sanders, Edward Kandrot, “CUDA By example: An Introduction to General Purpose GPU Programming”, Addison Wesley, 2011. |
| 7. | “CUDA C Programming Guide”, nVIDIA, 2012. |

|  |  |
| --- | --- |
| **Submitted by:** | DR N GOPALAKRISHNA KINI |

**(Signature of the faculty)**

|  |  |
| --- | --- |
| **Date:** | 04-01-2018 |

|  |  |
| --- | --- |
| **Approved by:** | DR. ASHALATHA NAYAK |

**(Signature of HOD)**

|  |  |
| --- | --- |
| **Date:** | 04-01-2018 |

**Faculty members teaching the course (IF MULTIPLE sections EXIST):**

|  |  |  |  |
| --- | --- | --- | --- |
| **FACULTY** | **Section** | **FACULTY** | **Section** |
| Ms. Jyothi Upadhya | A |  |  |
| Mr. Ashwath Rao B | B |  |  |
| Mr. Prakash Aithal | C |  |  |
| Dr.N.Gopalakrishna Kini | D |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**\*\*\*\*\*\*\*\*\***