**Walchand College of Engineering, Sangli**
*(Government Aided Autonomous Institute)*

**AY 2022-23**

## Course Information

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT501 |
| **Course Name** | Advanced Algorithms |
| **Desired Requisites:** | Computer Algorithms |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

## Course Objectives

| | |
|---|---|
| **1** | To exercise the Graph Algorithms |
| **2** | To classify shortest path computing techniques |
| **3** | To compare the algorithms based on performance and complexities |

## Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Solve graph related algorithms with real world problems | Apply |
| **CO2** | Calculate the shortest path for a given distance based scenario | Analyze |
| **CO3** | Verify the solution for engineering problem using graph algorithm | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Elementary Graph Algorithms and MST:** Representation of Graphs, BFS and DFS, Topological Sort, Strongly Connected Components Growing a Minimum Spanning Tree, Algorithms of Kruskal and Prim | 7 |
| II | **Single Source Shortest Path Algorithms:** Bellman-Ford Algorithm, SSSP in Directed Acyclic Graphs, Dijkstra's Algorithm, Difference Constraints and Shortest Paths, Proofs of Shortest-paths Properties | 6 |
| III | **APSP and Maximum Flow:** Shortest Paths and Matrix Multiplication, Floyd-Warshall Algorithm, Johnson's Algorithm for Sparse Graphs Flow Networks, Ford-Fulkerson Method, Maximum Bipartite Matching, Push-relable algorithms | 7 |
| IV | **Multithreaded Algorithms and Matrix Operations:** Dynamic Multithreading fundamentals, Multithreaded Matrix Multiplication, Multithreaded merge sort Solving systems of linear equations, Inverting matrices, Symmetric positive-definite matrices and least-squares approximation | 6 |
| V | **NP-Completeness:** Polynomial-time verification, NP-completeness and reducibility, NPcompleteness proofs, NP-complete problems | 7 |
| VI | **Approximation Algorithms:** The vertex-cover problem, The traveling-salesman problem, The set-covering problem, Randomization and linear programming, The subset-sum problem | 6 |

| Text Books | |
|---|---|
| 1 | Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, *"Introduction to Algorithms*", Third Edition the MIT Press Cambridge, London, England |

| References | |
|---|---|
| 1 | Horrowitz, Sahni Rajasekaran*, "Computer Algorithms",* Computer Science, W. H. Freeman and company Press, New york |

| Useful Links | |
|---|---|
| 1 | To be declared during the course on the CMS. |
| 2 | |

## CO-PO Mapping

| Programme Outcomes (PO) | | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | | | | |
| **CO2** | | 3 | | 2 | 1 | |
| **CO3** | 3 | | | | 2 | 1 |

## Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

## Assessment Plan based on Bloom's Taxonomy Level

| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

**Walchand College of Engineering, Sangli**
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**AY 2022-23**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT502 |
| **Course Name** | Unix Internal |
| **Desired Requisites:** | Operating System |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To interpret design principal and philosophy of the Unix/Linux OS. |
| **2** | To elaborate the architecture of Unix/Linux OS. |
| **3** | To use system call of Linux/Unix. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Interpret design principal and philosophy of the Unix/Linux OS | Apply |
| **CO2** | Analyze the architecture of Unix/Linux OS | Analyze |
| **CO3** | Compare various IPCs Linux OS | Analyze |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Unix Internals**<br>General Overview of the System - History, System Structure, User Perspective, Operating System Services, Assumption About Hardware. | 7 |
| II | **Introduction to the Kernel**<br>Architecture of UNIX OS, Introduction to system concepts, Kernel Data Structure, System Administration Architecture of UNIX OS, Introduction to system concepts, Kernel Data Structure, System Administration | 6 |
| III | **Internal Representation of Files**<br>Inodes, structure of the regular file, directories, conversion of a pathname to inode, super block, inode assignment to a new file, allocation of disk blocks, other file types. | 7 |
| IV | **Structure of Process**<br>Process stages and transitions, layout of system memory, the context of a Process, saving context of a process, manipulation of the process address space. | 7 |
| V | **Process Control**<br>Process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, the shell, system Boot and the Init process, Process Scheduling, system call for time, clock. | 6 |
| VI | **Inter Process Communication**<br>Types of IPCs, Importance of IPC and IPS (Inter process Synchronization), Shared Memory, Massage Queue, Semaphore, MPI, Open MP, Threads Vs Process, Comparison of various IPCs | 6 |

**Text Books**

| | |
|---|---|
| 1 | Maurice J. Bach, "*The Design of Unix Operating System*", PHI, 1994. |
| 2 | Sumitabha Das, "*Unix Concepts and Applications*", TMGH, 4th Edition, 2017. |

| References | |
|---|---|
| 1 | Beej Jorgensen , "*Beej's Guide to Unix IPC*", Brian -Beej Jorgensen Hall, Version 1.1.2, December, 2010 |
| 2 | Kay Robbins, Steve Robbins, "*UNIX Systems Programming: Communication, Concurrency and Threads"*, Pearson, 2nd Edition, December, 2015 |
| 3 | Eric Raymond , "*Art of UNIX Programming*", Pearson, 1st edition, October, 2003 |

| | **Useful Links** |
|---|---|
| 1 | https://nptel.ac.in/courses/106/102/106102132/<br>(Intro to Unix System Calls Part 1/2, Kernel Data Structures, Process structure, Context Switching, Fork, Context-Switch, Process Control Block, Locking, File System Implementation, File System Operation) |
| 2 | https://onlinecourses.nptel.ac.in/noc19_cs50<br>(Processes, Scheduling in Linux, IPC, thread) |
| 3 | https://github.com/suvratapte/Maurice-Bach-Notes |
| 4 | https://github.com/mit-pdos/xv6-public |
| 5 | https://www.geeksforgeeks.org/introduction-to-unix-system/ |
| 6 | http://www.di.uevora.pt/~lmr/syscalls.html |

**CO-PO Mapping**

**Programme Outcomes (PO)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | | | | |
| **CO2** | | | 1 | | | |
| **CO3** | 3 | | | 2 | | |

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level**

| Bloom's Taxonomy Level | MSE | ISE | ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | | M.Tech. (CS and IT) | | | |
| **Class, Semester** | | First Year M. Tech., Sem I | | | |
| **Course Code** | | 6IT560 | | | |
| **Course Name** | | Research Methodology | | | |
| **Desired Requisites:** | | | | | |
| | | | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
| **Lecture** | - | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | - | | | | |
| **Interaction** | 2 Hrs/Week | **Credits: 2** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To identify the research problem with scientific methods |
| **2** | To formulate research problems and hypothesis for dissertation |
| **3** | To evaluate the research artefacts for data and result analysis |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Interpret the thrust area for dissertation | Apply |
| **CO2** | Identify various data collection methods | Analyze |
| **CO3** | Formulate the research publication | Design |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction**<br>Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Various stages of research, Reference collection | 5 |
| II | **Research Problem and Design**<br>Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, Fundamentals of Research Design, Need for Research Design, Different Research Designs | 4 |
| III | **Data Collection Techniques**<br>Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Schedules, Other Methods of Data Collection | 4 |
| IV | **Processing and Analysis of Data**<br>Processing Operations, Types of Analysis, Statistics in Research, Measures of Asymmetry, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression , Partial Correlation, Association of Attributes | 4 |
| V | **Computers and Research**<br>Role of computer in research process, Data Analysis and Visualization Techniques, Data Storage, Scientific Simulations, Plagiarism Checker | 4 |
| VI | **Technical writing methods**<br>Paper Writing, Technical report, Types of Technical report, dissertation/thesis<br>writing. Presentation techniques, Patents and other IPRs, Tools for report writing. | 5 |

**List of Experiments:**

1. Compare difference between research methodology and research method
2. Compare and contrast between basic research and applied research in brief
3. Perform the literature survey using following tool:
4. Literature Survey Using Web of Science
5. Literature Survey Using Scopus
6. Design a model for a engineering research
7. Compare between model and process in engineering research
8. Perform data analysis using modern engineering tools
9. Apply the following characteristics of quality research to engineering problem:
   a) Identifying the problem
   b) Reviewing literature
   c) Setting objectives and hypothesis
   d) Choosing the study of design
   e) Deciding on the sample design
   f) Collecting data
   g) Processing and analyzing data
   h) Writing the report
   i) Disseminating the findings

| Text Books | |
|---|---|
| 1 | Kothari C. R, *"Research Methodology",* 2nd Edition, New Age International, 1990 |
| 2 | Chopra Deepak and Sondhi Neena, *"Research Methodology : Concepts and cases",* 2nd<br>Edition, Vikas Publishing House, New Delhi, 2015 |

| References | |
|---|---|
| 1 | Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction For Science & Engineering Students", 1st Edition, Kenwyn Juta & Co. Ltd.,1996 |
| 2 | G. Ramamurthy, "Research Methodology", 2nd Edition, Dream Tech Press, New Delhi, 2015 |

| Useful Links | |
|---|---|
| 1 | https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview - Academic Research & Report<br>Writing |
| 2 | https://www.scopus.com/search/form.uri?display=basic#basic |
| 3 | https://onlinecourses.nptel.ac.in/noc21_ge12/preview - Qualitative Research Methods And Research Writing |
| 4 | https://onlinecourses.nptel.ac.in/noc21_hs44/preview - Effective Writing |
| 5 | https://webofscienceacademy.clarivate.com/learn |
| 6 | https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview - Academic Research & Report<br>Writing |
| 7 | https://nptel.ac.in/courses/121/106/121106007/ |

| CO-PO Mapping | | | | | | |
|---|---|---|---|---|---|---|
| Programme Outcomes (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | 1 | | | |
| **CO2** | | | | 2 | | 1 |
| **CO3** | | 3 | | | | |

| Assessment |
|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40% |

**Assessment Plan based on Bloom's Taxonomy level**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

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|---|---|---|---|---|---|---|
| **AY 2022-23** | | | | | | |
| **Course Information** | | | | | | |
| **Programme** | | M.Tech. (CS and IT) | | | | |
| **Class, Semester** | | First Year M. Tech., Sem I | | | | |
| **Course Code** | | 6IT551 | | | | |
| **Course Name** | | Advanced Algorithms Lab | | | | |
| **Desired Requisites:** | | Data Structures, Computer Algorithms | | | | |
| | | | | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | | |
| **Lecture** | - | **LA1** | **LA2** | **Lab ESE** | **Total** | |
| **Tutorial** | - | 30 | 30 | 40 | 100 | |
| **Practical** | 2 Hrs/Week | | | | | |
| **Interaction** | - | **Credits: 1** | | | | |

| **Course Objectives** | |
|---|---|
| **1** | To demonstrate the concepts of Graph Algorithms. |
| **2** | To implement shortest path computing techniques. |
| **3** | To compare the algorithms based on complexities. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Demonstrate graph related algorithms with real world problems | Apply |
| **CO2** | Implement the shortest path for a given distance based scenario | Apply |
| **CO3** | Design approximation algorithms in graph | Create |

**List of Experiments / Lab Activities**

**List of Experiments:**
Activities are to be carried out individually.
Each student will perform the activity based on course on following areas.

1. Implement the Elementary Graph Algorithms and MST
2. Demonstrate the Single Source Shortest Path Algorithms
3. Implement the Multithreaded Algorithms and Matrix Operations
4. Study NP-Completeness and Polynomial-time verification
5. Demonstrate the Approximation Algorithms in graph theory

Student should perform the activities on the basis of the real-time applications in the subjects and submit the work with code, PPT, PDF, Text report document & reference material or on online GitHub. Students should maintain activity log book containing weekly progress

**Text Books**

| | |
|---|---|
| 1 | Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Third Edition the MIT Press Cambridge, London, England. |

**References**

| | |
|---|---|
| 1 | Horrowitz, Sahni Rajasekaran, "Computer Algorithms", Computer Science, W. H. Freeman and company Press, New york |

**Useful Links**

| | |
|---|---|
| 1 | https://nptel.ac.in/courses/106/101/106101060/ |

| CO-PO Mapping | | | | | | |
|---|---|---|---|---|---|---|
| **Programme Outcomes (PO)** | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 3 | | 1 | | | |
| **CO2** | | 2 | | | | |
| **CO3** | | | 3 | | 1 | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy level**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

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|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem-1 |
| **Course Code** | 6IT552 |
| **Course Name** | Unix Internal lab |
| **Desired Requisites:** | Operating System, (C/python) Programming language |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **Lab ESE (POE)** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To use various system call of Unix/Linux |
| **2** | To elaborate the various inter process communications |
| **3** | To impart the inter process communications for solving the real world problems |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Illustrate the difference between thread and process | Apply |
| **CO2** | Identify different system calls for Linux/Unix programming | Analyze |
| **CO3** | Implement various inter process communications available in operating system | Apply |

### List of Experiments / Lab Activities

**List of Experiments:**

**List of Experiments:**

1. Processing Environment : fork, vfork, wait, waitpid,exec (all variations exec), and exit
2. IPC: Interrupts and Signals: signal(any three type of signal ), alarm, kill, signal
3. File system Internals: Stat, fstat, ustat/lock/flock.
4. Threading concept: In c language (P thread) clone, threads of java
5. IPC: Semaphore: semaphore. h-semget, semctl, semop
6. IPC: Message Queue: msgget, msgsnd, msgrcv
7. IPC: Shared memory : shmget, shmat, shmdt
8. IPC: Sockets: socket system calls in C/socket programming of Java/python.
9. IPC: Pipe/FIFO
10. Scripting writing in Linux and python

Student should perform the activities on the basis of the real-time applications in the subjects and submit the work with code, PPT, PDF, Text report document & reference material or on online GitHub. Students should maintain activity log book containing weekly progress

### Text Books


| | |
|---|---|
| 1 | Maurice J. Bach, "*The Design of Unix Operating System*", PHI, 1994. |
| 2 | Sumitabha Das, "*Unix Concepts and Applications*", TMGH, 4th Edition, 2017. |


### References


| | |
|---|---|
| 1 | Beej Jorgensen , "*Beej's Guide to Unix IPC*", Brian -Beej Jorgensen Hall, Version 1.1.2, December, 2010 |
| 2 | Kay Robbins, Steve Robbins, "*UNIX Systems Programming: Communication, Concurrency and Threads*", Pearson, 2nd Edition, December, 2015 |

| | |
|---|---|
| 3 | Eric Raymond , “*Art of UNIX Programming*”, Pearson, 1st edition, October, 2003 |
| | |
| **Useful Links** | |
| 1 | https://users.cs.cf.ac.uk/Dave.Marshall/C/ |
| 2 | https://github.com/suvratapte/Maurice-Bach-Notes |
| 3 | https://github.com/mit-pdos/xv6-public |
| 4 | https://www.geeksforgeeks.org/introduction-to-unix-system/ |
| 5. | https://github.com/beejjorgensen/bgipc |
| 6. | http://www.di.uevora.pt/~lmr/syscalls.html |

**CO-PO Mapping**

**Programme Outcomes (PO)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | | 3 | | | |
| **CO2** | | 2 | | | | 1 |
| **CO3** | 1 | | | 2 | | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom’s Taxonomy Level**

| **Bloom’s Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT511 |
| **Course Name** | Professional Elective - 1: Cloud and Virtualization Techniques |
| **Desired Requisites:** | Computer Networks |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To elaborate fundamentals of virtualization |
| **2** | To integrate service and deployment model in cloud computing |
| **3** | To illustrate the significance of virtualization in data center |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Use service model of cloud computing | Apply |
| **CO2** | Choose virtualization techniques to deploy the services on cloud infrastructure | Apply |
| **CO3** | Analyze service models for data center applications | Analyze |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Cloud Computing**<br>Virtualization and Cloud Computing, Cloud Reference Model: IAAS, PAAS, SAAS, Cloud Deployment Model: Public Cloud, Private Cloud and Hybrid Cloud, Cloud Platforms in Industry | 7 |
| II | **Virtualization**<br>Hosted and Bare-Meta, Server Virtualization, Desktop Virtualization, Application Virtualization, Storage Virtualization | 6 |
| III | **Network Functions**<br>Public Cloud Networking: Route53, Content Delivery Networks, Resilience Infrastructure, Virtual Network Functions: Cloud Firewall, DNS, Load Balancers, Intrusion Detection Systems | 6 |
| IV | **Virtual Private Clouds (VPC)**<br>VPC fundamentals, Public and Private Subnets, Security Groups, Network Access Control List, Network Address Translation. | 7 |
| V | **Cloud Management**<br>Service Management in Cloud Computing, Data Management in Cloud Computing, Resource Management in Cloud | 7 |
| VI | **Advances in Cloud Computing**<br>Open Source and Commercial Clouds, Cloud Simulator, Research trend in Cloud Computing, Fog Computing | 6 |

| **Text Books** | |
|---|---|
| 1 | Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, *"Mastering cloud computing",* Mc Graw Hill Education, 3rd Edition, 2011 |
| 2 | Thomas Erl, Zaigham Mahmood and Ricardo Puttini, "*Cloud Computing: Concepts, Technology & Architecture"*, Pearson, 1st Edition, 2010 |

| **References** |
|---|

| | |
|---|---|
| 1 | Richardo Puttini, Thomas Erl, and Zaigham Mahmood, *"Cloud Computing: Concepts, Technology & Architecture"*, Pearson Prentice Hall, 2nd edition, 2013 |
| 2 | Srinivasan, J. Suresh, "*Cloud Computing: A practical approach for learning and implementation*", Pearson, 2nd Edition, 2012 |
| | |
| **Useful Links** | |
| 1 | Module: I, II, IV, V, VI<br>https://nptel.ac.in/content/syllabus_pdf/106105167.pdf |
| 2 | https://aws.amazon.com/ |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| **Programme Outcomes (PO)** | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 1 | | | | | |
| **CO2** | | | 2 | | 2 | |
| **CO3** | | 3 | | 1 | | |

| **Assessment** |
|---|
| The assessment is based on MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

| **Assessment Plan based on Bloom's Taxonomy Level** | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT512 |
| **Course Name** | Professional Elective - 1: Ruby & Go Programming Language |
| **Desired Requisites:** | C & CPP Programming |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To use various paradigm of Ruby and Go Programming Language |
| **2** | To choose features of Ruby for file handling and error handling |
| **3** | To demonstrate the features of Go language for process synchronization |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Implement object oriented programming concepts using Ruby | Apply |
| **CO2** | Demonstrate the concept of File handling using Ruby and Go language | Apply |
| **CO3** | Analyze the Synchronization problem using Go Language | Analyze |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Ruby Programming**<br>Brief history of Ruby, Installing & running Ruby, Command Line Arguments, Numbers, Text & Strings, Arrays & Hashes, Symbols, Expressions (True, False, Nil)<br>Classes, Modules & Objects: Objects, Classes, Variables | 7 |
| II | **Flow Control & Statements and Properties**<br>Conditionals, Loops, Error & Exception Handling, Threads & Fibers<br>Classes, Modules & Objects : Simple Ruby Classes, Object Instances, Attributes, Inheritance, Persistence<br>Methods, Attributes & Variables: Setter & Getter methods, Method Visibility (Access Control), Instance Variables | 7 |
| III | **Meta- programming & File Handling:**<br>Meta-programming :Exceptions, Types, Modules & Classes, Blocks & Strings, Variables, Missing Methods & Constants, Custom Structures, Dynamically adding methods, Threads, I/O Objects, Reading file, writing file. | 6 |
| IV | **Introduction to Go Language**<br>Introduction, Program Structure: names, declaration, variables, assignments, types, files, scope, number, string variables, arrays, slice | 6 |
| V | **Data Types and operations:**<br>Basic data types, composite data types, functions, control statements, methods, interface, pointers, structs | 6 |
| VI | **Concurrency with Shared variables:**<br>Race condition, mutual exclusion, memory synchronization ,package implementation | 7 |

| **Text Books** | |
|---|---|
| 1 | Davd Flanagan, Yukihiro Mataumoto, "*The Ruby Programming Language: Everything You Need to Know*", O'Reilly; 1st edition (12 February 2008) |

| | |
|---|---|
| 2 | Alan A. A. Donovan, Brian W. Kernighan, "*The Go Programming Language*", Pearson Education; First edition (1 February 2016) |

| | |
|---|---|
| **References** | |
| 1 | Yukihiro Matsumoto, David Flanagan , "*The Ruby Programming Language*", Shroff,1st Edition, 2008. |
| 2 | Caleb Doxsey, "*An Introduction to Programming in Go"*, CreateSpace Independent Publishing Platform (3 September 2012) |

| | |
|---|---|
| **Useful Links** | |
| 1 | https://onlinecourses.swayam2.ac.in/aic20_sp37/preview |
| 2 | https://www.javatpoint.com/ruby-tutorial |
| 3 | https://www.ruby-lang.org/en/documentation/quickstart/ |
| 4 | https://gobyexample.com/ |
| 5 | https://www.javatpoint.com/go-tutorial |
| 6 | https://www.coursera.org/specializations/google-golang |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 3 | | | 1 | | |
| **CO2** | | 2 | | | | 2 |
| **CO3** | | | 2 | 2 | | |

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level**

| Bloom's Taxonomy Level | MSE | ISE | ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

| | | | | | |
|---|---|---|---|---|---|
| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | | | | | |
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | | M.Tech. (CS and IT) | | | |
| **Class, Semester** | | First Year M. Tech., Sem I | | | |
| **Course Code** | | 6IT513 | | | |
| **Course Name** | | Professional Elective – 1: Artificial Intelligence | | | |
| **Desired Requisites:** | | Probability and Linear Algebra | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| | | |
|---|---|---|
| **Course Objectives** | | |
| **1** | To compare various techniques in Artificial Intelligence | |
| **2** | To elaborate methodologies for various application areas of Artificial Intelligence | |
| **3** | To illustrate various applications in Artificial Intelligence | |
| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
| At the end of the course, the students will be able to, | | |
| **CO1** | Apply fundamental concepts of Artificial Intelligence | Apply |
| **CO2** | Compare the architectural and functional structures of Artificial Intelligence | Analyse |
| **CO3** | Build an expert system in Artificial Intelligence | Create |

| Module | Module Contents | Hours |
|---|---|---|
| I | **AI and Problem Solving by Search**<br>Introduction to AI, Problem solving as state space search, Uninformed search, Heuristic search, CSP problems | 7 |
| II | **Knowledge Representation**<br>Introduction, to Knowledge representation, First order logic-I | 7 |
| III | **Knowledge Reasoning**<br>First order logic-II, Inference in First order logic-I, Bayesian network, decision network | 6 |
| IV | **Planning**<br>Introduction to Planning, Plan space planning, Planning graph and Graphplan | 6 |
| V | **Machine Learning**<br>Introduction to ML, Learning decision tress, Reinforcement learning, Learning in neural network, Deep Learning: A review. | 7 |
| VI | **Expert systems**<br>Introduction, Functionality /components of Expert systems, Architecture of ES, Building an Expert system | 6 |

| | |
|---|---|
| **Text Books** | |
| 1 | Rich Elaine and Kelvin Knight ,Nair,*" Artificial Intelligence"*, McGraw Hills 3rd edition,1991 |
| 2 | Janakiraman et al., *"Foundations of Artificial Intelligence and Expert Systems",* MacMillan India Ltd., 2007. |
| **References** | |
| 1 | Russell and Norvig," *Artificial Intelligence – A Modern Approach*", Prentice-Hall, 2010 (3rd edition). |

| | |
|---|---|
| 2 | course on NPTEL/SWAYAM by **Prof. Shyamanta M Hazarika** , IIT Guwahati-“ Fundamentals Of Artificial Intelligence” |
| | |
| **Useful Links** | |
| 1 | Module I,II,III<br>https https://onlinecourses.nptel.ac.in/noc19_me71/unit?unit=7&lesson=8 |
| 2 | Module IV,V<br>https://onlinecourses.nptel.ac.in/noc19_me71/unit?unit=16&lesson=17 |
| 3 | Module VI<br>Vlabs,iitb.ac.in |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| **Programme Outcomes (PO)** | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 1 | | 3 | | | |
| **CO2** | | 2 | | | | 2 |
| **CO3** | 2 | | | 1 | | |

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

**Assessment Plan based on Bloom’s Taxonomy Level**

| **Bloom’s Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

**Walchand College of Engineering, Sangli**
*(Government Aided Autonomous Institute)*

**AY 2022-23**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT514 |
| **Course Name** | Professional Elective - 2: Advanced Distributed Computing |
| **Desired Requisites:** | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 5 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To illustrate the various aspects of modern distributed systems |
| **2** | To compare various distributed architecture |
| **3** | To evaluate parallel and distributed computing applications |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Distinguish between various big data analytics techniques | Analyze |
| **CO2** | Study the various approach to implement distributed environment | Analyze |
| **CO3** | Evaluate the reliability and performance of various algorithms of distributed system | Evaluate |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction to Distributed Systems:** Task Creation and Termination (Async, Finish), Tasks in Java's Fork/Join Framework, Computation Graphs, Work, Span, Multiprocessor Scheduling | 6 |
| II | **Distributed System with Parallelism:** Parallel Speedup , Amdahl's Law, Reciprocal Array Sum using Async- Finish, Reciprocal Array Sum using Recursive Action's in Java's Fork/Join Framework | 7 |
| III | **Functional Parallelism:** Futures: Tasks with Return Value, Futures in Java's Fork/Join Framework, Memorization, Java Streams, Data Races and Determinism | 6 |
| IV | **Data flow Synchronization and Pipelining:** Split-phase Barriers with Java Phasers, Point-to-Point Synchronization with Phasers, One-Dimensional Iterative Averaging with Phasers, Pipeline Parallelism, Data Flow Parallelism | 7 |
| V | **Distributed Map Reduce:** Introduction to Map-Reduce, Hadoop Framework, Spark Framework, TF-IDF Example, Page Rank Example, Demonstration: Page Rank Algorithm in Spark | 7 |
| VI | **Client-Server Programming:** Introduction to Sockets, Serialization/Deserialization, Remote Method Invocation, Multicast Sockets, Publish-Subscribe Mode, Demonstration: File Server using Sockets | 6 |

**Text Books**

| | |
|---|---|
| 1 | Andrew S. Tanenbaum and Maarten Van Steen, "*Distributed Systems: Principles and Paradigms*", 2nd edition, Pearson Education, 2007. |

| | |
|---|---|
| 2 | George Coulouris, Jean Dollimore, Tim Kindberg, *"Distributed Systems: Concepts and Design"*, 4th Edition, Pearson Education, 2005. |
| | |
| **References** | |
| 1 | A. S. Tanenbaum and M. V. Steen, *"Distributed Systems: Principles and Paradigms"*, Second Edition, Prentice Hall, 2006 |
| | |
| **Useful Links** | |
| 1 | Module I, II, III, IV https://www.coursera.org/learn/parallel-programming-in-java?specialization=pcdp#syllabus Module V, VI https://www.coursera.org/learn/distributed-programming-in- java?specialization=pcdp#syllabus |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| **Programme Outcomes (PO)** | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 3 | | 1 | | | |
| **CO2** | | 1 | | | 2 | |
| **CO3** | 1 | | | 2 | | |

| **Assessment** |
|---|
| The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing). |

| **Assessment Plan based on Bloom's Taxonomy Level** | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

**Walchand College of Engineering, Sangli**
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**AY 2022-23**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT515 |
| **Course Name** | Professional Elective - 2: Modern Application Development |
| **Desired Requisites:** | Web Technology |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To demonstrate the static and dynamic web pages design |
| **2** | To develop programs for web using Scripting Languages |
| **3** | To implement responsive web pages |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Illustrate the basic elements and properties in different web applications. | Apply |
| **CO2** | Develop static and dynamic web applications | Create |
| **CO3** | Design and develop responsive web applications. | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **HTML 5 and Bootstrap:**<br>Introduction, Getting Started, Grid System, Fixed Layout, Fluid Layout, Responsive Layout, Typography<br>**Bootstrap Basics Elements:**<br>Jumbotron open link, Button, Button Groups, Grid, Table, Form, Alert, Wells, Badge & Label, Panels, Pagination, Pager, Image, Glyphicon,, Carousel, Progress Bar, List Group, Dropdown, Collapse, Tabs. | 7 |
| II | **Introduction to Node JS:**<br>Install Node.js Windows and Linux, Modules, HTTP Module, URL Module, First Example. Console, NPM: Package Manager, Node Globals, Node.js OS, Timer, Errors<br>**Node JS Basics:**<br>Buffers, Streams, File System, Path, String Decoder, Query String, ZLIB, Assertion, V8, Callbacks, Events, Punycode, TTY, Web Modules | 7 |
| III | **Node JS and MySQL :**<br>Create Connection, Create Database, Create Table, Insert Record, Update Record, Delete Record, Select Record, Select Unique, Drop Table | 6 |
| IV | **ReactJS:**<br>Introduction, Templating using JSX, Components, State and Props, Lifecycle of Components, Rendering List and Portals, Error Handling, Routers, Redux and Redux Saga, Immutable.js, Service Side Rendering, Unit Testing, Webpack | 6 |
| V | **Python Framework :**<br>Introduction to Django, Installation of Django, The Basics of Dynamic, Web Pages, The Django Template System, Interacting with a Database: Models, The Django Administration Site, Form Processing, File Handling Email Functionalities, Sessions and Cookies | 6 |

| | | |
|---|---|---|
| VI | **Ruby On Rails :**<br>Introduction, RVM(ruby version manager), Working in Linux(Ubuntu) Platform, Ruby Operators & Ruby Shell, Ruby Data types & Variables, Ruby methods and modules, OOP in Ruby, Basic loops and iterators.<br>**Rails :**Rails Installation and Ruby gems, Databases, Statements, RAILS Model, Controller, and Views | 7 |

| | |
|---|---|
| **Text Books** | |
| 1 | Benjamin Jakobus, "*Mastering Bootstrap 4*", Packt Publisher, 2nd Edition, 2018 |
| 2 | Jake Spurlock, "*Bootstrap: Responsive Web Development*", O'Reilly Publication, 1st Edition, 2013 |
| 3 | Ethan Brown, "*Web Development using Node and Express*", O'Really Publisher, 1st Edition, 2014. |
| **References** | |
| 1 | Daniel Rubio," *Beginning Django Web Application Development and Deployment with Python*", ApressPublication,1st Edition,2017 |
| 2 | Michael Hartl," *Ruby on Rails 3 Tutorial Learn Rails by Example*", Pearson Education Publication,1st Edition,2010 |
| **Useful Links** | |
| 1 | https://www.tutorialsteacher.com/nodejs/nodejs-tutorials |
| 2 | https://morioh.com/p/656c3d9c1bce |
| 3 | https://www.tutorialrepublic.com/twitter-bootstrap-tutorial/ |
| 4 | https://morioh.com/p/11c3e757a913 |
| 5 | https://www.djangoproject.com/start/ |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | | 2 | | |
| **CO2** | | | 1 | | 2 | |
| **CO3** | 1 | 3 | | 1 | | |

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

| Assessment Plan based on Bloom's Taxonomy Level | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT516 |
| **Course Name** | Professional Elective - 2: Image Processing and Pattern Recognition |
| **Desired Requisites:** | Mathematics-(Matrix, Fourier Transformation) |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To apply mathematical transformation for image processing |
| **2** | To compare image enhancement techniques |
| **3** | To elaborate image processing applications |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Apply concepts of a digital image processing for real-time application | Apply |
| **CO2** | Implement image segmentation and representation techniques | Apply |
| **CO3** | Analyze images in the frequency domain using various transforms | Analyze |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction and Pixel Relationship**<br>Need for Image Processing ,Some Applications of Image Processing-Fundamental steps in DIP, Components of digital image processing, sampling, quantization, Pixel Relationships in images, Distance measurements, Data structure for image representation | 7 |
| II | **Image Operations and Interpolations**<br>Arithmetic operations, Logical operations, Geometrical operations , Image interpolation techniques | 7 |
| III | **Image Transformation**<br>Need of transformation, DFT and properties, convolution Theorem, DCT | 6 |
| IV | **Image Enhancement**<br>Point operations ,Spatial filtering techniques, Frequency domain filtering | 6 |
| V | **Image Segmentation**<br>Classification of Image segmentation, Edge detection, Thresholding techniques, Region growing techniques | 7 |
| VI | **Pattern Recognition Fundamentals**<br>Basic concepts of pattern recognition, fundamental problems in pattern recognition system, design concepts and methodologies, example of automatic pattern recognition systems, a simple automatic pattern recognition model | 6 |

| **Text Books** | |
|---|---|
| 1 | S.Shridhar, *"Digital Image Processing"*, Oxford Unversity Press,2nd Edition,2016. |
| 2 | Millan sonka,Vaclav Hiavac, Roger Boyle, *"Image Processing Analysis and Machine Vision"*, CL Engineering,3rd Edition,2013. |

| References | |
|---|---|
| 1 | S. Jayraman, S Esakkiarajan , Veerakumar, *"Digital image processing"*, 1st Edition ,MGH,2017. |
| 2 | Rafel C. Gonzalez, Richard E. Woods, *"Digital Image Processing"*, 3rd Edition, Pearson Education, 2008 |

| Useful Links | |
|---|---|
| 1 | Module I,II,III<br>https://nptel.ac.in/courses/117/105/117105079/ |
| 2 | Module IV,V<br>https://nptel.ac.in/courses/106/105/106105223/ |
| 3 | Module VI<br>Vlabs,iitb.ac.in |

**CO-PO Mapping**

**Programme Outcomes (PO)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | | | 1 | | |
| **CO2** | | 2 | | | | 2 |
| **CO3** | 1 | | 1 | | | |

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level**

| Bloom's Taxonomy Level | MSE | ISE | ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

**Walchand College of Engineering, Sangli**
*(Government Aided Autonomous Institute)*

**AY 2022-23**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT553 |
| **Course Name** | Professional Elective – 1-Cloud and Virtualization Techniques Lab |
| **Desired Requisites:** | Computer Networks |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To introduce fundamentals of virtualization |
| **2** | To impart various service and deployment model in cloud computing |
| **3** | To acquaint the significance of virtualization in data center |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Demonstrate the fundamentals of cloud services using public cloud | Understand |
| **CO2** | Choose virtualization techniques to deploy the service on cloud infrastructure | Apply |
| **CO3** | Analyze service models for data center applications using open source tool | Analyze |

**List of Experiments:**

1. Create a Virtual machine using VMware on linux and analyze the performance of VM for loaded conditions
2. Implement a Docker platform on VM and Local Machine. Give performance analysis
3. Use AWS public cloud for IAAS, PAAS, SAAS
4. Implement kubernetes using docker for virtualization
5. Demonstrate and implement the Open Stack cloud in FOSS. Compare the feature of Open stack cloud with enterprise based public cloud

**Text Books**

| | |
|---|---|
| 1 | Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, *"Mastering cloud computing"*, Mc Graw Hill Education, 3rd Edition, 2011 |
| 2 | Thomas Erl, Zaigham Mahmood and Ricardo Puttini, *"Cloud Computing: Concepts, Technology & Architecture"*, Pearson, 1st Edition, 2010 |

**References**

| | |
|---|---|
| 1 | Richardo Puttini, Thomas Erl, and Zaigham Mahmood, *"Cloud Computing: Concepts, Technology & Architecture"*, Pearson Prentice Hall, 2nd edition, 2013 |
| 2 | Srinivasan, J. Suresh, *"Cloud Computing: A practical approach for learning and implementation"*, Pearson, 2nd Edition, 2012 |

**Useful Links**

| | |
|---|---|
| 1 | Module: I, II, IV, V, VI<br>https://nptel.ac.in/content/syllabus_pdf/106105167.pdf |
| 2 | https://aws.amazon.com/ |

| CO-PO Mapping | | | | | | |
|---|---|---|---|---|---|---|
| Programme Outcomes (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 3 | | 3 | | | |
| **CO2** | | 2 | | | | 1 |
| **CO3** | 1 | | | 2 | | |

| Assessment | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

| Assessment Plan based on Bloom's Taxonomy Level | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

**Walchand College of Engineering, Sangli**
*(Government Aided Autonomous Institute)*

**AY 2022-23**

| **Course Information** | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT554 |
| **Course Name** | Professional Elective – 1- Ruby & Go Programming Language Lab |
| **Desired Requisites:** | C & CPP Programming |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/week | | | | |
| **Interaction** | - | | | | |
| | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To introduce paradigm of Ruby and Go Programming Language |
| **2** | To define features of Ruby for file handling and error handling |
| **3** | To elaborate features of Go language for process synchronization |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Apply object oriented programming concepts using Ruby | III | Applying |
| **CO2** | Implement the concept of File handling using Ruby and Go language | III | Applying |
| **CO3** | Propose the solution for Synchronization problem using Go Language | VI | Creating |

| | **Module Contents** | |
|---|---|---|
| | **Introduction to Ruby Programming**<br>Brief history of Ruby, Installing & running Ruby, Command Line Arguments,<br>**Flow Control & Statements and Properties**<br>Conditionals, Loops, Error & Exception Handling, Threads & Fibers<br>Classes, Modules & Objects : Simple Ruby Classes, Object Instances<br>**Meta- programming & File Handling:**<br>Meta-programming :Exceptions, Types, Modules & Classes, Blocks & Strings<br>**Introduction to Go Language**<br>Introduction, Program Structure: names, declaration, variables, assignments, types, files, scope, number, string variables, arrays, slice<br>**Data Types and operations:**<br>Basic data types, composite data types, functions, control statements, methods, interface, pointers, structs<br>**Concurrency with Shared variables:**<br>Race condition, mutual exclusion, memory synchronization, package implementation | |

| **Text Books** | |
|---|---|
| 1 | Davd Flanagan, Yukihiro Mataumoto, "*The Ruby Programming Language: Everything You Need to Know*", i8004nrrlu de 43n noi ide t41l;yll e″O |
| 2 | Alan A. A. Donovan, Brian W. Kernighan, "*The Go Programming Language*", 4yleoi i63;2y noiu tnle 43n noi id t41l;yll e′dE |

| | |
|---|---|
| **References** | |
| 1 | Yukihiro Matsumoto, David Flanagan , "*The Ruby Programming Language*", Shroff,1st Edition, 2008. |
| 2 | Caleb Doxsey, "*An Introduction to Programming in Go"*, CreateSpace Independent Publishing Platform (3 September 2012) |
| **Useful Links** | |
| 1 | https://onlinecourses.swayam2.ac.in/aic20_sp37/preview |
| 2 | https://www.javatpoint.com/ruby-tutorial |
| 3 | https://www.ruby-lang.org/en/documentation/quickstart/ |
| 4 | https://gobyexample.com/ |
| 5 | https://www.javatpoint.com/go-tutorial |
| 6 | https://www.coursera.org/specializations/google-golang |

| CO-PO Mapping | | | | | | |
|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | | 2 | | |
| **CO2** | | 2 | | | 3 | 1 |
| **CO3** | 1 | | 3 | | 3 | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy Level**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| | | | | | |
|---|---|---|---|---|---|
| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | | | | | |
| **AY 2023-24** | | | | | |
| **Course Information** | | | | | |
| **Programme** | M.Tech. (CS and IT) | | | | |
| **Class, Semester** | First Year M. Tech., Sem I | | | | |
| **Course Code** | 6IT555 | | | | |
| **Course Name** | Professional Elective – 1-Artificial Intelligence Lab | | | | |
| **Desired Requisites:** | Probability and Linear Algebra | | | | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To compare various techniques in Artificial Intelligence |
| **2** | To elaborate methodologies for various application areas of Artificial Intelligence |
| **3** | To illustrate various applications in Artificial Intelligence |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | To Understand the concept of Artificial intelligence. | Understand |
| **CO2** | To apply various search algorithms of artificial intelligence. | Apply |
| **CO3** | To apply knowledge representation and reasoning techniques. | Apply |

**List of Experiments / Lab Activities**

**List of Experiments:**
Activities are to be carried out individually.
Each student will perform the activity based on course on following areas.

| Exp. No. | Experiment Name | Course Outcome |
|---|---|---|
| 1 | Write a program in Python/Prolog to implement simple facts and Queries | CO1 |
| 2 | Write a program in Python/Prolog to implement simple arithmetic | CO1 |
| 3 | Write a program in Python/Prolog to solve Monkey banana problem | CO1 |
| 4 | Write a program in Python/Prolog to solve Tower of Hanoi | CO2 |
| 5 | Write a Program to Implement Water-Jug problem using Python/Prolog | CO2 |
| 6 | Write a program in Python/Prolog to solve 8 Puzzle problems | CO2 |
| 7 | Write a program in Python/Prolog to solve 4-Queens problem | CO2 |
| 8 | Write a Program to Implement Missionaries-Cannibals Problems using | CO3 |
| 9 | Write a program in Python/Prolog to solve Traveling salesman problem | CO3 |
| 10 | Write a program to implement a Tic-Tac-Toe game. | CO3 |

Student should perform the activities on the basis of the real-time applications in the subjects and submit the work with code, PPT, PDF, Text report document & reference material or on online GitHub. Students should maintain activity log book containing weekly progress

**Text Books**

| | |
|---|---|
| 1 | Rich Elaine and Kelvin Knight ,Nair, *" Artificial Intelligence"*, McGraw Hills 3rd edition,1991 |

| | |
|---|---|
| 2 | Ivan Bratko , *"Prolog Programming for Artificial Intelligence Pearson Education India*, 3rd Edition, 2009. |
| | |
| | |
| **Useful Links** | |
| 1 | **https://nptel.ac.in/courses/106105077 (NPTEL/SWAYAM course by** Prof. Anupam Basu Department of CS and ITIIT Kharagpur Prof. S. Sarkar Department of CS and ITIIT Kharagpur) |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| **Programme Outcomes (PO)** | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 3 | | 1 | | | |
| **CO2** | | 2 | | | | |
| **CO3** | | | 3 | | 1 | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy level**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | | | | | | |
|---|---|---|---|---|---|---|
| **AY 2022-23** | | | | | | |
| **Course Information** | | | | | | |
| **Programme** | M.Tech. (CS and IT) | | | | | |
| **Class, Semester** | First Year M. Tech., Sem I | | | | | |
| **Course Code** | 6IT556 | | | | | |
| **Course Name** | Professional Elective – 2- Advanced Distributed Computing lab | | | | | |
| **Desired Requisites:** | | | | | | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 5 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To demonstrate the various aspects of modern distributed systems |
| **2** | To implement frameworks of distributed architecture |
| **3** | To analyze parallel and distributed computing applications |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Implement various big data analytics techniques | Analyze |
| **CO2** | Demonstrate various distributed System with Parallelism | Analyze |
| **CO3** | Evaluate the reliability and performance of various algorithms of distributed system | Evaluate |

**Lab activities/Experiments**

1. Implement concurrent day-time client-server application
2. Write a program that communicate data between two hosts
3. Implement Arithmetic Service that implements add, and subtract operations
4. Use distributed data processing frameworks and mobile application tool kits to implement parallelism.
5. Write a program to Trace Communication protocols in distributed systems.
6. Develop an application using a technology from distributed system.
7. Implement a word count application which counts the number of occurrences of each word a large collection of documents Using Map Reduce model.

Not limited to this list; Instructor can add more based on the theory course syllabus

| **Text Books** | |
|---|---|
| 1 | Andrew S. Tanenbaum and Maarten Van Steen, "*Distributed Systems: Principles and Paradigms*", 2nd edition, Pearson Education, 2007. |
| 2 | George Coulouris, Jean Dollimore, Tim Kindberg, *"Distributed Systems: Concepts and Design"*, 4th Edition, Pearson Education, 2005. |

| **References** | |
|---|---|
| 1 | A. S. Tanenbaum and M. V. Steen, *"Distributed Systems: Principles and Paradigms"*, Second Edition, Prentice Hall, 2006 |

**Useful Links**

| | |
|---|---|
| 1 | Module I, II, III, IV<br>https://www.coursera.org/learn/parallel-programming-in-java?specialization=pcdp#syllabus<br>Module V, VI<br>https://www.coursera.org/learn/distributed-programming-in- java?specialization=pcdp#syllabus |

| CO-PO Mapping | | | | | | |
|---|---|---|---|---|---|---|
| Programme Outcomes (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 1 | | 1 | | | 2 |
| **CO2** | | 1 | | | 2 | |
| **CO3** | 1 | | | 2 | | |

| Assessment | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

| Assessment Plan based on Bloom's Taxonomy Level | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT557 |
| **Course Name** | Professional Elective – 2- Modern Application Development Lab |
| **Desired Requisites:** | Object oriented programming concepts, Java Programming |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/week | | | | |
| **Interaction** | - | | | | |
| | | **Credits 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To introduce the android architecture and tools for developing Android applications |
| **2** | To impart current client side and server side web technologies on Android platform |
| **3** | To provide user interface application development |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| **CO1** | Describe the life cycles of Activities | III | Applying |
| **CO2** | Use the major components of Android API to develop their own apps | IV | Analysing |
| **CO3** | Deploy applications to the Android marketplace for distribution. | VI | Creating |

| **Textbooks** | |
|---|---|
| 1 | Beginning Android application development by Wei-Mag Lee |
| 2 | Learning Android by Marko Gargenta Publisher: O'Reilly Media |
| 3 | Android Apps for Absolute Beginners by Wallace Jackson 2nd Edition |

| **References** | |
|---|---|
| 1 | Reto Meier Publisher,‖Professional Android 4 Application Development‖ Wiley India |
| 2 | Android in Action Third Edition W.Frank Ableson,Robi Sen, Chris King, C. Enrique Ortiz |
| 3 | The Android Developer's Cook book *"Building Applications with the Android SDK"* by James Steele |

| **Useful Links** | |
|---|---|
| 1 | https://developer.android.com/guide |
| 2 | https://www.classcentral.com/course/androidpart1-1178 |
| 3 | https://www.udemy.com/topic/android-development/ |
| 4 | https://kotlinlang.org/docs/home.html |
| 5 | https://developer.apple.com/tutorials/SwiftUI |

| CO-PO Mapping | | | | | | |
|---|---|---|---|---|---|---|
| Programme Outcomes (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | 2 | | 1 | | |
| **CO2** | | | | | | 1 |
| **CO3** | | | | | 2 | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy Level**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | M.Tech. (CS and IT) | | | | |
| **Class, Semester** | First Year M. Tech., Sem I | | | | |
| **Course Code** | 6IT558 | | | | |
| **Course Name** | Professional Elective – 2- Image Processing and Pattern Recognition Lab | | | | |
| **Desired Requisites:** | Image Processing and Pattern Recognition,<br>Mathematics-(Matrix, Fourier Transformation) | | | | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Introduce foundational techniques of image processing and analysis techniques. to solve image processing problems of real world application |
| **2** | Provide directives to build a statistical classifier and know how to use other classifiers |
| **3** | Impart image processing and pattern recognition techniques to detect objects and activities in images and video |
| **4** | Instruct Matlab/python scripts to apply image processing algorithms. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Implement image enhancement techniques for image qualities. | Applying |
| **CO2** | Analyze the different segmentation techniques. | Analyze |
| **CO3** | Perform various image operations and morphological operations. | Creating |

**List of Experiments:**

1. Program to perform digital negative of an image
2. Program to perform (a) Down sampling of an image and (b) Enhance image using Histogram equalization.
3. Program to introduce noise in an image
   (a) Program to find contrast stretching of an image
   (b) Program to perform bit plane slicing on an image
4. Program to perform Rotation, Scaling & Translation operation on an image
5. Program to find Edge using LOG and DOG functions
6. Program to implement Morphological operations on an image
7. Program to perform Huffman Coding on an Image
8. Program to perform image compression using RLE encoding
9. Develop mini project in image processing

| **Text Books** | |
|---|---|
| 1 | Millan sonka, Vaclav Hiavac, Roger Boyle, "Image Processing Analysis and Machine Vision", 3rd Edition, CL Engineering, 2013. |
| 2 | Rafel C. Gonzalez, Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2008 |

| **References** | |
|---|---|
| 1 | Earl Gose, Richard Johnsonbaugh, "Pattern Recognition and Image Analysis", 1st Edition, Prentice Hall of India Private limited, 2009. |
| 2 | |

| | |
|---|---|
| **Useful Links** | |
| 1 | |
| 2 | |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| **Programme Outcomes (PO)** | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | | | | **1** | | |
| **CO2** | | | **2** | | | |
| **CO3** | **3** | | | | | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy Level**

| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

**SEMESTER –II**

| | | | | | |
|---|---|---|---|---|---|
| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | | | | | |
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | | M. Tech. (CS and IT) | | | |
| **Class, Semester** | | First Year M. Tech., **Sem II** | | | |
| **Course Code** | | 6IT521 | | | |
| **Course Name** | | Data Mining Methods and Applications | | | |
| **Desired Requisites:** | | Database Engineering | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| | | |
|---|---|---|
| **Course Objectives** | | |
| **1** | To exercise advanced data mining techniques | |
| **2** | To compare various algorithm for real-time application | |
| **3** | To propose a novice solution for real world problem | |
| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
| At the end of the course, the students will be able to, | | |
| **CO1** | Implement techniques and algorithms of Data Mining | Apply |
| **CO2** | Apply data mining techniques and algorithms for solving real life problems | Apply |
| **CO3** | Analyse various clustering and classification techniques in data mining | Analyse |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction :**<br>Data Mining, Kinds of Data, Kinds of Patterns, Technologies, Major Issues in Data Mining. Getting to Know Your Data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data<br>Similarity and Dissimilarity | 7 |
| II | **Data Pre-processing:**<br>Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization | 6 |
| III | **Mining Frequent Patterns:**<br>Basic Concepts, Frequent Item set Mining Methods, Pattern Evaluation Methods. | 7 |
| IV | **Classification**<br>Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-<br>Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy | 6 |
| V | **Cluster Analysis**<br>Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering. | 7 |

| | | |
|---|---|---|
| VI | **Outlier Detection**<br>Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering-Based Approaches, Classification-Based Approaches, Mining Contextual and Collective Outliers, Outlier Detection in High-Dimensional Data | 6 |

| | |
|---|---|
| | **Text Books** |
| 1 | Han Jiawei and Kamber Micheline *"Data Mining – Concepts and Techniques"* The Morgan Kaufmann Series in Data Management Systems ,3rd Edition, 2011 |
| 2 | Dunham M. H, *"Data Mining: Introductory and Advanced topics"*, Pearson, 2nd Edition, 2003 |
| | **References** |
| | Chattamvelli Rajan, *"Data Mining Methods: Concepts & Applications"*, Narosa Publishing House, 2nd Edition, 2010 |
| 2 | Mitra Sushmita, Acharya Tinku, *"Data Mining Multimedia, Soft Computing and Biometrics"*, WILEY Publication, 3rd Edition, 2003 |
| | **Useful Links** |
| 1 | https://onlinecourses.nptel.ac.in/noc20_cs12/preview |
| 2 | https://www.javatpoint.com/data-mining |
| 3 | https://data-flair.training/blogs/data-mining-tutorial/ |

**CO-PO Mapping**

**Programme Outcomes (PO)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | | | | 1 | |
| **CO2** | | 2 | | 2 | | |
| **CO3** | 1 | | 1 | | | |

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level**

| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT522 |
| **Course Name** | Scientific Computing |
| **Desired Requisites:** | Programming experience in C, C++, Java |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To use different programming paradigms in scientific computing. |
| **2** | To apply appropriate programming language for solving the problem |
| **3** | To demonstrate report writing using LATEX tool. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Compare functional and logical programming. | Analyze |
| **CO2** | Use Python programming language for solving the problem | Apply |
| **CO3** | Implement scripts to automate data formatting and analysis | Apply |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Data Science and Scientific Computing-**<br>Overview of the Data Science process, Scientific Computing Technologies, Regressions, Classification, Clustering | 7 |
| II | **Python-Numpy and Pandas:**<br>**NumPy:** Introduction, Numpy array, Numpy array indexing, Numpy operations.<br>**Pandas:** Series, Data frames, managing missing data, groupby, merging & concatenation, operations, data input and data output. | 6 |
| III | **Python for Data Visualization:**<br>Data Visualization through libraries like: Matplotlib, Seaborn, Plotly and Cufflinks, Geographical Plotting. | 6 |
| IV | **Working with Data in R –**<br>Variables , Vectors, Matrices, lists & Data frames , Logical vectored operators Image data type, Image representation, categorical data using Factors in R | 7 |
| V | **Data/Image Visualization using libraries –**<br>Using graphs to visualize data, Basic plotting in R, Manipulating the plotting window, Advanced plotting using lattice library in R. Image visualization in using Image processing tools | 7 |
| VI | **Data Reporting using LaTeX –**<br>LATEX Software installation, LATEX typesetting basics, LATEX math typesetting, Tables and matrices, Mathematics in Latex | 6 |

| **Text Books** | |
|---|---|
| 1 | Samir Madhavan, *"Mastering Python for Data Science",* August 2015, Packt Publishing, ISBN: 9781784390150 |

| **References** | |
|---|---|
| 1 | Gilbert Strang, *"Introduction to linear algebra"* ,Wellesley-Cambridge Press, 5$^{th}$ Edition, August 2016 |

| | |
|---|---|
| 2 | Douglas Montgomery, *"Applied statistics and probability for engineers"*, 6th Edition, Wiley Publications, January 2016 |

| **Useful Links** | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc20_cs36/course |
| 2 | https://spoken-tutorial.org/watch/Python+3.4.3/Plotting+Data/English/ |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | 2 | | | 1 |
| **CO2** | | | | | 2 | |
| **CO3** | | 1 | 3 | | | |

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level**

| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT571 |
| **Course Name** | Data Mining Methods and Applications Lab |
| **Desired Requisites:** | Data Mining |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To introduce student with concept of data mining |
| **2** | To provide knowledge applications of Data Mining applications. |
| **3** | To help students to address real-world challenges using Data mining algorithms. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Implement the software application using for data mining algorithm. | Apply |
| **CO2** | Write & explain a detailed project report for submission and evaluation. | Evaluate |
| **CO3** | Design and validate system for Data mining | Create |

**List of Experiments / Lab Activities**

**List of Experiments:**

Activities are to be carried out individually.

Each student will perform the activity based on course on following areas.

1. Design system for data analysis using data mining algorithms.
2. The system work on data set with different algorithm like classification, clustering, association, etc.
3. Industry Problem Statement( Sponsored Project)
4. Problem statements based on current or previously learned Technology.
5. At the end of the semester project group should achieve all the proposed objectives of the problem statement.
6. The work should be completed in all aspects of design, implementation and testing and follow software engineering practices.
7. Project report should be prepared and submitted in soft and hard form along with all the code and other dependency.

Student should perform the activities on the basis of the real-time applications in the subjects and submit the work with code, PPT, PDF, Text report document & reference material or on online GitHub.

Students should maintain activity log book containing weekly progress.

| **Text Books** | |
|---|---|
| 1 | Han Jiawei and Kamber Micheline "*Data Mining – Concepts and Techniques*" The Morgan Kaufmann Series in Data Management Systems ,3rd Edition, , 2011 |
| 2 | Dunham M. H, "*Data Mining: Introductory and Advanced topics*", Pearson, 2ndEdition, 2003 |

| **References** | |
|---|---|
| 1 | Chattamvelli Rajan, "*Data Mining Methods: Concepts & Applications*", Narosa Publishing House, 2nd Edition, 2010 |

| | |
|---|---|
| 2 | Mitra Sushmita, Acharya Tinku, *"Data Mining Multimedia, Soft Computing and Biometrics"*, WILEY Publication, 3rd Edition, 2003 |
| | |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc20_cs12/preview |
| 2 | https://www.javatpoint.com/data-mining |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 1 | | 2 | | 1 | |
| **CO2** | | 1 | | | | |
| **CO3** | 3 | | | 3 | | |

| **Assessment** | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

| **Assessment Plan based on Bloom's Taxonomy level** | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT572 |
| **Course Name** | Scientific Computing lab |
| **Desired Requisites:** | Programming experience in C,C++,Java |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To use different programming paradigms in scientific computing. |
| **2** | To apply appropriate programming language for solving the problem |
| **3** | To demonstrate report writing using LATEX tool. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Perform numerical computation using python libraries | Analyze |
| **CO2** | Implement statistical computation using R libraries | Apply |
| **CO3** | Compose the journal paper, reports using Open source tool (LATEX) | Create |

**List of Experiments / Lab Activities**

**Activities:**
Activities are to be carried out individually.
Each student will perform the activity based on course on following areas.

1. Exercise programs on Lists.
2. Exercise programs on Tuples.
3. Exercise programs on sets and dictionaries
4. Exercise programs on files.
   a) Write Python script to display file contents.
   b) Write Python script to copy file contents from one file to another.
5. Data visualization – plots in R
6. Exercise programs on Vectors, Matrices, lists in R
7. Exercise programs on Data frames and factors in R
8. Exercise program on image libraries using R
9. Create a journal paper using open source tool LATEX
10. Create a seminar/project report using open source tool LATEX

Student should perform the activities on the basis of the real-time applications in the subjects and submit the work with code, PPT, PDF, Text report document & reference material or on online GitHub.
Students should maintain activity log book containing weekly progress.

| **Text Books** | |
|---|---|
| 1 | Douglas Montgomery, *"Applied statistics and probability for engineers"*, 6th Edition, Wiley Publications, January 2016 |
| 2 | Samir Madhavan, *"Mastering Python for Data Science"*, August 2015, Packt Publishing, ISBN: 9781784390150 |

**References**

| | |
|---|---|
| 1 | Gilbert Strang, *"Introduction to linear algebra"* ,Wellesley-Cambridge Press, 5th Edition, August 2016 |
| | |

| **Useful Links** | |
|---|---|
| 1 | https://docs.python.org |
| 2 | https://www.docs.rstudio.com |
| 3 | https://www.overleaf.com |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 3 | | | 3 | | |
| **CO2** | | | | | | |
| **CO3** | 1 | 2 | 2 | | | 1 |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy level**

| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

| Course Information | |
|---|---|
| **Programme** | M. Tech. ( CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT573 |
| **Course Name** | Pre-dissertation Work and Seminar |
| **Desired Requisites:** | |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Practical** | 4 Hrs/ Week | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Interaction** | - | 30 | 30 | 40 | 100 |
| | | **Credits: 2** | | | |

| Course Objectives | |
|---|---|
| **1** | To Review and increase students' understanding of the specific topics. |
| **2** | To induce Learning management of values. |
| **3** | To teach how research papers are written and read such papers critically and efficiently and to summarize and review them to gain an understanding of a new field, in the absence of a textbook. |
| **4** | To teach how to judge the value of different contributions and identify promising new directions in specified area. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| **CO1** | Apply the existing knowledge on real life problems | III | Applying |
| **CO2** | Investigate the selected topic/ system. | IV | Analysing |
| **CO3** | Verify the outcomes of the work have solved the specified problems. | V | Evaluating |

**List of Experiments / Lab Activities/Topics**

**Contents:**

The pre-dissertation work will start in semester II and should preferably be a problem with research potential and should involve scientific research review, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based preferably on the area in which the candidate is interested to undertake the dissertation work. The candidate has to be in regular contact with their guide and the topic of seminar/dissertation must be mutually decided. The examination shall consist of the preparation of report consisting literature review, detailed problem statement, case studies, etc,

according to type of work carried out. The work has to be presented in front of the examiners panel formed by DPGC for evaluation.

| Textbooks | |
|---|---|
| 1 | Suitable books based on the contents of the dissertation/seminar topic selected. |

| References | |
|---|---|
| 1 | Suitable books based on the contents of the dissertation/seminar topic selected and research papers from reputed national and international journals and conferences. |

| | |
|---|---|
| **Useful Links** | |
| 1 | As per the need of the dissertation/seminar topic. |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **CO1** | 2 | 2 | 1 | | | |
| **CO2** | 3 | | | | 1 | |
| **CO3** | | 3 | | | 2 | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom’s Taxonomy level**

| Bloom’s Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | | M. Tech. (CS and IT) | | | |
| **Class, Semester** | | First Year M. Tech., Sem II | | | |
| **Course Code** | | 6IT531 | | | |
| **Course Name** | | Professional Elective – 3: Distributed Operating System | | | |
| **Desired Requisites:** | | Operating Systems, Distributed Network | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To elaborate fundamental characteristics of distributed operating systems. |
| **2** | To compare distributed operating system |
| **3** | To interpret the communication, process, naming, synchronization in distributed operating systems |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| CO1 | Analyze the characteristics of distributed operating systems | Analyze |
| CO2 | Use distributed operating systems for distributed application | Apply |
| CO3 | Compare various distributed operating systems | Analyze |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction to distributed Systems :**<br>Definition and goals, Hardware and Software concepts, Design issues | 6 |
| II | **Communication & Synchronization in distributed systems:**<br>Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC Clock synchronization and related algorithms, mutual exclusion,<br>Deadlock in distributed systems | 6 |
| III | **Processes and processors & Distributed File Systems:**<br>Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, Real time distributed systems, Process migration and related issues.<br>Introduction, features & goal of distributed file system, | 7 |
| IV | **Distributed Shared Memory :**<br>Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing | 6 |
| V | **Naming & Distributed Web-based Systems :**<br>Overview, Features, Basic concepts, System oriented names, Object locating mechanisms, Issues in designing human oriented names, Name caches, Naming and security, DNS Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication:<br>Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications | 7 |
| VI | **Security &Case Study :**<br>Google FS/BigTable, Introduction of Security in Distributed OS,<br>Overview of security techniques, features, Need, Access Control, Security Management ,Java RMI, Sun Network File System, Google case study | 7 |

| | |
|---|---|
| **Text Books** | |
| 1 | Pradeep K. Sinha *"Distributed Operating Systems Concepts and Design"*, Eastern Economy Edition, PHI, 1998. |
| 2 | George Coulouris, Jean Dollimore,Tim Kindberg *"Distributed Systems: Concepts and Design",* Fifth Edition, Pearson, 2012. |
| | |
| **Reference s** | |
| 1 | Sunita Mahajan & Seema Shah, *"Distributed Computing",* Second Edition, OXFORD, 2013 |
| | |
| **Useful Links** | |
| 1 | https://nptel.ac.in/courses/106/106/106106107/ |
| 2 | https://nptel.ac.in/courses/106/106/106106168/ |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 1 | | 3 | | | 2 |
| **CO2** | | 1 | | 2 | | |
| **CO3** | 2 | | 1 | | | |

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level**

| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **20** | **20** | **50** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | M. Tech. (CS and IT) | | | | |
| **Class, Semester** | First Year M. Tech., Sem II | | | | |
| **Course Code** | 6IT532 | | | | |
| **Course Name** | Professional Elective – 3: System Programming | | | | |
| **Desired Requisites:** | Data Structures and Operating Systems | | | | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 2** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To elaborate the concepts in systems programming. |
| **2** | To analyze the structure and design of assemblers, linkers and loaders. |
| **3** | To interpret high level programming languages executions using system programs |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Analyze the working of system programs | Analyze |
| **CO2** | Study the working of parsers of compilers | Analyze |
| **CO3** | Compare the static and dynamic linking | Analyze |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Overview of System Software:**<br>Introduction, Software, Software Hierarchy, Systems Programming, Machine Structure, Interfaces, Address Space, Computer Languages, Tools, Life Cycle of a Source Program, Levels of System Software, Overview of Language Processors Programming Languages and Language Processors, Language Processing Activities, Program Execution, Fundamental of Language Processing, Symbol Tables | 6 |
| II | **Assemblers:**<br>Elements of Assembly Language Programming, Design of the Assembler, Assembler Design Criteria, Types of Assemblers, Two-Pass Assemblers, One-Pass Assemblers, Single pass Assembler for Intel x86 , Algorithm of Single Pass Assembler, Multi-Pass Assemblers, Advanced Assembly Process, Variants of Assemblers Design of two pass assembler, | 6 |
| III | **Macro and Macro Processors:**<br>Introduction, Macro Definition and Call, Macro Expansion, Nested Macro Calls, Advanced Macro Facilities, Design Of a Macro Pre-processor, Design of a Macro Assembler, Functions of a Macro Processor, Basic Tasks of a Macro Processor, Design Issues of Macro Processors, Features, Macro Processor Design Options, Two-Pass Macro Processors, One-Pass Macro Processors | 7 |
| IV | **Linkers and Loaders:**<br>Introduction, Relocation of Linking Concept, Design of a Linker, Self-Relocating Programs, Linking in MSDOS, Linking of Overlay Structured Programs, Dynamic Linking, Loaders, Different Loading Schemes, Sequential and Direct Loaders, Compile-and-Go Loaders, General Loader Schemes, Absolute Loaders, Relocating Loaders, Practical Relocating Loaders, Linking Loaders, Relocating Linking Loaders, Linkers v/s Loaders | 7 |

| | | |
|---|---|---|
| V | **Scanning and Parsing**:<br>Programming Language Grammars, Classification of Grammar, Ambiguity in Grammatic Specification, Scanning, Parsing, Top Down Parsing, Bottom up Parsing, Language Processor Development Tools, LEX, YACC, **Compilers**: Causes of Large Semantic Gap, Binding and Binding Times, Data Structure used in Compiling, Scope Rules, Memory Allocation, Compilation of Expression, Compilation of Control Structure, Code Optimization | 7 |
| VI | **Interpreters & Debuggers:**<br>Benefits of Interpretation, Overview of Interpretation, The Java Language Environment, Java Virtual Machine, Types of Errors, Debugging Procedures, Classification of Debuggers, Dynamic/Interactive Debugger | 6 |

| **Text Books** | |
|---|---|
| 1 | D M Dhamdhere, "*System Programming"*, McGraw Hill Publication, second revised edition, 2009 |
| 2 | Srimanta Pal, "*System Programming"*, Oxford University Press, 2011 |
| 3 | R.K. Maurya & A. Godbole, "*System Programming and Compiler Construction",* Dreamtech Press, 2014 |

| **References** | |
|---|---|
| 1 | Leland L. Beck, "*System Software – An Introduction to Systems Programming"*, Pearson Education Asia,3rd edition, 2000 |
| 2 | Santanu Chattopadhyay, „*System Software",* Prentice-Hall India, 2007 |
| 3 | R K Maurya and Anand A Godbole "*System Programming and Compiler Construction (Includes Labs)"*, Dreamtech Press, 2014 |

| **Useful Links** | |
|---|---|
| 1 | www.cs.jhu.edu/~scott/pl/lectures/parsing.html |
| 2 | www.en.wikipedia.org/wiki/System_programming |
| 3 | https://nptel.ac.in/courses/106/106/106106197/ |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | 3 | | | |
| **CO2** | 1 | 2 | | 1 | | |
| **CO3** | | | 1 | | | 1 |

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

| Assessment Plan based on Bloom's Taxonomy Level | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT533 |
| **Course Name** | Professional Elective - 3: Mathematics for Machine Learning |
| **Desired Requisites:** | Mathematics |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To use linear algebra and calculus for machine learning. |
| **2** | To elaborate matrix theory for machine learning. |
| **3** | To compare optimization and probability for real applications |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Apply the concepts of linear algebra and calculus for machine learning algorithms | Apply |
| **CO2** | Compare different algorithms for dimensionality reduction | Analyse |
| **CO3** | Evaluate the optimization & probabilistic algorithms | Evaluate |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Linear Algebra Basics:**<br>Vector spaces and subspaces, basis and dimensions, linear transformation, four fundamental subspaces. | 6 |
| II | **Matrix Theory:**<br>Norms and spaces, eigenvalues and eigenvectors, Special Matrices and their properties, least squared and minimum normed solutions. SVD: Properties and applications, low rank approximations, Gram Schmidt process, polar decomposition | 7 |
| III | **Dimensions Reduction Algorithms:**<br>Principal component analysis, linear discriminant analysis, minimal polynomial and Jordan canonical form. | 6 |
| IV | **Calculus:**<br>Basic concepts of calculus: partial derivatives, gradient, directional derivatives, Jacobian, hessian, convex sets, convex functions and its properties. | 6 |
| V | **Optimization:**<br>Unconstrained and Constrained optimization, Numerical optimization techniques for constrained and unconstrained optimization: Newton‟s method, Steepest descent method, Penalty function method. Introduction to SVM, Error minimizing LPP, concepts of duality, hard and soft margin classifiers. | 7 |
| VI | **Probability:**<br>Basic concepts of probability: conditional probability, Bayes" theorem, independence, theorem of total probability, expectation and variance, few discrete and continuous distributions, joint distributions and co-variance. | 7 |

| **Text Books** | |
|---|---|
| 1 | W. Cheney, *"Analysis for Applied Mathematics"*, New York: Springer Science+Business Medias, 2001. |

| | |
|---|---|
| 2 | S. Axler, *"Linear Algebra Done Right"*, Springer International Publishing, 3rd edition, 2015 |
| | |

| **References** | |
|---|---|
| 1 | All Modules taken from below link course. https://onlinecourses.nptel.ac.in/noc21_ma38/ |
| | |

| **Useful Links** | |
|---|---|
| 1 | https://nptel.ac.in/courses/111/107/111107137/ |
| | |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | | 2 | | |
| **CO2** | | 3 | 3 | | 2 | |
| **CO3** | 1 | | | 1 | | |

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level**

| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2020-21**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. ( CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT 534 |
| **Course Name** | Professional Elective – 3-Soft Computing and applications |
| **Desired Requisites:** | Basic knowledge of mathematics |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To foster student's abilities to implement soft computing based solutions for real-world problems |
| **2** | To impart knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms |
| **3** | To discuss hybrid applications of ANN, Fuzzy and GA |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

| | | |
|---|---|---|
| **CO1** | analyze soft computing techniques and their roles in building intelligent machines | Analyze |
| **CO2** | evaluate fuzzy logic and neural networks techniques to solve various engineering problems | Evaluate |
| **CO3** | build prototyping applications using genetic algorithms and hybrid approaches | Create |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction:** Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence, Characteristics of Neuro Computing and Soft Computing, Difference between Hard Computing and Soft Computing, Concepts of Learning and Adaptation | 6 |
| II | **Fuzzy Logic:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making | 7 |
| III | **Neural Networks:** Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance Architectures, Advances in Neural Networks | 7 |
| IV | **Genetic Algorithms:** Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition | 7 |
| V | **Hybrid Systems:** Introduction to Hybrid Systems, Adaptive Neuro Fuzzy Inference System(ANFIS) | 6 |

| | | |
|---|---|---|
| VI | **Deep Learning:** Spark auto encoder, Convolutional neural networks, Recurrent neural networks, Deep belief networks | 7 |

| | |
|---|---|
| **Text Books** | |
| 1 | Rajasekaran S., Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003 |
| 2 | Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press e-book |
| 3 | |
| 4 | |

| | |
|---|---|
| **References** | |
| 1 | Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2003 |
| 2 | George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI, 1995 |
| 3 | |
| 4 | |

**Useful Links**

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **CO1** | 2 | | | 3 | | |
| **CO2** | | | 2 | 2 | | 2 |
| **CO3** | 2 | | 2 | 2 | | 2 |

**The strength of mapping is to be written as 1,2,3; Here, 1: Low, 2: Medium, 3: High**
**Each CO of the course must map to at least one PO.**

**Assessment**

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level (Marks)**

| **Bloom's Taxonomy Level** | | **MSE** | **ISE** | **ESE** | **Total** |
|---|---|---|---|---|---|
| 1 | Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| 2 | Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| 3 | Apply | 10 | 10 | 20 | **40** |
| 4 | Analyze | 10 | 5 | 10 | **25** |
| 5 | Evaluate | 10 | 5 | 10 | **25** |
| 6 | Create | | | 10 | **10** |
| **Total** | | **30** | **20** | **50** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | | |
|---|---|---|---|---|---|---|
| **AY 2022-23** | | | | | | |
| **Course Information** | | | | | | |
| **Programme** | | M. Tech. (CS and IT) | | | | |
| **Class, Semester** | | First Year M. Tech., Sem II | | | | |
| **Course Code** | | 6IT535 | | | | |
| **Course Name** | | Professional Elective - 4: Big Data Computing | | | | |
| **Desired Requisites:** | | Data Mining | | | | |
| | | | | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | | |
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** | |
| **Tutorial** | - | 30 | 20 | 50 | 100 | |
| **Practical** | - | | | | | |
| **Interaction** | - | **Credits: 3** | | | | |

| **Course Objectives** | |
|---|---|
| **1** | To elaborate the fundamental concepts of big data analytics |
| **2** | To analyze the big data using various techniques |
| **3** | To represent big data using visualization tools |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Elaborate the fundamentals of various big data analytics techniques | Apply |
| **CO2** | Study the various approach to implement distributed environment | Analyze |
| **CO3** | Evaluate the performance of algorithms on advanced distributed system | Evaluate |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Big Data:**<br>Big Data and its Importance, Four V"s of Big Data, Drivers for Big Data – Introduction to Big Data Analytics, Big Data Analytics applications. | 6 |
| II | **Big Data Technologies:**<br>Hadoop"s Parallel World, Data discovery, Open source technology for Big Data Analytics, Cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics | 7 |
| III | **Processing Big Data:**<br>Detecting Patterns in Complex Data with Clustering and Link Analysis, Identifying previously unknown groupings within a data set, Segmenting the customer market with the K–Means algorithm, Defining similarity with appropriate distance measures, Constructing tree–like clusters with hierarchical clustering, Clustering text documents and tweets to aid understanding | 7 |
| IV | **Hadoop Mapreduce:**<br>Introduction to Map-Reduce, Hadoop Framework, Spark Framework | 6 |
| V | **Distributed Map Reduce:**<br>TF-IDF Example, Page Rank Example, Demonstration: Page Rank Algorithm in Spark | 6 |
| VI | **Analytic Tools:**<br>PIG overview, SQL vs. PIG, PIG Latin, User Defined Functions, Data Processing Operators, Overview of Hive, Hive QL, Tables, Querying Data | 7 |

| **Text Books** | |
|---|---|
| 1 | Prajapati Vignesh, *"Big Data Analytics with R and Hadoop"*, Packt Publishing, 1st Edition, 2013 |
| 2 | Minelli Michael, Chambers Michehe, *"Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business"*, Ambiga Dhiraj, Wiely CIO Series, 1st Edition, 2013 |

**References**

| | |
|---|---|
| 1 | Franks Bill, *"Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics"*, Wiley and SAS Business Series,1st Edition , 2012 |
| | |
| **Useful Links** | |
| | Module I, II, III, IV, V, VI<br>https://nptel.ac.in/courses/106/104/106104189/ |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 1 | | 1 | | | |
| **CO2** | | 1 | | 2 | | |
| **CO3** | 3 | | 2 | | 1 | |

| **Assessment** |
|---|
| The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

| **Assessment Plan based on Bloom's Taxonomy Level** | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT536 |
| **Course Name** | Professional Elective - 4: High Performance Computing |
| **Desired Requisites:** | Operating System |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To elaborate the concepts of process and thread in high performance computing |
| **2** | To evaluate the performance of parallel programs with sequential program |
| **3** | To compare multi-core and many-core architectures |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Apply parallel computing algorithm for solving the problem. | Apply |
| **CO2** | Analyse the parallel implemented algorithms for performance parameters. | Analyze |
| **CO3** | Design the appropriate parallel algorithm for the given problem. | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Basic Parallel Algorithm**<br>Introduction to Parallel Computing, Parallelism on the JVM, Running Computations in Parallel, Monte Carlo Method to Estimate Pi, First-Class Tasks | 6 |
| II | **Basic Task in Parallel Algorithms**<br>Parallel Sorting, Data Operations and Parallel Mapping, Parallel Fold (Reduce) Operation Associativity, Parallel Scan (Prefix Sum) Operation | 7 |
| III | **Data-Parallelism** Data-Parallel Programming, Data-Parallel Operations, Scala Parallel Collections<br>Splitters and Combiners | 7 |
| IV | **Data Structures for Parallel Computing**<br>Implementing Combiners, Parallel Two-phase Construction, Conc-tree Data Structure, Amortized, Constant-time Append Operation, Conc-Tree Combiners | 7 |
| V | **Sorting**<br>Issues, sorting network, Bubble sort | 6 |
| VI | **Graph Algorithms**<br>MST, SSSP, APSP | 6 |

| **Text Books** | |
|---|---|
| 1 | Anath Grama, Ansul Gupta, George Karypis, Vipin Kumar, *"Introduction to parallel computing, Second Edition",* Pearson Education, 2003 |

| **References** | |
|---|---|
| 1 | Horrowitz, Sahni, Rajasekaran, *"Computer Algorithms"*, Computer Science, W. H. Freeman and company Press, New York, 1997 |

| Useful Links | |
|---|---|
| 1 | Module I, II, III, IV<br>https://www.coursera.org/learn/parprog1?ranMID=40328&ranEAID=*GqSdLGGurk&ranSiteID=.GqSdLGGurk-ntwHfWI_xX32aIgZXdr9Ug&siteID=.GqSdLGGurk-ntwHfWI_xX32aIgZXdr9Ug&utm_content=10&utm_medium=partners&utm_source=linkshare&utm_campaign=*GqSdLGGurk#syllabus |

| CO-PO Mapping | | | | | | |
|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | | 1 | | 1 | | |
| **CO2** | 2 | | 2 | | 1 | |
| **CO3** | | 2 | | 3 | | |

| Assessment |
|---|
| The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

| Assessment Plan based on Bloom's Taxonomy Level | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | M. Tech. (CS and IT) | | | | |
| **Class, Semester** | First Year M. Tech., Sem II | | | | |
| **Course Code** | 6IT537 | | | | |
| **Course Name** | Professional Elective - 4: Deep Learning | | | | |
| **Desired Requisites:** | | | | | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To elaborate the models of Deep Learning |
| **2** | To compare the applications of Deep Learning with performance parameters |
| **3** | To interpret the problem to solve using Deep Learning |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Apply the fundamentals of Deep Learning for suitable applications | Apply |
| **CO2** | Compare the optimization techniques pertaining to Deep Learning | Analyze |
| **CO3** | Build and compare various Deep Learning model for solving real world application | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Fundamentals of Neural Networks:**<br>McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks. Backpropagation algorithm. | 7 |
| II | **Optimizations in Gradient Descent:**<br>Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Bais correction in Adam. | 6 |
| III | **Regularization:**<br>Regularization: Bias Variance Trade off, L2 regularization, Early stopping, Data-set augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout. Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization. | 7 |
| IV | **Deep Learning for word encoding-Natural Language Processing:**<br>Eigen values and eigen vectors, Basis, Principal Component Analysis and its interpretations, Singular Value Decomposition, Learning Vectorial Representations Of Words: One hot representation of words, SVD for learning word representation. | 7 |
| V | **Convolutional Neural Networks for Computer Vision:**<br>Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks | 6 |
| VI | **Recurrent Neural Networks**:<br>Recurrent Neural Network, Back Propagation through time(BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTM. | 6 |

| | |
|---|---|
| **Text Books** | |
| 1 | Aurelien Geron , " *Hands-On Machine Learning with Scikit-Learn, Keras and Tensor Flow:* |
| | *Concepts, Tools and Techniques to Build Intelligent Systems*", 2nd Edition, O"Reilly,2019 |
| 2 | Eugene Charniak, *"Introduction to Deep Learning, The MIT Press Cambridge"*, 1st Edition, 2019 |
| | |
| **References** | |
| 1 | Ian Goodfellow, Yoshua Bengio and Aoron Courville *"Deep Learning",* The MIT Press Cambridge, Massachusetts London, England, 2017 |
| | |
| **Useful Links** | |
| 1 | All Modules taken from below link https://www.classcentral.com/course/swayam-deep-learning-iitropar-43579 |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | | 1 | | | 1 | |
| **CO2** | | 2 | | 2 | | |
| **CO3** | 2 | | 1 | | | |

**Assessment**

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level**

| **Bloom's Taxonomy Level** | **MSE** | **ISE** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 20 | **40** |
| Analyze | 10 | 5 | 10 | **25** |
| Evaluate | 10 | 5 | 10 | **25** |
| Create | | | 10 | **10** |
| **Total** | **30** | **20** | **50** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. ( CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT538 |
| **Course Name** | Professional Elective - 4: Geographical Information System & Remote Sensing -Interdisciplinary |
| **Desired Requisites:** | Fundamentals of Image processing |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 2** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To impart knowledge of the fundamentals of Remote Sensing (RS) and geographical information systems (GIS) |
| **2** | To make students familiar with Data and Data Products in RS and GIS. |
| **3** | To acquaint students advantages and applications of RS and GIS |
| **4** | |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Understand and summarize fundamental concepts in RS and GIS | Understand |
| **CO2** | Interpret and Apply various satellite RS data and demonstrate GIS data and GIS database management system | Apply |
| **CO3** | Compare and examine data and data Products of RS and GIS | Analyse |
| **CO4** | Select and Verify RS and GIS data and data products to design solution for various interdisciplinary problems | Evaluate |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Concepts and Foundation of Remote Sensing**<br>Introduction, Remote Sensing System, Electromagnetic Energy, Electromagnetic Spectrum and its Characteristics, Energy Interaction in the Atmosphere and with the Earth's Surface, Resolution in Remote Sensing, Broad Classifications of Sensors and Platform, Earth Observation Satellite and Sensors, Data Reception, Transmission and Processing, Remote Sensing Data and Data Products. | 7 |
| II | **Satellite Image Interpretation and Processing**<br>Interpretation Procedure and Elements, Interpretation strategies and keys, Digital Image processing and Image Analysis steps, Image Rectification and Restoration, Image Enhancement, Spatial Filtering, Image Transformation, Image Classification and Analysis. | 7 |
| III | **Applications of Remote Sensing**<br>Land use Land Cover Mapping, Crop Inventory, Ground Water Mapping, Urban Growth, Flood Plain Mapping, Disaster Management. | 6 |
| IV | **GIS – An Overview**<br>Introduction, Geographical concepts and Terminology, Difference between Image Processing system and GIS, Various GIS packages and their salient features, Essentials components of GIS, Utility of GIS, GPS | 7 |

| | | |
|---|---|---|
| V | **GIS Data**<br>GIS Data types and Data Representation, Data Acquisition, Georeferencing of GIS Data, Raster and Vector data, Raster to Vector conversion, Remote Sensing Data in GIS, GIS Database and Database Management System | 7 |
| VI | **GIS Spatial Data Analysis and Applications**<br>Measurements in GIS-Lengths, Perimeters, and Areas, Queries, Reclassification, Buffering and Neighborhood Functions, Map Overlay, Spatial Interpolation, Analysis of Surfaces, Network Analysis, GIS Applications | 6 |

| | |
|---|---|
| | **Text Books** |
| 1 | Chandra, A.M. and Gosh, S.K., "Remote Sensing and GIS", Narosa Publishing House. 2008 |
| 2 | Lo, C.P. and Young, A.K.W., "Concepts and Techniques of Geographical Information System", Prentice Hall India. 20012 |
| | **References** |
| 1 | Lillesand, T.M. and Kieffer, "Remote Sensing and Image Interpretation", John Wiley and Sons, 6th Edition. 2012 |
| 2 | Chang, K, "Introduction to Geographical Systems", Tata McGraw-Hill, 4th Edition. 2010 |
| | **Useful Links** |
| 1 | NPTEL: https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce08<br>https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ce10 |
| 2 | https://www.usgs.gov |
| 3 | https://bhuvan.nrsc.gov.in/bhuvan_links.php# |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **CO1** | | | 2 | | | |
| **CO2** | | | 2 | | | |
| **CO3** | 2 | | | 2 | | |
| **CO4** | 3 | | | 2 | | 2 |

**Assessment**

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

**Assessment Plan based on Bloom's Taxonomy Level (Marks)**

| Bloom's Taxonomy Level | | MSE | ISE | ESE | Total |
|---|---|---|---|---|---|
| 1 | Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| 2 | Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| 3 | Apply | 10 | 10 | 20 | **40** |
| 4 | Analyze | 10 | 5 | 10 | **25** |
| 5 | Evaluate | 10 | 5 | 10 | **25** |
| 6 | Create | | | 10 | **10** |
| **Total** | | **30** | **20** | **50** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | M. Tech. (CS and IT) | | | | |
| **Class, Semester** | First Year M. Tech., Sem II | | | | |
| **Course Code** | 6IT574 | | | | |
| **Course Name** | Professional Elective – 3-Distributed Operating Systems Lab | | | | |
| **Desired Requisites:** | | | | | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To elaborate the models of Distributed Systems |
| **2** | To implement the models of Distributed Systems |
| **3** | To describe the problem to solve using Deep Learning |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Demonstrate Learning models for suitable applications | Apply |
| **CO2** | Implement distributed network communication systems | Apply |
| **CO3** | Apply security techniques to solve real world distributed applications | Evaluate |

**List of Experiments / Lab Activities**

**List of Experiments:**
Activities are to be carried out individually.
Each student will perform the activity based on course on following areas.

1. Study of Case Studies: SUN RPC, DEC RPC Clock synchronization and related algorithms
1. Implement concurrent day-time client-server application.
2. Configure following options on server socket and tests them: SO_KEEPALIVE, SO_LINGER, SO_SNDBUF, SO_RCVBUF, TCP_NODELAY
3. Incrementing a counter in shared memory
4. Create CORBA based server-client application
5. Design XML Schema and XML instance document
6. Implement Trigonometric Service that implements sin, and cos operations.
7. Configuring reliability and security options
8. Write a program to Test open source ESB using web service.

Not limited to this list; Instructor can add more based on the theory course syllabus

**Text Books**

| | |
|---|---|
| 1 | Pradeep K. Sinha "Distributed Operating Systems Concepts and Design", Eastern Economy Edition,PHI, 1998. |
| 2 | George Coulouris, Jean Dollimore,Tim Kindberg "Distributed Systems: Concepts and Design", Fifth Edition, Pearson, 2012. |

**References**

| | |
|---|---|
| 1 | Sunita Mahajan & Seema Shah, *"Distributed Computing"*, Second Edition, OXFORD, 2013 |

**Useful Links**

| | |
|---|---|
| 1 | https://nptel.ac.in/courses/106/106/106106107/<br>https://nptel.ac.in/courses/106/106/106106168/ |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 1 | | 3 | | | 2 |
| **CO2** | | 1 | | 2 | | |
| **CO3** | 1 | | 1 | | | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy level**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT575 |
| **Course Name** | Professional Elective – 3- System Programming lab |
| **Desired Requisites:** | Data Structures and Operating Systems |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2Hrs/week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To elaborate the concepts in systems programming. |
| **2** | To analyze the structure and design of assemblers, linkers and loaders. |
| **3** | To use high level programming languages to describe system programs |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Demonstrate the working of system programs | Analyze |
| **CO2** | **Study the working of parsers of compilers** | Analyze |
| **CO3** | **Compare the static and dynamic linking** | Analyze |

### List of Experiments / Lab Activities

**List of Experiments:**
Activities are to be carried out individually.
Each student will perform the activity based on course on following areas.

1. Create a menu driven interface for
   a) Displaying contents of a file page wise
   b) Counting vowels, characters, and lines in a file
   c) Copying a file
2. Write a program to check blance parenthesis of a given program. Also generate the error report.
3. Write a program to create symbol table for a given assembly language program.
4. Write a program to create symbol table for a given high-level language program.
5. Implementation of single pass assembler on a limited set of instructions.
6. Exploring various features of debug command.
7. Use of lax and YACC tools.

Not limited to this list; Instructor can add more based on the theory course syllabus

| **Text Books** | |
|---|---|
| 1 | D M Dhamdhere, "*System Programming*", McGraw Hill Publication, second revised edition, 2009 |
| 2 | Srimanta Pal, "*System Programming*", Oxford University Press, 2011 |

| | |
|---|---|
| 3 | R.K. Maurya & A. Godbole, "*System Programming and Compiler Construction", Dreamtech Press, 2014 |
| | |
| **References** | |
| 1 | Leland L. Beck, "*System Software – An Introduction to Systems Programming*", Pearson Education Asia,3rd edition, 2000 |
| 2 | Santanu Chattopadhyay, „*System Software", Prentice-Hall India, 2007 |
| 3 | R K Maurya and Anand A Godbole "*System Programming and Compiler Construction (Includes Labs)"*, Dreamtech Press, 2014 |
| | |
| **Useful Links** | |
| 1 | www.cs.jhu.edu/~scott/pl/lectures/parsing.html |
| 2 | www.en.wikipedia.org/wiki/System_programming |
| 3 | https://nptel.ac.in/courses/106/106/106106197/ |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | 3 | | | |
| **CO2** | 1 | 2 | | 1 | | |
| **CO3** | | | 1 | | | 1 |

| **Assessment** | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

| **Assessment Plan based on Bloom's Taxonomy level** | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

**Walchand College of Engineering, Sangli**
*(Government Aided Autonomous Institute)*

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech, Sem II |
| **Course Code** | 6IT576 |
| **Course Name** | Professional Elective – 3-Mathematics for Machine Learning Lab |
| **Desired Requisites:** | Probability, Linear Algebra and Programming |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To compare various techniques in Machine Learning |
| **2** | To elaborate methodologies for various application areas of Machine Learning |
| **3** | To illustrate various applications in Machine Learning |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | To Understand the concept of Linear Algebra and Probabilities. | Understand |
| **CO2** | To apply various algorithms of Machine Learning. | Apply |
| **CO3** | To implement code for various applications of Machine Learning | Implement |

**List of Experiments / Lab Activities**

**List of Experiments:**

1 Write a program in Python to implement simple facts of basic Linear Algebra.
2 Write a program in Python to implement simple facts of Matrices and Vectors.
3 Write a program in Python to calculate the eigenvalues and eigenvectors, SVD.
4 Write a program in Python to implement PCA for dimensionality reduction.
5 Write a Program to test the basic concepts of calculus.
6 Write a program in Python to implement of linear discriminant analysis.
7 Write a program in Python to implement of Gradient Descent algorithm from scratch.
8 Write a Program to Implement Support Vector Machine on MNIST dataset.
9 Write a program in Python to implement Gram Schmidt algorithm.
10 Write a program to implement a data compression.

Activities are to be carried out individually.
Each student will perform the activity based on course on following areas.
Student should perform the activities on the basis of the real-time applications in the subjects and submit the work with code, PPT, PDF, Text report document & reference material or on online GitHub. Students should maintain activity log book containing weekly progress

**Text Books**

| | |
|---|---|
| 1 | Aurélien Géron ,*" Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow"O'Reilly Media, Inc., 2nd Edition,2019* |

**References**

| | |
|---|---|
| 1 | |

| Useful Links | |
|---|---|
| 1 | **https://onlinecourses.nptel.ac.in/noc21_ma38/preview (NPTEL/SWAYAM course by** Prof. By Prof. Sanjeev Kumar, Prof. S. K. Gupta \| IIT Roorkee ) |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| **Programme Outcomes (PO)** | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 3 | | 1 | | | |
| **CO2** | | 2 | | | | |
| **CO3** | | | 3 | | 1 | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy level**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2020-21**

| **Course Information** | |
|---|---|
| **Programme** | M.Tech. ( CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT 534 |
| **Course Name** | Professional Elective – 3- Soft Computing and applications Lab |
| **Desired Requisites:** | Basic knowledge of mathematics |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 10 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To foster student's abilities to implement soft computing based solutions for real-world problems |
| **2** | To impart knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms |
| **3** | To discuss hybrid applications of ANN, Fuzzy and GA |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | analyze soft computing techniques and their roles in building intelligent machines | Analyze |
| **CO2** | evaluate fuzzy logic and neural networks techniques to solve various engineering problems | Evaluate |
| **CO3** | build prototyping applications using genetic algorithms and hybrid approaches | Create |

| | **Lab activities/Experiments** | **Hours** |
|---|---|---|
| | 10 /12 experiments using MATLAB and following toolboxs:<br>**Neural Nework Toolbox for**<br>1.Creating a Neural Network<br>2. Use various Commands of the Neural Network Toolbox<br>3. Implement one algorithm using Neural Network Graphical User Interface Toolbox<br>**Fuzzy Logic MATLAB Toolbox for**<br>4.Commands in Fuz.zy Logic Toolbox<br>5. Implement Simulink Blocks in Fuzzy Logic Toolbox<br>6. Write an algorithm using Fuzzy logic GUI Toolbox<br>**Genetic Algorithm MATLAB Toolbox for**<br>7. Use various Commands of MATIAB Genetic Algorithm Commands<br>8. Implement one algorithm using Generic Algorithm Graphical User Interface.<br>Not limited to this list; Instructor can add more based on the theory course syllabus. | 6 |

| **Text Books** | |
|---|---|
| 1 | Rajasekaran S., Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003 |
| 2 | Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press e-book |

| **References** | |
|---|---|
| 1 | Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2003 |
| 2 | George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI, 1995 |

**Useful Links**

| | |
|---|---|
| 3 | |

| CO-PO Mapping | | | | | | |
|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | | 3 | | |
| **CO2** | | | 2 | 2 | | 2 |
| **CO3** | 2 | | 2 | 2 | | 2 |

| Assessment | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

| Assessment Plan based on Bloom's Taxonomy level | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | M. Tech. (CS and IT) | | | | |
| **Class, Semester** | First Year M. Tech., Sem II | | | | |
| **Course Code** | 6IT578 | | | | |
| **Course Name** | Professional Elective – 4- Big Data Computing Lab | | | | |
| **Desired Requisites:** | Cloud computing | | | | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To demonstrate the big data computing using Apache Hadoop |
| **2** | To experiment the distributed file system and its interfacing |
| **3** | To solve real world challenges using big data analytics |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Apply the concepts of big data computing for data analytics | Apply |
| **CO2** | Identify the characteristics of datasets in big data | Apply |
| **CO3** | Evaluate scaling techniques to compute the big data | Evaluate |

**List of Experiments / Lab Activities**

**List of Experiments:**

Activities are to be carried out individually.

Each student will perform the activity based on course on following areas.

1. Implement the following file management tasks in Hadoop: Adding Files and Directories, Retrieving Files, Deleting Files
2. Exploring various shell commands in Hadoop.
3. Industry Problem Statement( if any)
4. To implement basic Word Count Map-Reduce program to understand Map Reduce Paradigm with number of occurrences of each word appearing in an input file and perform a MapReduce Job for word search count (look for specific keywords in a file).
5. Implement Map Reduce program that mines weather data (or any real-time data set). Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented

Student should perform the activities on the basis of the real-time applications in the subjects and submit the work with code, PPT, PDF, Text report document & reference material or on online GitHub.

Students should maintain activity log book containing weekly progress.

| **Text Books** | |
|---|---|
| 1 | Prajapati Vignesh, *"Big Data Analytics with R and Hadoop"*, Packt Publishing, 1st Edition, 2013 |
| 2 | Minelli Michael, Chambers Michehe, *"Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business"*, Ambiga Dhiraj, Wiely CIO Series, 1st Edition, 2013 |

**References**

| | |
|---|---|
| 1 | Franks Bill, *"Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics"*, Wiley and SAS Business Series,1st Edition , 2012 |
| | |
| **Useful Links** | |
| 1 | Module I, II, III, IV, V, VI<br>https://nptel.ac.in/courses/106/104/106104189/ |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | 1 | | | |
| **CO2** | | 3 | | 2 | 2 | |
| **CO3** | 1 | | 1 | | | |

| **Assessment** | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

| **Assessment Plan based on Bloom's Taxonomy level** | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT579 |
| **Course Name** | Professional Elective – 4- High Performance Computing lab |
| **Desired Requisites:** | Computer Algorithm |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To elaborate the concepts of process and thread in high performance computing |
| **2** | To evaluate the performance of parallel programs with sequential program |
| **3** | To compare multi-core and many-core architectures |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Apply the parallel algorithm to solve the problem | Apply |
| **CO2** | Implement the parallel algorithms for performance parameters | Apply |
| **CO3** | Develop the appropriate parallel algorithm to speed up the computation | Create |

**List of Experiments / Lab Activities**

**Lab Activities:**
Activities are to be carried out individually.
Each student will perform the activity based on course on following areas.
Implementations are expected using OpenACC platform

1. Implement PI Calculation.
2. Implement Matrix Transpose Program.
3. Write a program to find the factorial of a given number.
4. Write a program to find squares of array elements.
5. Implement odd-even Sort.
6. Implement Quick Sort.
7. Program on vector computation.
8. Study of Profiling tools.

Student should perform the activities on the basis of the real-time applications in the subjects and submit the work with code, PPT, PDF, Text report document & reference material or on online GitHub.
Students should maintain activity log book containing weekly progress.

| **Text Books** | |
|---|---|
| 1 | Anath Grama, Ansul Gupta, George Karypis, Vipin Kumar, *"Introduction to parallel computing"*, Second Edition, Pearson Education |
| | |

| **References** | |
|---|---|
| 1 | Horrowitz, SahniRajasekaran, *"Computer Algorithms"*, Computer Science, W. H. Freeman and company Press, New York, |

**Useful Links**

| | |
|---|---|
| 1 | https://www.coursera.org/learn/parprog1?ranMID=40328&ranEAID=*GqSdLGGurk&ranSiteID=.GqSdLGGurk-ntwHfWI_xX32aIgZXdr9Ug&siteID=.GqSdLGGurk-ntwHfWI_xX32aIgZXdr9Ug&utm_content=10&utm_medium=partners&utm_source=linkshare&utm_campaign=*GqSdLGGurk#syllabus |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | | | 3 | | | |
| **CO2** | 2 | 2 | | 1 | | |
| **CO3** | | 1 | | | | 2 |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy level**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |

| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 6IT580 |
| **Course Name** | Professional Elective – 4- Deep Learning lab |
| **Desired Requisites:** | Mathematics, Machine learning |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 3<br>0 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** |
|---|
| To elaborate the models of Deep Learning |
| To compare the applications of Deep Learning with performance parameters |
| To interpret the problem to solve using Deep Learning |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | |
|---|---|
| At the end of the course, the students will be able to, | |
| Apply the Deep Learning model for suitable applications | Apply |
| Implement deep neural network systems | Apply |
| Build Deep Learning model for solving real world application | Evaluate |

**List of Experiments / Lab Activities**

**List of Experiments:**

Activities are to be carried out individually.

Each student will perform the activity based on course on following areas.

9. Perform the perceptron learning algorithm
10. Perform the gradient descent algorithm and its types
11. Perform the feedforward neural networks
12. Perform the AdaGrad algorithm
13. Perform L2 regularization and ensemble methods
14. Study and explain the better activation functions and better weight initialization methods
15. Perform principal component analysis and its interpretation
16. Perform bag of words and skip gram model
17. Perform CNN related algorithms (LeNet, AlexNet, ZF-Net, VGGNet, GoogleNet, ResNet, etc…)
18. Perform object detection using CNN
19. Perform YOLO algorithm
20. Perform RNN algorithm
21. State and explain with example Back propagation through time (BPTT)

**Text Books**

Prajapati Vignesh, *"Big Data Analytics with R and Hadoop"*, Packt Publishing, 1st Edition, 2013

Minelli Michael, Chambers Michehe, *"Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business"*, Ambiga Dhiraj, Wiely CIO Series, 1st Edition, 2013

**References**

Franks Bill, *"Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics"*, Wiley and SAS Business Series,1st Edition , 2012

**Useful Links**

Module I, II, III, IV, V, VI
https://nptel.ac.in/courses/106/104/106104189/

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| **CO1** | 2 | | 2 | | 2 | |
| **CO2** | | 3 | | 3 | | |
| **CO3** | 1 | | 1 | | | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom's Taxonomy level**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |
| | | | | |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | | |
|---|---|---|---|---|---|---|
| **AY 2022-23** | | | | | | |
| **Course Information** | | | | | | |
| **Programme** | | M.Tech. (CS and IT) | | | | |
| **Class, Semester** | | First Year M. Tech., Sem I | | | | |
| **Course Code** | | 6IT551 | | | | |
| **Course Name** | | Professional Elective – 4- Geographical Information System & Remote Sensing - Lab | | | | |
| **Desired Requisites:** | | Basic mathematics, Geographical Information System & Remote Sensing | | | | |
| | | | | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | | |
| **Lecture** | - | **LA1** | **LA2** | **Lab ESE** | **Total** | |
| **Tutorial** | - | 30 | 30 | 40 | 100 | |
| **Practical** | 2 Hrs/Week | | | | | |
| **Interaction** | - | **Credits: 1** | | | | |

| **Course Objectives** | |
|---|---|
| **1** | To perform data analysis on raster and vector data |
| **2** | To prepare thematic maps using GIS software. |
| **3** | To perform querying on attribute data and get desired results. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Demonstrate geo-data creation and handling | Apply |
| **CO2** | Design thematic maps | Apply |
| **CO3** | Create simple GIS application | Create |

**List of Experiments / Lab Activities**

**List of Experiments:**

Activities are to be carried out individually.

Each student will perform the activity based on course on following areas.

1. Familiarization with GIS Software – Q GIS
2. Geo-data Input and preprocessing
3. Geo Referencing
4. Digitization of Map
5. Creation of Thematic Maps
6. Data Conversion – Vector to Raster,
7. Data Conversion – Raster to Vector
8. Adding Attribute Data
9. Querying On Attribute Data
10. Vector Analysis
11. Raster Analysis
12. Map Composition

13. Simple Applications of GIS

Student should perform the activities on the basis of the real-time applications in the subjects and submit the work with code, PPT, PDF, Text document report & reference. Students should maintain activity log book containing weekly progress.

| | |
|---|---|
| **Text Books** | |
| 1 | Lo, C.P. and Young, A.K.W., “Concepts and Techniques of Geographical Information System”, Prentice Hall India. |
| **References** | |
| 1 | Chandra, A.M. and Gosh, S.K., “Remote Sensing and GIS”, Narosa Publishing House. 2008 |
| **Useful Links** | |
| 1 | |

**CO-PO Mapping**

**Programme Outcomes (PO)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | | | 2 | 2 |
| **CO2** | | 3 | | 3 | | |
| **CO3** | 1 | | 1 | 2 | 2 | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 13<br>Marks Submission at the end of Week 13 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

**Assessment Plan based on Bloom’s Taxonomy level**

| Bloom’s Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Understand | To be used minimum | To be used minimum | To be used minimum | To be used minimum |
| Apply | 10 | 10 | 10 | **30** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | 5 | 5 | 10 | **20** |
| Create | 5 | 5 | 10 | **20** |
| **Total** | **30** | **30** | **40** | **100** |