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

AY 2021-22

Course Information

Programme	M.Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem I
Course Code	5IT501
Course Name	Advanced Algorithms
Desired Requisites:	Computer Algorithms

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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
2	

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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli
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AY 2021-22

Course Information

Programme	M.Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem I
Course Code	5IT502
Course Name	Unix Internal
Desired Requisites:	Operating System

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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** General Overview of the System - History, System Structure, User Perspective, Operating System Services, Assumption About Hardware.	7
II	**Introduction to the Kernel** 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** 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** 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** 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** 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/ (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 (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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

<table>
<tr><td colspan="6">Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)</td></tr>
<tr><td colspan="6">AY 2021-22</td></tr>
<tr><td colspan="6">Course Information</td></tr>
<tr><td colspan="2">Programme</td><td colspan="4">M.Tech. (CS and IT)</td></tr>
<tr><td colspan="2">Class, Semester</td><td colspan="4">FirstYear M. Tech., Sem I</td></tr>
<tr><td colspan="2">Course Code</td><td colspan="4">5IT560</td></tr>
<tr><td colspan="2">Course Name</td><td colspan="4">Research Methodology</td></tr>
<tr><td colspan="2">Desired Requisites:</td><td colspan="4"></td></tr>
<tr><td colspan="2">Teaching Scheme</td><td colspan="4">Examination Scheme (Marks)</td></tr>
<tr><td>Lecture</td><td>2 Hrs/week</td><td>LA1</td><td>LA2</td><td>Lab ESE</td><td>Total</td></tr>
<tr><td>Tutorial</td><td>-</td><td>30</td><td>30</td><td>40</td><td>100</td></tr>
<tr><td>Practical</td><td>-</td><td colspan="4"></td></tr>
<tr><td>Interaction</td><td>1 Hrs/Week</td><td colspan="4">Credits: 2</td></tr>
</table>

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** 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** 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** 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** 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** Role of computer in research process, Data Analysis and Visualization Techniques, Data Storage, Scientific Simulations, Plagiarism Checker	4
VI	**Technical writing methods** Paper Writing, Technical report, Types of Technical report, dissertation/thesis 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 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 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 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

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

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
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AY 2021-22

Course Information

Programme	M.Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem I
Course Code	5IT551
Course Name	Activity based Lab for Advanced Algorithms
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 (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

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 2021-22

Course Information

Programme	M.Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem-1
Course Code	5IT552
Course Name	Activity based Lab for Unix Internal
Desired Requisites:	Operating System, (C/python) Programming language

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 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 (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

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	FirstYear M. Tech., Sem I				
Course Code	5IT553				
Course Name	Presentation and Technical Report Writing				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	-				
Interaction	1 Hr/week	**Credits: 1**			

Course Objectives		
1	To elaborate ethical guidelines during technical content preparation and presentation	
2	To use various report writing tools	
3	To analyze various relevant practices of presentation and report/paper writing	
Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Use appropriate charts, tables and figures in presentation and report	Analyze
CO2	Compare suitable tools towards practicing write-up and presentation	Evaluate
CO3	Create effective report and presentations of the technical work	Create
List of Experiments / Lab Activities		

List of Experiments:

PART – A Technical Report Writing

1. Experiment 1: Writing technical reports using proper Tense and grammar.
2. Experiment 2: Study of various types of technical Reports
    a. Project report
    b. Types of Paper(Journal/Conference)
    c. Indexing(Sci/Scopus)
    d. Intellectual Property Rights (IPR)
    e. Selection of paper type for possible publication.
3. Experiment 3: Study of technical report Structure - I
    a. Preamble
    b. Abstract
    c. Literature review/survey
    d. Problem statement
    e. Objectives
4. Experiment 3: Study of technical report Structure – II
    a. Methodologies
    b. Results
    c. Discussions
    d. Conclusion
    e. Acknowledgements
5. Experiment 4: Use of Bibliographies/references and proper citations in reports.
6. Experiment 5: Use of Citations, referring style and method of using citations.
7. Experiment 6: Study of Plagiarism
    a. Checking plagiarism
    b. Minimizing plagiarism
8. Experiments 7: Learn the Publication Ethics and Peer Review and Mentoring

PART – B Presentation

9. PPT's and Animations
10. Presentation structure, Number of slides and Time management
11. Presentation styles
12. Figures and Tables for data representations

Part –C Tools and Practices

13. Open Office, Latex, Beamer, Flash, GNU Plot etc.
14. End Note; Mendeley, Grammarly, Ginger, 1 Checker, Turnitin etc.

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 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 Writing
2	https://onlinecourses.swayam2.ac.in/cec21_ge18/preview Academic Writing
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	Experiment 8 https://webofscienceacademy.clarivate.com/learn

CO-PO Mapping						
Programme Outcomes (PO)						
	PO1	PO2	PO3	PO4	PO5	PO6

CO1	2		1			
CO2	1			3		
CO3		2			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 (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

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
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AY 2021-22

Course Information	
Programme	M.Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem I
Course Code	5IT511
Course Name	Professional Elective - 1: Cloud and Virtualization Techniques
Desired Requisites:	Computer Networks

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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** 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** Hosted and Bare-Meta, Server Virtualization, Desktop Virtualization, Application Virtualization, Storage Virtualization	6
III	**Network Functions** 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)** VPC fundamentals, Public and Private Subnets, Security Groups, Network Access Control List, Network Address Translation.	7
V	**Cloud Management** Service Management in Cloud Computing, Data Management in Cloud Computing, Resource Management in Cloud	7
VI	**Advances in Cloud Computing** 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 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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli
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AY 2021-22

Course Information

Programme	M.Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem I
Course Code	5IT512
Course Name	Professional Elective - 1: Ruby & Go Programming Language
Desired Requisites:	C & CPP Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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** Brief history of Ruby, Installing & running Ruby, Command Line Arguments, Numbers, Text & Strings, Arrays & Hashes, Symbols, Expressions (True, False, Nil) Classes, Modules & Objects: Objects, Classes, Variables	7
II	**Flow Control & Statements and Properties** Conditionals, Loops, Error & Exception Handling, Threads & Fibers Classes, Modules & Objects : Simple Ruby Classes, Object Instances, Attributes, Inheritance, Persistence Methods, Attributes & Variables: Setter & Getter methods, Method Visibility (Access Control), Instance Variables	7
III	**Meta- programming & File Handling:** 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** Introduction, Program Structure: names, declaration, variables, assignments, types, files, scope, number, string variables, arrays, slice	6
V	**Data Types and operations:** Basic data types, composite data types, functions, control statements, methods, interface, pointers, structs	6
VI	**Concurrency with Shared variables:** 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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*	
AY 2021-22	
Course Information	
Programme	M.Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem I
Course Code	5IT513
Course Name	Professional Elective – 1: Artificial Intelligence
Desired Requisites:	Probability and Linear Algebra

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**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** Introduction to AI, Problem solving as state space search, Uninformed search, Heuristic search, CSP problems	7
II	**Knowledge Representatio**n Introduction, to Knowledge representation, First order logic-I	7
III	**Knowledge Reasoning** First order logic-II, Inference in First order logic-I, Bayesian network, decision network	6
IV	**Planning** Introduction to Planning, Plan space planning, Planning graph and Graphplan	6
V	**Machine Learning** Introduction to ML, Learning decision tress, Reinforcement learning, Learning in neural network, Deep Learning: A review.	7
VI	**Expert systems** 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 https https://onlinecourses.nptel.ac.in/noc19_me71/unit?unit=7&lesson=8

2	Module IV,V https://onlinecourses.nptel.ac.in/noc19_me71/unit?unit=16&lesson=17
3	Module VI 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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*	
AY 2021-22	
Course Information	
Programme	M.Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem I
Course Code	5IT514
Course Name	Professional Elective - 2: Advanced Distributed Computing
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	M.Tech. (CS and IT)				
Class, Semester	First Year M. Tech., Sem I				
Course Code	5IT515				
Course Name	Professional Elective - 2: Modern Application Development				
Desired Requisites:	Web Technology				

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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:** Introduction, Getting Started, Grid System, Fixed Layout, Fluid Layout, Responsive Layout, Typography **Bootstrap Basics Elements:** 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:** Install Node.js Windows and Linux, Modules, HTTP Module, URL Module, First Example. Console, NPM: Package Manager, Node Globals, Node.js OS, Timer, Errors **Node JS Basics:** Buffers, Streams, File System, Path, String Decoder, Query String, ZLIB, Assertion, V8, Callbacks, Events, Punycode, TTY, Web Modules	7
III	**Node JS and MySQL :** Create Connection, Create Database, Create Table, Insert Record, Update Record, Delete Record, Select Record, Select Unique, Drop Table	6
IV	**ReactJS:** 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 :** 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 :** 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. **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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	M.Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem I
Course Code	5IT516
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	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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** 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** Arithmetic operations, Logical operations, Geometrical operations , Image interpolation techniques	7
III	**Image Transformation** Need of transformation, DFT and properties, convolution Theorem, DCT	6
IV	**Image Enhancement** Point operations ,Spatial filtering techniques, Frequency domain filtering	6
V	**Image Segmentation** Classification of Image segmentation, Edge detection, Thresholding techniques, Region growing techniques	7
VI	**Pattern Recognition Fundamentals** 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 https://nptel.ac.in/courses/117/105/117105079/
2	Module IV,V https://nptel.ac.in/courses/106/105/106105223/
3	Module VI 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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT521
Course Name	Data Mining Methods and Applications
Desired Requisites:	Database Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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 :** 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 Similarity and Dissimilarity	7
II	**Data Pre-processing:** Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization	6
III	**Mining Frequent Patterns:** Basic Concepts, Frequent Item set Mining Methods, Pattern Evaluation Methods.	7
IV	**Classification** Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy	6
V	**Cluster Analysis** Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering.	7
VI	**Outlier Detection** 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

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
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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT522
Course Name	Scientific Computing
Desired Requisites:	Programming experience in C, C++, Java

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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-** Overview of the Data Science process, Scientific Computing Technologies, Regressions, Classification, Clustering	7
II	**Python-Numpy and Pandas:** **NumPy:** Introduction, Numpy array, Numpy array indexing, Numpy operations. **Pandas:** Series, Data frames, managing missing data, groupby, merging & concatenation, operations, data input and data output.	6
III	**Python for Data Visualization:** Data Visualization through libraries like: Matplotlib, Seaborn, Plotly and Cufflinks, Geographical Plotting.	6
IV	**Working with Data in R –** 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 –** 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 –** 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, 5th 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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT571
Course Name	Activity Based Lab for Data Mining Methods and Applications
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. 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 (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

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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Course Information

Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT572
Course Name	Activity Based Lab for Scientific Computing
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 (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

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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Course Information	
Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT573
Course Name	Industrial Project
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 elaborate the recent methods and trends in industrial projects
2	To exercise the industry practices and standards
3	To explore the industry ready applications and projects

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Analyze various aspects, methodologies and practices in industry	Analyze
CO2	Demonstrate the trends in industry	Apply
CO3	Design industry ready applications	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.
Topic Selection:
Significance and Scope of comprehensive topic with exploration at each level, technical competency with Research oriented topic, literature survey of reliable and valid sources. Responsibly summarized literature
Relevance to Dissertation:
At least three topics in relevance to thirst area of dissertation need to be overlooked.
Scope of Topic:
Relevance, significance and expected outcome discussion in stated problem statements for area of dissertations.
Report writing:
Proper citation of sources, organized section of chapters, standard and valid references, nearly absolute contents.
This course will include carrying out a project considering the social needs, innovative designing, and implementation as well as exploring its commercialization / patenting of the project.
Visit nearby industry for selection of problem statement

Text Books	
1	--

References	
1	--

Useful Links	
1	--

CO-PO Mapping

	Programme Outcomes (PO)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		1			
CO2	2			2	1	
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 (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

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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Course Information	
Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT523
Course Name	Professional Elective – 3: Distributed Operating System
Desired Requisites:	Operating Systems, Distributed Network

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

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 :** Definition and goals, Hardware and Software concepts, Design issues	4
II	**Communication & Synchronization in distributed systems:** 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, Deadlock in distributed systems	5
III	**Processes and processors & Distributed File Systems:** 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. Introduction, features & goal of distributed file system,	4
IV	**Distributed Shared Memory :** Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing	4
V	**Naming & Distributed Web-based Systems :** 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: Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications	5
VI	**Security &Case Study :** Google FS/BigTable, Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management ,Java RMI, Sun Network File System, Google case study	4

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/
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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom’s Taxonomy Level				
Bloom’s Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT524
Course Name	Professional Elective – 3: System Programming
Desired Requisites:	Data Structures and Operating Systems

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	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:** 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	4
II	**Assemblers:** 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,	5
III	**Macro and Macro Processors:** 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	4
IV	**Linkers and Loaders:** 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	5

V	**Scanning and Parsing**: 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	4
VI	**Interpreters & Debuggers:** Benefits of Interpretation, Overview of Interpretation, The Java Language Environment, Java Virtual Machine, Types of Errors, Debugging Procedures, Classification of Debuggers, Dynamic/Interactive Debugger	4

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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT525
Course Name	Professional Elective - 3: Mathematics for Machine Learning
Desired Requisites:	Mathematics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

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:** Vector spaces and subspaces, basis and dimensions, linear transformation, four fundamental subspaces.	4
II	**Matrix Theory:** 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	5
III	**Dimensions Reduction Algorithms:** Principal component analysis, linear discriminant analysis, minimal polynomial and Jordan canonical form.	4
IV	**Calculus:** Basic concepts of calculus: partial derivatives, gradient, directional derivatives, Jacobian, hessian, convex sets, convex functions and its properties.	4
V	**Optimization:** 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.	5
VI	**Probability:** 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.	4

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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

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Course Information	
Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT526
Course Name	Professional Elective - 4: Big Data Computing
Desired Requisites:	Data Mining

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

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:** Big Data and its Importance, Four V's of Big Data, Drivers for Big Data – Introduction to Big Data Analytics, Big Data Analytics applications.	4
II	**Big Data Technologies:** 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	5
III	**Processing Big Data:** 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	4
IV	**Hadoop Mapreduce:** Introduction to Map-Reduce, Hadoop Framework, Spark Framework	5
V	**Distributed Map Reduce:** TF-IDF Example, Page Rank Example, Demonstration: Page Rank Algorithm in Spark	4
VI	**Analytic Tools:** PIG overview, SQL vs. PIG, PIG Latin, User Defined Functions, Data Processing Operators, Overview of Hive, Hive QL, Tables, Querying Data	4

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 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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6..

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*	
AY 2021-22	
Course Information	
Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT527
Course Name	Professional Elective - 4: High Performance Computing
Desired Requisites:	Operating System

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

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** Introduction to Parallel Computing, Parallelism on the JVM, Running Computations in Parallel, Monte Carlo Method to Estimate Pi, First-Class Tasks	5
II	**Basic Task in Parallel Algorithms** Parallel Sorting, Data Operations and Parallel Mapping, Parallel Fold (Reduce) Operation Associativity, Parallel Scan (Prefix Sum) Operation	4
III	**Data-Parallelism** Data-Parallel Programming, Data-Parallel Operations, Scala Parallel Collections Splitters and Combiners	5
IV	**Data Structures for Parallel Computing** Implementing Combiners, Parallel Two-phase Construction, Conc-tree Data Structure, Amortized, Constant-time Append Operation, Conc-Tree Combiners	4
V	**Sorting** Issues, sorting network, Bubble sort	4
VI	**Graph Algorithms** MST, SSSP, APSP	4

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 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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme		M. Tech. (CS and IT)			
Class, Semester		First Year M. Tech., Sem II			
Course Code		5IT528			
Course Name		Professional Elective - 4: Deep Learning			
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

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:** 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.	5
II	**Optimizations in Gradient Descent:** Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Bais correction in Adam.	4
III	**Regularization:** 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.	5
IV	**Deep Learning for word encoding-Natural Language Processing:** 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.	4
V	**Convolutional Neural Networks for Computer Vision:** Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks	4
VI	**Recurrent Neural Networks**: Recurrent Neural Network, Back Propagation through time(BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTM.	4

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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**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	5	5	15	**25**
Evaluate	5	5	15	**25**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

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

AY 2021-22

Course Information

Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT575
Course Name	Activity Based Lab for Big Data Computing
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 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 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. 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 (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

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	5IT576
Course Name	Activity Based Lab for High Performance Computing
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 (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

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 2021-22

Course Information

Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	5IT577
Course Name	Activity Based Lab for Deep Learning
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 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 Deep Learning model for suitable applications	Apply
CO2	Implement deep neural network systems	Apply
CO3	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.

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

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 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 (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

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 2021-22

Course Information

Programme	M. Tech. (CS and IT)
Class, Semester	First Year M. Tech., Sem II
Course Code	
Course Name	Open Elective - 4: Machine Learning and Applications
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To explain the concept supervised and unsupervised machine learning techniques.
2	To introduce various machine learning algorithms.
3	To discuss problem solving approaches using appropriate machine learning techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Summaries various machine learning algorithms for Regression and Classification.	Understand
CO2	Apply appropriate learning algorithm for particular problems.	Apply
CO3	Structuring Machine Learning algorithms with performance parameters.	Analyze

Module	Module Contents	Hours
I	**Introduction:** Probability Theory, Linear Algebra, Convex Optimization, Statistical Decision Theory - Regression, Classification, Bias Variance trade off.	4
II	**Regression:** Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares, Linear Classification, Logistic Regression, Linear DiscriminantAnalysis.	4
III	**Artificial Neural Networks:** Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation.	5
IV	**Algorithms:** Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multiway Splits, Missing Values,Decision Trees – Instability Evaluation Measures, Support Vector Machines,	5
V	**Learning Theory:** Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting	4
VI	**Clustering:** Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering	4

Text Books

1	Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, *"The Elements of Statistical Learning"*, Springer, 2nd Edition, 2009.

References

1	Christopher Bishop, *"Pattern Recognition and Machine Learning"*, Springer, 1st Edition, 2006.

Useful Links

1	https://www.classcentral.com/course/swayam-introduction-to-machine-learning-5288

2	https://web.stanford.edu/~hastie/Papers/ESLII.pdf
3	http://users.isr.ist.utl.pt/~wurmd/Livros/school/Bishop%20-%20Pattern%20Recognition%20And%20Machine%20Learning%20-%20Springer%20%202006.pdf

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

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

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**