# Walchand College of Engineering

*(Government Aided Autonomous Institute)*

Vishrambag, Sangli-416415

1947

## Syllabus

## F. Y. M. Tech.

## (Computer Science and Information Technology)

## With effect from

## Academic Year
## 2023-24 (FY M.Tech)

Shelapur
30-8-23
PG-co-ordinator

Bharat
Mrs. B.S. Shetty
DAC

HOD(IT)
H.O.D.
Dept. of Information Technology
Walchand College of Engineering, Sangli.

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2023-24**

## Course Information

| | |
|---|---|
| **Program** | M. Tech. All Branches |
| **Class, Semester** | First Year M. Tech., Semester I |
| **Course Code** | 7IC501 |
| **Course Name** | Research Methodology and IPR |

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

## Course Objectives

| | |
|---|---|
| 1 | To prepare students for undergoing research, identify and formulate the research problems, state the hypothesis, design a research layout, set a research process and methodology. |
| 2 | To enable student interpret the results, propose theories, suggest possible/alternative solutions, solve, and prove the solution adapted–logically and analytically, conclude the research findings. |
| 3 | To impart knowledge to analyze critically the literature and publish research in conferences, journals and to expose students to research ethics, IPR and Patents |

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

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

| | | |
|---|---|---|
| CO1 | **Demonstrate** a research solution in respective engineering domain using appropriate Engineering research process and research methodology. | Apply |
| CO2 | **Device** feasible solution to a research problem in respective engineering domain based on economic, social and legal aspects using appropriate research procedures and practices. | Analyze |
| CO3 | **Write** research publication, Dissertation, IPR and patent document. | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Engineering Research Process**<br>Meaning of research problem, Sources of research problem, Criteria and Characteristics of a good research problem, Errors in selecting a research problem, Definition, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations. | 6 |
| II | **Research Methodology**<br>Problem statement formulation, resources identification for solution, Experimental and Analytical modelling, Simulations, Numerical and Statistical methods in engineering research. Hypothesis and its testing by different techniques: Z-test etc., | 6 |
| III | **Research Methods**<br>Uni and Multivariate Analysis: ANOVA, Design of Experiments/Taguchi Method, Regression Analysis. Software tools like spreadsheets.<br>Processing and Analysis of Data: Processing Operations, Types of Analysis-Presentation and Interpretation of Data Editing, Classification and Tabulation- | 7 |

Solapure 25-8-2023
Dr. S.S. Solapure

Dr. R.S. Desai 23/8/2023
Mechanics De

| | | |
|---|---|---|
| | Interpretation. Analyse your results and draw conclusions. | |
| IV | **Research Practices**<br>Effective literature studies approaches, critical analysis, Plagiarism, Research ethics, Mendeley - Reference Management Software.<br>Research communication- Effective Technical Writing, Writing a research article for Journal/conference paper, Technical report, Dissertation/ Thesis report writing, Software used for report writing such as WORD, Latex etc. Presentation techniques for paper/report/seminar. Publishing article in Scopus/SCI/Web of science indexed journal or conference. | 7 |
| V | **Intellectual Property Rights (IPR)**<br>Nature of Intellectual Property: Patents, Designs, Trade and Copyright, Ownership of copyright, Term of copyright, Technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. New developments in IPR, Traditional knowledge ,Various Case Studies. | 7 |
| VI | **Patents**<br>Patent Rights: Scope of Patent Rights. Various Patent databases. Geographical Indications. Procedure for grants of patents, Patenting under PCT. Licensing and transfer of technology. Administration of Patent System. Introduction to International Scenario: WIPO, TRIPs, Patenting under PCT | 6 |

| | |
|---|---|
| | **Textbooks** |
| 1 | Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2004 |
| 2 | Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for Science & Engineering Students" Juta and Company Ltd, 2000. |
| 3 | Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners", SAGE Publications, 4th Ed.-2014. |
| | |
| | **References** |
| 1 | Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Technological Age", ASPEN Publishers, 2016. |
| 2 | Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 |
| 3 | Mayall, "Industrial Design", McGraw Hill, 1992. |
| 4 | Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007 |
| 5 | Deepak Chopra and Neena Sondhi, Research Methodology : Concepts and cases, Vikas Publishing House, New Delhi |
| | |
| | **Useful Links** |
| 1 | NPTEL :: General - NOC:Introduction to Research |
| 2 | Introduction to Research - Course (nptel.ac.in) |
| 3 | Qualitative Research Methods And Research Writing - Course (nptel.ac.in) |
| 4 | https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview - Academic Research & Report Writing |
| 5 | https://www.scopus.com/search/form.uri?display=basic#basic |
| 6 | https://onlinecourses.nptel.ac.in/noc21_ge12/preview - Qualitative Research Methods And Research Writing |
| 7 | https://onlinecourses.nptel.ac.in/noc21_hs44/preview - Effective Writing |
| 8 | https://webofscienceacademy.clarivate.com/learn |

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Dr. S. S. Solapure
Associate Professor

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|---|---|
| 9 | https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview - Academic Research & Report Writing |
| 10 | https://nptel.ac.in/courses/121/106/121106007/ |
| 11 | https://www.wipo.int/about-wipo/en/ |

**CO-PO Mapping**

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

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

**Assessment**

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

Solapur
28-8-2023
Dr. S. S. Solapure
Associate Professor (IT)

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | FirstYear M. Tech., Sem I |
| **Course Code** | 7IC501 |
| **Course Name** | Research Methodology and IPR |
| **Desired Requisites:** | Mathematics basics |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Interpret the thrust area for dissertation | Apply |
| **CO2** | Identify various data collection methods | Analyze |
| **CO3** | Formulate the research publication | Design |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Various stages of research, Reference collection | 7 |
| II | **Research Problem and Design**<br>Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, Fundamentals of Research Design, Need for Research Design, Different Research Designs | 6 |
| III | **Data Collection Techniques**<br>Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Schedules, Other Methods of Data Collection | 7 |
| IV | **Processing and Analysis of Data**<br>Processing Operations, Types of Analysis, Statistics in Research, Measures of Asymmetry, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression , Partial Correlation, Association of Attributes | 6 |
| V | **Computers and Research**<br>Role of computer in research process, Data Analysis and Visualization Techniques, Data Storage, Scientific Simulations, Plagiarism Checker | 7 |
| VI | **Technical writing methods**<br>Paper Writing, Technical report, Types of Technical report, dissertation/thesis writing. Presentation techniques, Tools for report writing. Patents and other IPRs, | 6 |

**List of Assignment:**

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: Web of Science, Scopus
4. Design a model for an engineering research
5. Compare between model and process in engineering research and perform data analysis using modern engineering tools
6. 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 MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 7IT501 |
| **Course Name** | Advanced Algorithms |
| **Desired Requisites:** | Computer Algorithms |

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

**Course Objectives**

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

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

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

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

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

| | |
|---|---|
| | |
| **Text Books** | |
| 1 | Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, *"Introduction to Algorithms*", Third Edition the MIT Press Cambridge, London, England |
| | |
| **References** | |
| 1 | Horrowitz, Sahni Rajasekaran, *"Computer Algorithms",* Computer Science, W. H. Freeman and company Press, New york |
| | |
| **Useful Links** | |
| 1 | To be declared during the course on the CMS. |
| 2 | |

**CO-PO Mapping**

**Programme Outcomes (PO)**

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

**Assessment**

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 7IT502 |
| **Course Name** | Unix Internal |
| **Desired Requisites:** | Operating System |

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

**Course Objectives**

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

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

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

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

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

**Text Books**


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

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

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

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

**Assessment**

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

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2023-24** | | | | | |
| **Course Information** | | | | | |
| **Programme** | M.Tech. (CS and IT) | | | | |
| **Class, Semester** | First Year M. Tech., Sem I | | | | |
| **Course Code** | 7IT503 | | | | |
| **Course Name** | Database Design and Performance Tuning (Theory) | | | | |
| **Desired Requisites:** | Database | | | | |
| | | | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Preparing to interpret database design, constructing and tuning according to the specifications. |
| **2** | To impart database security and administrative and performance monitoring Tasks. |
| **3** | To apprise about the requirements, data structures, retrieval techniques of complex database systems. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Comprehend the database design cycle and administration | Understanding |
| **CO2** | Evaluating database performance and tuning on the basis of guidelines and KPI's | Analyze |
| **CO3** | Devising optimized query plans and analyzing parallel and distributed transactions | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | Concepts of Database Design and administration<br>Introduction, Software Development cycle (SDLC), Database Development cycle (DDLC),Automated Design tools, Normalization concepts Database Administration DBA Tasks, Defining the Organization's DBMS Strategy, Managing User access, Database performance management | 7 |
| II | Query Processing and Optimization<br>Introduction, Query processing, syntax analyzer, query decomposition, query optimization (cost estimation), pipelining and materialization, Heuristics in Query Optimization, structure of query evaluation plans | 6 |
| III | Parallel and distributed transaction processing<br>Parallel and distributed database architectures, Distributed transactions, Optimization of Distributed Queries, Multi-database Query Processing, Distributed concurrency control and recovery | 7 |
| IV | Database security<br>Introduction, database security issues, Access control in database systems (DAC, MAC, RAC), Inference control, multilevel database security, statistical database recovery, Intrusion tolerant database systems, SQL injection | 7 |

| | | |
|---|---|---|
| V | Physical Database Design and Tuning<br>Physical DB Design, Index selection, Guidelines for Index Selection, Clustering and Indexing, Overview of Database Tuning, Choices in Tuning the Conceptual Schema, Choices in Tuning Queries, DBMS Benchmarks | 6 |
| VI | Complex database systems<br>Introduction to Spatial Databases: Spatial Data Structures, Spatial Storage and Indexing, spatial queries, Multimedia databases, Temporal and sequential databases | 6 |

| | |
|---|---|
| **Text Books** | |
| 1 | S.K.Singh, "Database systems: Concepts, Design and Application ",2nd Edition, Pearson Education, 2011 |
| 2 | Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Second Edition, Tata McGraw Hill Inc, 2008. |
| **References** | |
| 1 | IBM DB2 Universal Database- Administration Guide: Performance, V. 8, 2002. |
| 2 | Craig S. Mullins, Database Administration: The Complete Guide to Practices and Procedures, Addison-Wesley Professional, 2002. |
| 3 | Dennis Shasha and Philippe Bonnet, Database Tuning, Principles, Experiments and Troubleshooting Techniques, Elsevier Reprint 2005. |
| **Useful Links** | |
| 1 | |

**CO-PO Mapping**

**Programme Outcomes (PO)**

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

**Assessment**

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 7IT551 |
| **Course Name** | Advanced Algorithms Lab |
| **Desired Requisites:** | Data Structures, Computer Algorithms |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Demonstrate graph related algorithms with real world problems | Apply |
| **CO2** | Implement the shortest path for a given distance based scenario | Apply |
| **CO3** | Design approximation algorithms in graph | Create |

**List of Experiments / Lab Activities**

**List of Experiments:**

Activities are to be carried out individually.

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

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

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

**Text Books**

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

**References**

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

**Useful Links**

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

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

**Assessment**

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

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem-1 |
| **Course Code** | 7IT552 |
| **Course Name** | Unix Internal lab |
| **Desired Requisites:** | Operating System, (C/python) Programming language |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Illustrate the difference between thread and process | Apply |
| **CO2** | Identify different system calls for Linux/Unix programming | Analyze |
| **CO3** | Implement various inter process communications available in operating system | Apply |

**List of Experiments / Lab Activities**

**List of Experiments:**

**List of Experiments:**

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

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

**Text Books**

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

**References**

| | |
|---|---|
| 1 | Beej Jorgensen , "*Beej's Guide to Unix IPC*", Brian -Beej Jorgensen Hall, Version 1.1.2, December, 2010 |

| | |
|---|---|
| 2 | Kay Robbins, Steve Robbins, "*UNIX Systems Programming: Communication, Concurrency and Threads"*, Pearson, 2nd Edition, December, 2015 |
| 3 | Eric Raymond , "*Art of UNIX Programming*", Pearson, 1st edition, October, 2003 |
| | |

| **Useful Links** | |
|---|---|
| 1 | https://users.cs.cf.ac.uk/Dave.Marshall/C/ |
| 2 | https://github.com/suvratapte/Maurice-Bach-Notes |
| 3 | https://github.com/mit-pdos/xv6-public |
| 4 | https://www.geeksforgeeks.org/introduction-to-unix-system/ |
| 5. | https://github.com/beejjorgensen/bgipc |
| 6. | http://www.di.uevora.pt/~lmr/syscalls.html |

**CO-PO Mapping**

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

**Assessment**

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

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

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem-1 |
| **Course Code** | 7IT553 |
| **Course Name** | Database Design and Performance Tuning (Lab) |
| **Desired Requisites:** | Database Engineering or Database Management System (DBMS) |

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

**Course Objectives**

| | |
|---|---|
| **1** | To provide students with an understanding of the practices of database design, query processing, transaction processing. |
| **2** | To provide students with hands- on database recovery and security. |
| **3** | To provide students with hands- on database tuning to improve DBMS performance. |

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

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

| | | |
|---|---|---|
| **CO1** | Demonstrating the database design cycle and administration. | Apply |
| **CO2** | Evaluating database performance and tuning on the basis of guidelines and KPI's | Analyze |
| **CO3** | Devising optimized query plans and analyzing parallel and distributed transactions. | Create |

**List of Experiments / Lab Activities**

**List of Experiments:**

1. Database Design and administration DBMS software's (e.g. DB2,Oracle)
2. Query Processing and Optimization 10
3. Study of performance tuning parameters.
4. Study of providing security to DBMS. 8
5. Study of recovery of DBMS.
6. Study of Transaction Processing in DBMS.

**Text Books**

| | |
|---|---|
| 1 | IBM DB2 Universal Database- Administration Guide: Performance, Vol. 8, 2002. |
| 2 | Oracle 10g Administration study Guide, Sybex Publisher, 2005 |

**References**

| | |
|---|---|
| 1 | IBM DB2 Universal Database- Administration Guide: Performance, V. 8, 2002. |
| 2 | Craig S. Mullins, Database Administration: The Complete Guide to Practices and Procedures, Addison-Wesley Professional, 2002. |
| 3 | Dennis Shasha and Philippe Bonnet, Database Tuning, Principles, Experiments and Troubleshooting Techniques, Elsevier Reprint 2005. |

| Useful Links | |
|---|---|
| 1 | |

**CO-PO Mapping**

**Programme Outcomes (PO)**

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

**Assessment**

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

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

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 7IT511 |
| **Course Name** | Professional Elective - 1: Cloud and Virtualization Techniques |
| **Desired Requisites:** | Computer Networks |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Use service model of cloud computing | Apply |
| **CO2** | Choose virtualization techniques to deploy the services on cloud infrastructure | Apply |
| **CO3** | Analyze service models for data center applications | Analyze |

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

**Text Books**

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

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

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

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 7IT512 |
| **Course Name** | Professional Elective - 1: Ruby & Go Programming Language |
| **Desired Requisites:** | C & CPP Programming |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Implement object oriented programming concepts using Ruby | Apply |
| **CO2** | Demonstrate the concept of File handling using Ruby and Go language | Apply |
| **CO3** | Analyze the Synchronization problem using Go Language | Analyze |

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

**Text Books**

| | |
|---|---|
| 1 | Davd Flanagan, Yukihiro Mataumoto, "*The Ruby Programming Language: Everything You Need to Know*", O'Reilly; 1st edition (12 February 2008) |
| 2 | Alan A. A. Donovan, Brian W. Kernighan, "*The Go Programming Language*", Pearson Education; First edition (1 February 2016) |

**References**

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

**Useful Links**

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

**CO-PO Mapping**

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

**Assessment**

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

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

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

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 7IT514 |
| **Course Name** | Professional Elective – 1: Artificial Intelligence |
| **Desired Requisites:** | Probability and Linear Algebra |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Apply fundamental concepts of Artificial Intelligence | Apply |
| **CO2** | Compare the architectural and functional structures of Artificial Intelligence | Analyse |
| **CO3** | Build an expert system in Artificial Intelligence | Create |

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

**Text Books**

| | |
|---|---|
| 1 | Rich Elaine and Kelvin Knight ,Nair,*" Artificial Intelligence"*, McGraw Hills 3rd edition,1991 |
| 2 | Janakiraman et al., *"Foundations of Artificial Intelligence and Expert Systems",* MacMillan India Ltd., 2007. |

**References**

| | |
|---|---|
| 1 | Russell and Norvig," *Artificial Intelligence – A Modern Approach*", Prentice-Hall, 2010 (3rd edition). |

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

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

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

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

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

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 6IT513 |
| **Course Name** | Professional Elective - 2: Advanced Distributed Computing |
| **Desired Requisites:** | |

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

**Course Objectives**

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

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

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

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

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

**Text Books**

| | |
|---|---|
| 1 | Andrew S. Tanenbaum and Maarten Van Steen, "*Distributed Systems: Principles and Paradigms"*, 2nd edition, Pearson Education, 2007. |
| 2 | George Coulouris, Jean Dollimore, Tim Kindberg, *"Distributed Systems: Concepts and Design"*, 4th Edition, Pearson Education, 2005. |
| | |
| **References** | |
| 1 | A. S. Tanenbaum and M. V. Steen, *"Distributed Systems: Principles and Paradigms"*, Second Edition, Prentice Hall, 2006 |
| | |
| **Useful Links** | |
| 1 | Module I, II, III, IV https://www.coursera.org/learn/parallel-programming-in-java?specialization=pcdp#syllabus Module V, VI https://www.coursera.org/learn/distributed-programming-in- java?specialization=pcdp#syllabus |

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 7IT515 |
| **Course Name** | Professional Elective – 2: Parallel Algorithms |
| **Desired Requisites:** | Computer Algorithm |

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

**Course Objectives**

| | |
|---|---|
| **1** | To experiment the parallel architecture in Parallel Algorithms |
| **2** | To use the process of parallelization in computer algorithms |
| **3** | To compare the thread and process parallel architecture |

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

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

| | | |
|---|---|---|
| **CO1** | Implement the sequential and parallel algorithms | Apply |
| **CO2** | Compare the speedup factor of sequential and parallel algorithms | Analyze |
| **CO3** | Design the parallel algorithm to improve the performance parameters | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | Parallel Computing: Motivation and scope | 6 |
| II | GPGPU Programming : OpenACC, CUDA, OpenCL | 6 |
| III | Trends in processor architecture and limitations of memory systems | 6 |
| IV | Dichotomy and organization of parallel platforms | 7 |
| V | Communication costs in parallel machines | 7 |
| VI | Routing mechanism and processor mapping techniques | 7 |

**Text Books**

| | |
|---|---|
| 1 | Anath Grama, Ansul Gupta, George Karypis, Vipin Kumar, *"Introduction to parallel computing",* Second Edition, Pearson Education, 2003 |
| 2 | Jaegeun Han, Bharatkumar Sharma, *"Learn CUDA Programming",* First Edition, Packt publishing, 2019 |

**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/106/102/106102114/ |
| 2 | https://nptel.ac.in/courses/106/102/106102163/ |

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 7IT516 |
| **Course Name** | Professional Elective – 2: Software Reliability and Testing |
| **Desired Requisites:** | Software Engineering |

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

**Course Objectives**

| | |
|---|---|
| **1** | To elaborate Software Reliability and Testing. |
| **2** | To illustrate project management cycle for software development. |
| **3** | To use Agile development techniques for software development. |

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

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

| | | |
|---|---|---|
| **CO1** | Apply concepts of Software Reliability and Testing | Understand |
| **CO2** | Analyze Software Reliability Growth Models in Software Development | Analyze |
| **CO3** | Evaluate the Software system to detect fault tolerance | Analyze |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Basic of Software Testing:** Software Testing, Testing types, Flow graph, Cyclomatic complexity, Graph Matrices, Debugging & Test Case Strategies | 7 |
| II | **Software Quality:** Software Quality Assurance, Software Reuse, Documentation Requirements, Standards, Software Configuration Management, Version Control, Baselines | 7 |
| III | **Software Reliability:** Software Reliability, Software Reliability Issues, Statistical Testing and Software Quality Management, ISO 9000, Case Tools, Characteristics of Case Tools | 7 |
| IV | **User Interface and Design**: Concept of user Interface and Design, Types of user Interface, Component Based GUI Development | 7 |
| V | **Software Fault Detection:** Basic terminology of Fault tolerant, Fault detection using fault tree, Fault tolerant in SRE, Techniques for Fault tolerant: Recovery blocks, N- version programming | 5 |
| VI | **Software Fault Analysis:** Fault tree modelling, Fault tree analysis, Analysis of fault tolerant software system, Quantitative analysis of fault tolerant system | 6 |

**Text Books**

| | |
|---|---|
| 1 | Jalote Pankaj, *"An Integrated Approach to Software Engineering",* Narosa Publication, 3rd Edition, 2010. |
| 2 | Sommerville, *"Software Engineering"*, Pearson Education India, New Delhi,2nd Edition, 2006 |

| References | |
|---|---|
| 1 | Musa John D., *"Software Reliability Engineering"*, Tata McGraw Hill, 2nd Edition, 1999 |
| 2 | Lyu, *"Software Reliability Engineering"*, IEEE Computer Society Press, 1st Edition, 1996 |
| | |
| **Useful Links** | |
| 1 | Module I, II, III, IV, V - https://onlinecourses.nptel.ac.in/noc21_cs15/preview |

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

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

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

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | MTech. (CS & IT) |
| **Class, Semester** | First year M. Tech., Sem I |
| **Course Code** | 7IT517 |
| **Course Name** | Professional Elective - 2: IoT Systems and Applications |
| **Desired Requisites:** | Computer Networks |

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

**Course Objectives**

| | |
|---|---|
| **1** | To infer the concept of Internet of Things (IoT). |
| **2** | To apply basic WSN protocols for IoT systems. |
| **3** | To create IoT based applications in different paradigms. |

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

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

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Apply IoT concept in real time scenario | III | Applying |
| **CO2** | Analyze use of WSN protocols in IoT applications | III | Applying |
| **CO3** | Develop IoT enabled services | VI | Creating |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to IoT:** Sensing, Actuation, Basics of Networking, Communication Protocols | 7 |
| II | **Sensor Networks:** Machine-to-Machine Communications, Interoperability in IoT | 7 |
| III | Introduction toIoT Programming: Integration of Sensors and Actuators with Arduino, Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi | 7 |
| IV | **Introduction to SDN:** SDN for IoT, Data Handling and Analytics, Cloud Computing, Sensor-Cloud, Fog Computing | 6 |
| V | **IOT Application:** Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT | 6 |
| VI | **Case Study:** Agriculture, Healthcare, Activity Monitoring | 6 |

**Text Books**

| | |
|---|---|
| 1 | Arshdeep Bahga and Vijay K. Madisetti, *"Internet of Things: A Hands-on Approach",* VPT, 1st Edition, 2014 |
| 2 | Samuel Greengard, *"The internet of things",* MIT Press, 1st Edition, 2015 |

**References**

| | |
|---|---|
| 1 | Pethuru Raj and Anupama C. Raman, *"The Internet of Things: Enabling Technologies, Platforms, and Use Cases",* CRC Press, 1st edition, 2017 |

| | |
|---|---|
| 2 | Adrian McEwen, Hakim Cassimally*," Designing the Internet Of Things"*, Wiley, 1st Edition, 2013 |

| Useful Links | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc19_cs65/preview |
| | |
| | |

**CO-PO Mapping**

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

**Assessment**

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M.Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem I |
| **Course Code** | 7IT518 |
| **Course Name** | Professional Elective - 2: Image Processing and Pattern Recognition |
| **Desired Requisites:** | Mathematics-(Matrix, Fourier Transformation) |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Apply concepts of a digital image processing for real-time application | Apply |
| **CO2** | Implement image segmentation and representation techniques | Apply |
| **CO3** | Analyze images in the frequency domain using various transforms | Analyze |

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

**Text Books**

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

| References | |
|---|---|
| 1 | S. Jayraman, S Esakkiarajan , Veerakumar, *"Digital image processing"*, 1st Edition ,MGH,2017. |
| 2 | Rafel C. Gonzalez, Richard E. Woods, *"Digital Image Processing"*, 3rd Edition, Pearson Education, 2008 |
| | |
| **Useful Links** | |
| 1 | Module I,II,III<br>https://nptel.ac.in/courses/117/105/117105079/ |
| 2 | Module IV,V<br>https://nptel.ac.in/courses/106/105/106105223/ |
| 3 | Module VI<br>Vlabs,iitb.ac.in |

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

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

# SEMESTER –II

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., **Sem II** |
| **Course Code** | 7IT521 |
| **Course Name** | Data Mining Methods and Applications |
| **Desired Requisites:** | Database Engineering |

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

**Course Objectives**

| | |
|---|---|
| **1** | To exercise advanced data mining techniques |
| **2** | To compare various algorithm for real-time application |
| **3** | To propose a novice solution for real world problem |

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

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

| | | |
|---|---|---|
| **CO1** | Implement techniques and algorithms of Data Mining | Apply |
| **CO2** | Apply data mining techniques and algorithms for solving real life problems | Apply |
| **CO3** | Analyse various clustering and classification techniques in data mining | Analyse |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction :** 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 DataSimilarity 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**<br>Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering-Based Approaches, Classification-Based Approaches, Mining Contextual and Collective Outliers, Outlier Detection in High-Dimensional Data | 6 |

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

| **References** | |
|---|---|
| | Chattamvelli Rajan, *"Data Mining Methods: Concepts & Applications"*, Narosa Publishing House, 2nd Edition, 2010 |
| 2 | Mitra Sushmita, Acharya Tinku, *"Data Mining Multimedia, Soft Computing and Biometrics"*, WILEY Publication, 3rd Edition, 2003 |

| **Useful Links** | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc20_cs12/preview |
| 2 | https://www.javatpoint.com/data-mining |
| 3 | https://data-flair.training/blogs/data-mining-tutorial/ |

**CO-PO Mapping**

**Programme Outcomes (PO)**

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

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

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

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT522 |
| **Course Name** | Scientific Computing |
| **Desired Requisites:** | Programming experience in C, C++, Java |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Compare functional and logical programming. | Analyze |
| **CO2** | Use Python programming language for solving the problem | Apply |
| **CO3** | Implement scripts to automate data formatting and analysis | Apply |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Data Science and Scientific Computing-** 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 MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

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

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

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

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | M. Tech. (CS and IT) | | | | |
| **Class, Semester** | First Year M. Tech., Sem II | | | | |
| **Course Code** | 7IT523 | | | | |
| **Course Name** | Agile Development (Theory) | | | | |
| **Desired Requisites:** | | | | | |

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

| **Course Objectives** | |
|---|---|
| **1** | To define basics of Software Testing and techniques. |
| **2** | To elaborate project management for software development. |
| **3** | To illustrate Agile development techniques for software development. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Demonstrate use of automation testing tools | Apply |
| **CO2** | Implement project management techniques like planning, risk analysis, scheduling. | Apply |
| **CO3** | Evaluate software development life cycle using Agile tools and DevOps. | Evaluate |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Software Testing Introduction:**<br>Introduction, Importance of Software testing, How to conduct Software testing, Basic terminology of Software testing, Manual Testing Process, Difference between Manual and Automated Testing, Software testing Roles and Responsibilities, V Model of Software Development | 7 |
| II | **Test Case Design Techniques**<br>Static Techniques, Dynamic Techniques, Black-box Test Techniques, White-box Test Techniques, Experience-based Test Techniques, Levels of Software Testing | 6 |
| III | **Types of Software Testing**<br>**i) Functional Testing:** Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Sanity/Smoke Testing, Regression Testing.<br>**ii) Non Functional Testing:** Performance Testing. (Load, Stress, Spike and Endurance Testing), Usability Testing, Compatibility Testing, Reliability Testing, Security Testing | 6 |
| IV | **Project Management**<br>Software Product Management, Requirements Analysis/Design, Planning and Scheduling, Monitoring, Risk Analysis, Project Leadership, Teamwork, Project Organization and Team Structures, Resource Allocation, Software Quality Management Software Testing Standards | 7 |

| | | |
|---|---|---|
| V | **Agile Testing**<br>The Fundamentals of Agile Software Development, Extreme Programming, Aspects of Agile Approaches, The Differences between Testing in Traditional and Agile Approaches, Status of Testing in Agile Projects, Role and Skills of a Tester in an Agile Team, Agile Testing Methods, Assessing Quality Risks and Estimating Test Effort, Techniques in Agile Projects, Tools in Agile Projects | 7 |
| VI | **DevOps Testing**<br>DevOps**,** Version control with Git, Git, Jenkins, Maven, Integration with Jenkins, Continuous Integration and Continuous Delivery CI/CD: Jenkins Creating pipelines, Setting up runners Containers and container orchestration (Dockers and Kubernetes) or application development and deployment. | 6 |

| **Text Books** | |
|---|---|
| 1 | Glenford J. Myers, Corey Sandler, Tom Badgett, "*The Art of Software Testing*", Third edition, Wiley, 2011, ISBN: 978-1-118-13315-6 |
| 2 | Ron Patton, Corey Sandler, Tom Badgett, "*Software Testing*", Second edition, Sams, 2005 |
| 3 | Lisa Crispin and Janet Gregory, "*Agile Testing: A Practical Guide for Testers and Agile Teams*", First edition, Addison-Wesley Signature Series, 2009 |
| 4 | Teresa Luckey, Joseph Phillips, "*Software Project Management For Dummies*", First edition, Wiley, 2006, ISBN: 9780471749349 |

| **References** | |
|---|---|
| 1 | Lee Copeland, "*A Practitioner's Guide to Software Test Design*", First edition, Artech House, 2003, ISBN-13: 978-1580537919. |
| 2 | Joakim Verona · "*Practical DevOps*", First edition, Artech House, 2016, ISBN-13: 9781785886522, 1785886525. |
| 3 | Henry· "*Software Project Management: A Real-World Guide To Success*", First edition, Pearson Education, 2004, ISBN- 9788131717929, 8131717925 |

| **Useful Links** | |
|---|---|
| 1 | https://www.javatpoint.com/software-testing-tutorial |
| 2 | https://www.guru99.com/software-testing.html |
| 3 | https://www.getzephyr.com/insights/developing-devops-testing-strategy-benefits-best-practices-tools |
| 4 | https://www.softwaretestinghelp.com/agile-scrum-methodology-for-development-and-testing/ |

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT571 |
| **Course Name** | Data Mining Methods and Applications Lab |
| **Desired Requisites:** | Data Mining |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Implement the software application using for data mining algorithm. | Apply |
| **CO2** | Write & explain a detailed project report for submission and evaluation. | Evaluate |
| **CO3** | Design and validate system for Data mining | Create |

**List of Experiments / Lab Activities**

**List of Experiments:**

Activities are to be carried out individually.

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

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

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

Students should maintain activity log book containing weekly progress.

**Text Books**

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

| References | |
|---|---|
| 1 | Chattamvelli Rajan, "*Data Mining Methods: Concepts & Applications*", Narosa Publishing House, 2nd Edition, 2010 |
| 2 | Mitra Sushmita, Acharya Tinku*, "Data Mining Multimedia, Soft Computing and Biometrics",* WILEY Publication, 3rd Edition, 2003 |
| | |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc20_cs12/preview |
| 2 | https://www.javatpoint.com/data-mining |

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

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT572 |
| **Course Name** | Scientific Computing lab |
| **Desired Requisites:** | Programming experience in C,C++,Java |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Perform numerical computation using python libraries | Analyze |
| **CO2** | Implement statistical computation using R libraries | Apply |
| **CO3** | Compose the journal paper, reports using Open source tool (LATEX) | Create |

**List of Experiments / Lab Activities**

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

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

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

**Text Books**

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

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

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

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

**Assessment**

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

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

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. ( CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT545 |
| **Course Name** | Pre-dissertation Work / Seminar |
| **Desired Requisites:** | |

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

**Course Objectives**

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

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

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

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

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

**Contents:**

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

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

**Textbooks**

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

**References**

| | |
|---|---|
| 1 | Suitable books based on the contents of the dissertation/seminar topic selected and research papers |

| | |
|---|---|
| | from reputed national and international journals and conferences. |
| | |
| **Useful Links** | |
| 1 | As per the need of the dissertation/seminar topic. |

| **CO-PO Mapping** | | | | | | |
|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **CO1** | 2 | 2 | 1 | | | |
| **CO2** | 3 | | | | 1 | |
| **CO3** | | 3 | | | 2 | |
| The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High<br>Each CO of the course must map to at least one PO. | | | | | | |

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

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|---|---|---|---|---|---|
| **AY 2023-24** | | | | | |
| **Course Information** | | | | | |
| **Programme** | M. Tech. (CS and IT) | | | | |
| **Class, Semester** | First Year M. Tech., Sem II | | | | |
| **Course Code** | 7IT531 | | | | |
| **Course Name** | Professional Elective – 3: Distributed Operating System | | | | |
| **Desired Requisites:** | Operating Systems, Distributed Network | | | | |
| | | | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

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

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

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

| | | |
|---|---|---|
| VI | **Security &Case Study :**<br>Google FS/BigTable, Introduction of Security in Distributed OS,<br>Overview of security techniques, features, Need, Access Control, Security Management ,Java RMI, Sun Network File System, Google case study | 7 |

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

| **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 MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

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

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

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT532 |
| **Course Name** | Professional Elective – 3: System Programming |
| **Desired Requisites:** | Data Structures and Operating Systems |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Analyze the working of system programs | Analyze |
| **CO2** | Study the working of parsers of compilers | Analyze |
| **CO3** | Compare the static and dynamic linking | Analyze |

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

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

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

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

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

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

**Assessment**

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

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

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

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

**Walchand College of Engineering, Sangli**
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**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT533 |
| **Course Name** | Professional Elective - 3: Mathematics for Machine Learning |
| **Desired Requisites:** | Mathematics |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Apply the concepts of linear algebra and calculus for machine learning algorithms | Apply |
| **CO2** | Compare different algorithms for dimensionality reduction | Analyse |
| **CO3** | Evaluate the optimization & probabilistic algorithms | Evaluate |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Linear Algebra Basics:** Vector spaces and subspaces, basis and dimensions, linear transformation, four fundamental subspaces. | 6 |
| 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 | 7 |
| III | **Dimensions Reduction Algorithms:** Principal component analysis, linear discriminant analysis, minimal polynomial and Jordan canonical form. | 6 |
| IV | **Calculus:** Basic concepts of calculus: partial derivatives, gradient, directional derivatives, Jacobian, hessian, convex sets, convex functions and its properties. | 6 |
| 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. | 7 |
| 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. | 7 |

| Text Books | |
|---|---|
| 1 | W. Cheney, *"Analysis for Applied Mathematics",* New York: Springer Science+Business Medias, 2001. |
| 2 | S. Axler*,"Linear Algebra Done Right",* Springer International Publishing, 3rd edition, 2015 |
| | |

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

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

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

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

# 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** | 7IT 534 |
| **Course Name** | Professional Elective – 3-Soft Computing and applications |
| **Desired Requisites:** | Basic knowledge of mathematics |

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

**Course Objectives**

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

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

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

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

| | | |
|---|---|---|
| V | **Hybrid Systems:** Introduction to Hybrid Systems, Adaptive Neuro Fuzzy Inference System(ANFIS) | 6 |
| VI | **Deep Learning:** Spark auto encoder, Convolutional neural networks, Recurrent neural networks, Deep belief networks | 7 |

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

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

**Useful Links**

**CO-PO Mapping**

**Programme Outcomes (PO)**

| | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **CO1** | 2 | | | 3 | | |
| **CO2** | | | 2 | 2 | | 2 |
| **CO3** | 2 | | 2 | 2 | | 2 |

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

**Assessment**

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

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

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT535 |
| **Course Name** | Professional Elective - 4: Big Data Computing |
| **Desired Requisites:** | Data Mining |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Elaborate the fundamentals of various big data analytics techniques | Apply |
| **CO2** | Study the various approach to implement distributed environment | Analyze |
| **CO3** | Evaluate the performance of algorithms on advanced distributed system | Evaluate |

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

**Text Books**

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

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

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

**Assessment**

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

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

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT536 |
| **Course Name** | Professional Elective - 4: High Performance Computing |
| **Desired Requisites:** | Operating System |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Apply parallel computing algorithm for solving the problem. | Apply |
| **CO2** | Analyse the parallel implemented algorithms for performance parameters. | Analyze |
| **CO3** | Design the appropriate parallel algorithm for the given problem. | Create |

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

**Text Books**

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

**References**

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

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

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

**Assessment**

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

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

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. (CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT537 |
| **Course Name** | Professional Elective - 4: Deep Learning |
| **Desired Requisites:** | |

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

**Course Objectives**

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

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

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

| | | |
|---|---|---|
| **CO1** | Apply the fundamentals of Deep Learning for suitable applications | Apply |
| **CO2** | Compare the optimization techniques pertaining to Deep Learning | Analyze |
| **CO3** | Build and compare various Deep Learning model for solving real world application | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Fundamentals of Neural Networks:** McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks. Backpropagation algorithm. | 7 |
| II | **Optimizations in Gradient Descent:** Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Bais correction in Adam. | 6 |
| 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. | 7 |
| 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. | 7 |
| 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 | 6 |

| | | |
|---|---|---|
| VI | **Recurrent Neural Networks**:<br>Recurrent Neural Network, Back Propagation through time(BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTM. | 6 |

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

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

**Assessment**

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

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

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

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

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

**AY 2023-24**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. ( CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7IT538 |
| **Course Name** | Professional Elective - 4: Geographical Information System & Remote Sensing -Interdisciplinary |
| **Desired Requisites:** | Fundamentals of Image processing |

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

**Course Objectives**

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

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

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

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

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

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

| **Text Books** | |
|---|---|
| 1 | Chandra, A.M. and Gosh, S.K., "Remote Sensing and GIS", Narosa Publishing House. 2008 |
| 2 | Lo, C.P. and Young, A.K.W., "Concepts and Techniques of Geographical Information System", Prentice Hall India. 20012 |

| **References** | |
|---|---|
| 1 | Lillesand, T.M. and Kieffer, "Remote Sensing and Image Interpretation", John Wiley and Sons, 6th Edition. 2012 |
| 2 | Chang, K, "Introduction to Geographical Systems", Tata McGraw-Hill, 4th Edition. 2010 |

| **Useful Links** | |
|---|---|
| 1 | NPTEL: https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce08<br>https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ce10 |
| 2 | https://www.usgs.gov |
| 3 | https://bhuvan.nrsc.gov.in/bhuvan_links.php# |

**CO-PO Mapping**

**Programme Outcomes (PO)**

| | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **CO1** | | | 2 | | | |
| **CO2** | | | 2 | | | |
| **CO3** | 2 | | | 2 | | |
| **CO4** | 3 | | | 2 | | 2 |

**Assessment**

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

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

**AY 2022-23**

**Course Information**

| | |
|---|---|
| **Programme** | M. Tech. ( CS and IT) |
| **Class, Semester** | First Year M. Tech., Sem II |
| **Course Code** | 7OE510 |
| **Course Name** | Open Elective -: Machine Learning & Applications |
| **Desired Requisites:** | |

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

**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,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Compare various machine learning algorithms for Regression and Classification. | IV | Analysing |
| **CO2** | Apply appropriate learning algorithm for a problems. | III | Applying |
| **CO3** | Evaluate Machine Learning algorithms with performance parameters. | V | Evaluating |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction and Regression Analysis**<br>Machine Learning concepts, Supervised learning, Unsupervised learning, linear regression in one variable, cost function, gradient descent, linear regression with multiple variables: gradient descent | 7 |
| II | **Logistic Regression**<br>Classification, hypothesis representation, decision boundary, cost function, simplified cost function and gradient descent, optimization, one v/s all | 6 |
| III | **Artificial Neural Networks:**<br>Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation. | 6 |
| IV | **Support Vector Machine:**<br>Optimization objective, mathematics behind large margin classification, kernels using as SVM | |
| V | **Learning Theory:**<br>Regularization, bias/ Variance trade-off, error analysis, ensemble methods, practical advice on how to use learning algorithms, precision/recall trade-off | 7 |
| VI | **Unsupervised Learning**<br>Clustering, k-means, EM, principal component analysis, outliers detection | 6 |

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

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