TY Sem I

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

AY 2022-23

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Database Engineering
Desired Requisites:	

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

Course Objectives

1	To introduce basic concepts of database management systems
2	To impart conceptual designs for databases
3	To describe issues associated with transaction management

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	Manipulate the relational databases	III	Applying
CO2	Inspect databases using Query languages	V	Evaluating
CO3	Evaluate transaction processing techniques	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction:** Database Systems, Types of Database Systems, Data abstraction, Data Models, Architecture of Database Systems.	3
II	**Relational Model:** Structure of Relational Databases, database schema, keys, Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus **Integrity Constraints and Design:** Domain Constraints, Referential Integrity, Triggers, Normal forms, Functional Dependencies, Decomposition.	5
III	**Query Processing:** Query processing, Query Cost, measures of query cost, Evaluation of expression, Equivalence of Expressions. Structured Query Language (SQL), Unstructured Query Language (MongoDB, MariaDB, NoSQL)	5
IV	**Indexing and Hashing:** Ordered and secondary Indices, B+ Tree Index Files, Static Hashing, Dynamic hashing, Comparison of Indexing, Grid files, Bitmap indices.	4
V	**Transactions:** Properties and states, Concurrent execution, Serializability. **Concurrency Control:** Lock-Based Protocols, 2 phase locking protocol, Graph based protocols, Time stamp based protocols, Dead lock handling	5
VI	**Crash Recovery:** Failure Classification, storage Structure, Log-Based Recovery, Shadow Paging, recovery with concurrent transactions, buffer management, backups.	4

Text Books

1	Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, "*Database System Concepts*", McGraw-Hill Education, 6th Edition, 2010.

2	Raghu Ramakrishnan, "*Database Management Systems*", McGraw-Hill Education, 3rd Edition, 2003.
References	
1	J.D. Ullman, "*Principles of Database Systems*", Galgotia Publications, 2nd Edition, 1999
2	Wiederhold, "*Database Design*", McGraw Hill Inc, 2nd Edition, 1983
3	C.J.Date, A.Kannan, S.Swamynathan, "*An Introduction to Database Systems*", Pearson Education, 8th Edition, 2006.
Useful Links	
1	https://nptel.ac.in/courses/106/105/106105175/
2	http://www.nptelvideos.in/2012/11/database-management-system.html
3	https://www.tutorialspoint.com/mongodb/mongodb_overview.htm
4	https://www.tutorialspoint.com/mariadb/mariadb_introduction.htm

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1					3							1		
CO2		1			2								1	
CO3	1	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)

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AY 2022-23

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Operating System
Desired Requisites:	Computer Architecture

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

Course Objectives

1	To introduce various system calls and system programs
2	To describe OS functionalities
3	To comprehend the services provided by operating system

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	Distinguish between different types of OS	II	Understanding
CO2	Illustrate the concept of process and synchronization	III	Applying
CO3	Analyse the deadlocks and memory management challenges in system	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction :** Notion of operating systems, Computer system organization, Computer System architecture, Computer System Structure, Operating System Operations, Process Management, Memory Management, Storage Management, protection and security. **System Structure:** Operating system services, user operating system interface, system calls, types of system calls, system programs, operating system design and implementation, operating system structure.	5
II	**Process** Process Concept, Process Scheduling, Operation on process, Cooperating process, Threads, Inter-process Communication (Algorithms evaluation). **Process Scheduling:** Basic concept, Scheduling Criteria, Scheduling Algorithms, Multiple processor scheduling, Real time scheduling.	8
III	**Inter-process Synchronization** Background, Classical problems of synchronization, Critical Region, The critical section problem, Synchronization Hardware, Monitors, Semaphores.	6
IV	**Deadlocks** System modes, Deadlock characterization, Methods for handling deadlocks Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.	5

V	**Memory Management** Background, Logical Versus Physical Address space, Swapping Contiguous Allocation, Paging, Segmentation, Segmentation with paging. **Virtual Memory:** Background, Demand paging, Page replacement, Page replacement algorithms, Allocation of frames, thrashing (Only concept), Demand segmentation. Virtualization concept and case studies	8
VI	**File System Management** File concept, access methods, directory and disk structure, file-system mounting, file sharing, protection. **Implementing File System :** File system structure, file-system implementation, directory implementation, allocation methods, free-space management	6

Text Books	
1	James. L. Peterson and A. Silberchatz ,"*Operating System Concepts*", Addison Westley Publication, 9th Edition,2018
2	Milan Milenkovic ,"*Operating System – Concept and Design*", TMGH,1st Edition,2001

References	
1	William Stallings," *Operating Systems : Internals and Design Principles*",Peterson Publication,7th Edition,2013
2	Crowley Charles ," *Operating Systems : A Design-Oriented Approach*",Mc Graw Hill Publication,1st Edition,2017

Useful Links	
1	https://www.gatevidyalay.com/operating-system/
2	https://www.javatpoint.com/os-tutorial
3	https://www.geeksforgeeks.org/operating-systems/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1												2	2	
CO2			2	3										
CO3					1									

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
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Assessment

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

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Computer Algorithm
Desired Requisites:	Data Structures

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

Course Objectives

1	To comprehend the logic of algorithm and its complexity
2	To analyse standard algorithms for parallelism involved
3	To Understand parallel algorithms

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	Select and apply appropriate logic for solving the problem.	III	Applying
CO2	Analyse the algorithmic solution and look for parallelism.	IV	Analysing
CO3	Design the appropriate algorithm for the given problem.	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction:** Design and Analysis of Algorithm Greedy Algorithms: Knapsack problem, Huffman codes, Dynamic Programming: Matrix-chain multiplication, Longest common sub-sequence.	5
II	P**rinciples of parallel algorithm design:** Preliminaries, Decomposition techniques, characteristics of task and interaction, Mapping techniques, overhead, parallel algorithm model **Programming using MPI:** MPI basics, send, receive, overlapping computation and communication, collective communication	5
III	**All-Pairs Shortest Paths (APSP) and Maxflow** Shortest paths and matrix multiplication, The Floyd-Warshall algorithm, Flow Networks, Ford Fulkerson method, Maximum Bipartite matching	4
IV	**Single-Source Shortest Path (SSSP)** Shortest paths and relaxation, Bellman-Ford algorithm, Single-source shortest paths in directed Acyclic graphs, Topological sort, Dijkstra's algorithm	4
V	**String Matching:** The Rabin-Karp algorithm, Knuth-Morris-Pratt algorithm. Computational Geometry: Determining whether any pair of segments intersects, Finding the convex hull, Finding the closest pair of points.	4

VI	**Complexity class and Approximation Algorithm** NP-Completeness: NP completeness and reducibility, NP-complete problem. Approximation Algorithms: The vertex-cover problem, The travelling-salesman problem, The set-covering problem	4

Text Books	
1	Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, *"Introduction to Algorithms",* Third Edition the MIT Press Cambridge, London, England, 2009
2	Anath Grama, Ansul Gupta, George Karypis, Vipin Kumar, *"Introduction to parallel computing",* Second Edition, Pearson Education, 2003 (For mdule IV)
References	
1	Horrowitz, Sahni Rajasekaran, *"Computer Algorithms",* Computer Science, W. H. Freeman and company Press, New york, 1997
2	
Useful Links	
1	https://nptel.ac.in/courses/106/104/106104019/
2	https://nptel.ac.in/courses/106/101/106101060/

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1					3							1		
CO2		1			2								1	
CO3	1	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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Database Engineering Lab
Desired Requisites:	Programming Lab

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

Course Objectives

1	To demonstrate basic concepts of conceptual database design
2	To introduce database schemas in DBMS
3	To illustrate between various transaction management protocols

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	Summarize real world problems into relational databases	III	Applying
CO2	Execute Query languages on databases	III	Applying
CO3	Study transaction processing techniques	IV	Analysing

List of Experiments / Lab Activities

List of Experiments:

1. Implement SELECT and PROJECT operation Assignment, Implement INSERT, DELETE and UPDATE operation database
2. Perform String operations and Aggregate functions on database
3. Perform Inner and Outer Join operations on database Assignment, Domain constraints & Referential Integrity Assignment
4. Program for sparse index and dense index Assignment
5. Program for static hashing Assignment, Program for Dynamic hashing Assignment
6. Program for log based protocol for transaction Assignment
7. Implementation of JDBC/ODBC driver for database connectivity
8. Program for Time Stamp protocol for transaction Assignment
9. Program for Deadlock Detection Assignment
10. perform CRUD (Create, Read, Update, Delete) operations on MongoDB databases
11. filtering for data efficiently on MongoDB databases
12. Working with command prompts and create database and tables on MariaDB.
13. Perform CRUD (Create, Read, Update, Delete) operations on MariaDB.

Text Books

1	Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, "*Database System Concepts*", McGraw-Hill Education, 6th Edition, 2010.
2	Raghu Ramakrishnan, "*Database Management Systems*", McGraw-Hill Education, 3rd Edition, 2003.

References

1	J.D. Ullman, "*Principles of Database Systems*", Galgotia Publications, 2nd Edition, 1999
2	Wiederhold, "*Database Design*", McGraw Hill Inc, 2nd Edition, 1983
3	C.J.Date, A.Kannan, S.Swamynathan, "*An Introduction to Database Systems*", Pearson Education, 8th Edition, 2006.

Useful Links	
1	https://nptel.ac.in/courses/106/105/106105175/
2	http://www.nptelvideos.in/2012/11/database-management-system.html

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2			2						2	1		
CO2		2			2						3	2	1	
CO3					2						2	3		1

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

Assessment

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

Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	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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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Computer Algorithm Lab
Desired Requisites:	Programming Language

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

Course Objectives

1	To recognize the logic of algorithm and its complexity
2	To realize standard algorithms and their parallel counterparts.
3	To categorize the algorithms based on complexity and adapt to the equivalent approximate algorithm.

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	Select and apply appropriate algorithms for solving the problem	III	Applying
CO2	Study the problem statement for algorithmic approach	IV	Analysing
CO3	Design the appropriate algorithm for problem statement	VI	Creating

List of Experiments / Lab Activities

List of Experiments:

1. Design Of Algorithm and Analysis with gprof profiler.
2. Problem of paragraph alignment and justification.
3. Implementation of Optimal Binary Search Tree.
4. MPI communication Assignment.
5. MPI performance analysis.
6. Implementation of gift box packaging using SSSP algorithm.
7. Application of APSP algorithm.
8. Graph algorithms implementations
9. Application deployment on AWS.
10. Implementation of approximate algorithm.

Text Books

1	Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, *"Introduction to Algorithms",*Third Edition the MIT Press Cambridge, London, England, 2009
2	Anath Grama, Ansul Gupta, George Karypis, Vipin Kumar, *"Introduction to parallel computing",* Second Edition, Pearson Education, 2003 (For mdule IV)

References

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

Useful Links

1	https://nptel.ac.in/courses/106/104/106104019/
2	https://nptel.ac.in/courses/106/101/106101060/

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
					3							1		
CO1		1			2								1	
CO2	1	2												2
CO3					3							1		
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	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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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Mini Project - 2
Desired Requisites:	Java programming

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

Course Objectives

1	To plan for various activities of the project and distribute the work amongst team members.
2	To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.
3	To understand the importance of document design by compiling Technical Report on the Mini Project work carried out.

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	Understand, plan and execute a Mini Project with team	III	Applying
CO2	Prepare a technical report based on the Mini project	I	Remembering
CO3	Deliver technical seminar based on the Mini Project work carried out	IV	Analysing

List of Experiments / Lab Activities

List of Experiments:

Mini-project is to be carried out in a group of maximum 5 to 6 students.

Each group will carry out a mini-project by developing any application software based on the following areas.

1. Design and develop application using any one or more programming languages: Java with concepts swing, AWS, threading, APIs, etc.
2. Industry based problem / Sponsored application /Game/ Interdisciplinary application /socially useful application / Problem solving of previously learned complex concepts.
3. Project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing and follow software engineering practices.
5. Project reports should be prepared and submitted in soft and hard form along with the code and other dependency documents. Preferable use online code repositories (github/bitbucket)
6. Project will be evaluated continuously by the guide/panel as per assessment plan.
7. Presentation and report should use standard templates provided by department.

Project report (pre-defined template) should be prepared using Latex/Word and submitted along with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or on an online repository.

Students should maintain a project log book containing weekly progress of the project.

Text Books	
1	Rajendra Kumbhar , "*How to Write Project Reports, Ph. D. Thesis and Research Articles*", Universal Prakashan, 2015
2	Marilyn Deegan, " *Academic Book of the Future Project Report*", A Report to the AHRC & the British Library, 2017
References	
1	https://www.youtube.com/watch?v=0oSDa2kf5I8 (report writing)
2	
Useful Links	
1	https://pats.cs.cf.ac.uk/wiki/lib/exe/fetch.php?media=project-report.pdf
2	http://users.iems.northwestern.edu/~hazen/Writing%20Project%20Reports%202004a.pdf
3	https://www.upgrad.com/blog/java-project-ideas-topics-for-beginners/
4	https://www.geeksforgeeks.org/computer-science-projects/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1			2							3		
CO2										2			2	
CO3							3				2			1

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High

Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.

IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks

LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	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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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Mini Project - 3
Desired Requisites:	Android Programming

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

Course Objectives

1	To plan for various activities of the project and distribute the work amongst team members.
2	To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.
3	To understand the importance of document design by compiling Technical Report on the Mini Project work carried out.

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	Understand, plan and execute a Mini Project with team	III	Applying
CO2	Prepare a technical report based on the Mini project	IV	Analysing
CO3	Deliver technical seminar based on the Mini Project work carried out	IV	Analysing

List of Experiments / Lab Activities

List of Experiments:

Mini-project is to be carried out in a group of maximum 5 to 6 students.
Each group will carry out a mini-project by developing any application software based on the following areas.

1. Design and develop mobile application using any scripting language with android studios (Kotlin, Java, etc) (Flutter/Eclipse/ android studio/etc.)
2. Industry based problem / Sponsored application /Game/ Interdisciplinary application /socially useful application / Problem solving of previously learned complex concepts.
3. Project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing and follow software engineering practices.
5. Project reports should be prepared and submitted in soft and hard form along with the code and other dependency documents. Preferable use online code repositories (github/bitbucket)
6. Project will be evaluated continuously by the guide/panel as per assessment plan.
7. Presentation and report should use standard templates provided by department.

Project report (pre-defined template) should be prepared using Latex/Word and submitted along with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or on an online repository.
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2	Marilyn Deegan, " *Academic Book of the Future Project Report*", A Report to the AHRC & the British Library, 2017
References	
1	https://www.youtube.com/watch?v=0oSDa2kf5I8 (report writing)
Useful Links	
1	https://pats.cs.cf.ac.uk/wiki/lib/exe/fetch.php?media=project-report.pdf
2	http://users.iems.northwestern.edu/~hazen/Writing%20Project%20Reports%202004a.pdf
3	https://www.upgrad.com/blog/java-project-ideas-topics-for-beginners/
4	https://www.geeksforgeeks.org/computer-science-projects/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1			2							3		
CO2										2			2	
CO3							3				2			1

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
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Assessment

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

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
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(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 1: Distributed Computing
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 introduce the various aspects of modern distributed systems
2	To elaborate distributed architecture, synchronization and fault tolerance
3	To explain the contemporary knowledge in distributed computing

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	Comprehend the fundamentals of distributed computing	II	Understanding
CO2	Distinguish the various approach to implement distributed environment	IV	Analysing
CO3	Evaluate the reliability and performance of various algorithms of distributed system	V	Evaluating

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, Memoization, Java Streams, Data Races and Determinism	6
IV	**Data flow Synchronization and Pipelining:** Split-phase Barriers with Java Phasers, Point-to-Point Sychronization 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)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3		1					1					2		
CO2		1													
CO3	2											1		1	

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)

Walchand College of Engineering, Sangli
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AY 2022-23

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 1:Advanced Programming Languages
Desired Requisites:	C & CPP Programming

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

Course Objectives

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

Course Outcomes (CO) with Bloom's Taxonomy Level

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

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

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

Text Books	
1	Davd Flanagan, Yukihiro Mataumoto, "*The Ruby Programming Language: Everything You Need to Know*", (O′Reilly; 1st edition (12 February 2008
2	Alan A. A. Donovan, Brian W. Kernighan, "*The Go Programming Language*", Pearson (Education; First edition (1 February 2016
References	
1	Yukihiro Matsumoto, David Flanagan , "*The Ruby Programming Language*", Shroff,1st Edition, 2008.
2	Caleb Doxsey, "*An Introduction to Programming in Go"*, CreateSpace Independent Publishing Platform (3 September 2012)
Useful Links	
1	https://onlinecourses.swayam2.ac.in/aic20_sp37/preview
2	https://www.javatpoint.com/ruby-tutorial
3	https://www.ruby-lang.org/en/documentation/quickstart/
4	https://gobyexample.com/
5	https://www.javatpoint.com/go-tutorial
6	https://www.coursera.org/specializations/google-golang

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				2										
CO2		2			3								2	
CO3			3		3								2	1
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)

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Course Information

Programme	B.Tech. Information Technology
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 1: Graph Theory
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 provide basics of graph theory
2	To illustrate various properties of graph in concern with applications
3	To analyze the various algorithm and applications of graph theory

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	Summarize the basic concepts of graphs, circuits and trees	II	Understanding
CO2	Apply various operations of graph theory on real-time application	IV	Analysing
CO3	Implement the algorithms of graphs theory for engineering applications	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction to Graphs, Paths and Trees:** Introduction to graphs, Basic properties of graphs, Complete and bi-partite graphs, Isomorphism of graphs, Paths and circuits	6
II	**Cut Set and Planar Graph:** Cut sets, connectivity and separability, network flows, isomorphism, Planner graphs, Kuratowski's two graphs, representation of planner graphs, detection of Planarity, Vertex Colouring of graphs, Edge Colouring of graphs,The four-colour and five-colour theorems	7
III	**Weighted Graph and Matrix representation:** Eulerian Graphs, Hamiltonian cycles, Matrix representation of graphs, Chordal graphs, Weighted graphs, Matching's in graphs, Hall's 'marriage' theorem and its application	6
IV	**Graph Algorithm:** Travelling salesman's problem & Chinese postman problem, Distances in graphs, Shortest path and Dijkstra's algorithm, Floyd – Warshall Algorithm, Bellman-Ford Algorithm	7
V	**Spanning Tree:** Trees, Spanning tree in graphs, Minimum spanning tree algorithms, Kruskal's algorithm, Independence sets and covering in graphs	7
VI	**Applications of Graph Thoery:** Perfect Graphs, Applications of graphs in switching theory, Directed Graphs (or Digraphs)	6

Text Books	
1	Deo Narsing *,"Graph Theory With Applications To Engineering And Computer Science",* 2nd Edition, PHI Publication, 2011
2	Wilson Robin J, *"Introduction to Graph Theory"*, 5th Edition, Longman Publication", 2012
References	
1	Parthasarathy K. R.*," Basic Graph Theory",* McGraw-Hill Professional Publishing,3rd Edition, 1994
Useful Links	
1	Module I, II, III, IV, V, VI https://onlinecourses.swayam2.ac.in/cec20_ma03/preview

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2			2												
CO3	2													1	
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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective – 1: Fundamentals of Artificial Intelligence
Desired Requisites:	Basic Course in Probability and Linear Algebra

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

Course Objectives

1	To introduce the concepts and techniques in Artificial Intelligence (AI)
2	To impart methodologies for various application areas of AI
3	To elaborate state of the art applications in AI

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 fundamental concepts of AI	III	Applying
CO2	Compare the architectural and functional structures of AI	IV	Analysing
CO3	Build an expert system in AI	VI	Creating

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

Text Books

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

References

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

2	Prof. Shyamanta M Hazarika " Fundamentals Of Artificial Intelligence" (NPTEL/Swayam Course)

Useful Links	
1	Module I,II,III https https://onlinecourses.nptel.ac.in/noc19_me71/unit?unit=7&lesson=8
2	Module IV,V https://onlinecourses.nptel.ac.in/noc19_me71/unit?unit=16&lesson=17
3	Module VI Vlabs,iitb.ac.in

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1		2										2		
CO2			3												
CO3	2													3	

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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective - 1: Soft Computing
Desired Requisites:	Artificial Intelligence, Tool like Matlab/Scilab

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

Course Objectives

1	To introduce various component of soft computing.
2	To impart soft computing concepts to solve engineering and optimization problems.
3	To familiarize with the swarm intelligence methods

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	Classify hard and soft computing concepts	IV	Analysing
CO2	Compare the working of swarm intelligence methods	IV	Analysing
CO3	Justify the soft computing technique for real-time problem	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction** History, Scope of Soft Computing, components of Soft Computing- Neural Networks, Application scope of ANN, Fuzzy Logic, Genetic algorithm, Swarm Intelligence, Hybrid System, Hard vs. Soft Computing.	5
II	**Artificial Neural Network (ANN)** Fundamental Concept, Evolution of Neural network, Basic models of ANN, important terminologies of ANN, Mc-Culloch Pitts Neuron, Linear separability, AND,OR, EXOR problem solving by ANN, Supervised Learning, Unsupervised Learning, Application to ANN to real world problem.	4
III	**Genetic Algorithms (GA)** Introduction, basic operators and Terminologies in GA, Genetic operators – Selection, crossover, reproduction and mutation – fitness function, traditional vs. Genetic algorithm, simple genetic algorithm, general genetic algorithm, the schema theorem, classification of GA, Genetic programming. Application to GA to real world problem.	4
IV	**Introduction to classical set and fuzzy sets** Introduction, Classical set (crisp set) Fuzzy sets and their properties, Fuzzy models, Membership function, Defuzzification. Application to Fuzzy logic to real world problem.	4
V	**Swarm Intelligence (SI)** Ant colony optimization (ACO), Particle Swarm Optimization (PSO), Harmony search (HS), Artificial Bee Colony algorithm (ABC), Teaching Learning Based Optimization Algorithm (TLBO).	4
VI	**Applications of soft computing** Hybrid System, optimization using GA/ANN/SI, Application of soft computing in multiple disciplines, Function Optimization.	5

Text Books	
1	Jyh-Shing Roger Jang, Chuen-Tsai Sun, and Eiji Mizutani "*Neuro Fuzzy and Soft computing: A Computational Approach to Learning and Machine Intelligence*", Prentice Hall, New Delhi, 1986.
2	Goldberg, David E, "*Genetic Algorithms in Search, Optimization and Machine Learning*", Addison Wesley, New Delhi, 1989.
3	Sivanandam S N and Deepa S N, "*Principles of Soft computing*", Wiley India Edition., 2008.
References	
1	Timothy J. Ross, "*Fuzzy Logic with Engineering Application*", Tata McGraw Hill, New Delhi, 2004.
2	Robert J Schalkff, "*Artificial Neural Networks*", McGraw Hill, New Delhi, 1997.
3	Sivanandam S N and Deepa S N," *Introduction to Genetic algorithms"*, Springer Verlag, Heidelberg, 2008.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs11/preview (Week no 1,2,3,4,5,8) Or https://nptel.ac.in/courses/106/105/106105173/ (Week no 1,2,3,4,5,8)
2	https://www.urbanpro.com/online-class/cs-302-new-soft-computing/1794165

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2		2		2										
CO3					3									1

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)

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AY 2022-23

Course Information

Programme	B. Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	
Course Name	Professional Elective - 1:Data Management, Protection and Governance
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 introduce high-level phases of data life cycle management
2	To compare various aspects of data storage, data availability, data protection.
3	To provide exposure to various solutions/reference architectures data protection

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 different standards for compliance and governance of data	III	Applying
CO2	Distinguish various types of data threats to ensure data center security	IV	Analysing
CO3	Design data intensive enterprise applications and industry standards in data management	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction to data life cycle management (DLM)** Goals of data life cycle management, Challenges involved- Volume of data source, Ubiquity of data locations, User demand for access, Stages of data life cycle – creation, storage, usage, archival, destruction, Risks involved without DLM, benefits, best practices	4
II	**Data storage and data availability** **Storage technology:** Hard Disk Device (HDD), Solid State Devices (SSD), memory devices, Data access - block, files, object, Data center End to End View – overview of complete stack including storage, network, host, cluster, applications, virtual machines, cloud storage, Storage virtualization technologies - RAID level, storage pooling, storage provisioning, Advance topics in storage virtualization – storage provisioning, thinprovisioning, Cloud storage – S3, glacier, storage tiering, High Availability-Introduction to high availability, clustering, failover, parallel access, Disaster Recovery -Need of disaster recovery, Building blocks - global cluster, wide-area-connector (WAC), heartbeat, Split-brain – problem and solutions o Preparing for DR – firedrill	8
III	**Introduction to data protection** Introduction-Need for data protection, basic of back-up/restore, Snapshots for data protection, copy-data management (cloning, DevOps), De-duplication, Replication, Long Term Retention – LTR, Archival, Design considerations-System recovery, Solution architecture, Backup v/s Archival, media considerations and management (tapes, disks, cloud), challenges with new edge technology (cloud, containers), General Data Protection Regulations overview	8

IV	**Data Threats and Data center security** Type of Threats-Denial of Service (DoS), man in the middle attacks, Unintentional data loss, Repudiation, Malicious attacks to steal data, Understanding, Identification and Threat modelling tools, Introduction to Ransomware, Security-Authorization and authentication - access control, Transport Layer Security (TLS), key management, security in cloud, Design and architecture considerations for security	7
V	**Data regulation, compliance and governance** Regulations requirements and Privacy Regulations-General Data Protection Regulation (GDPR), The Health Insurance Portability and Privacy Act of 1996 (HIPPA), PII (Personal Identity Information), Information Governance- Auditing, Legal Hold, Data classification and tagging (Natural Language Processing)	5
VI	**Applications uninterrupted** Understand data management aspects of traditional and new edge applications, Reference architecture/best practices (pick 2-3 case studies from below topics)-Transactional Databases (Oracle, MySQL, DB2), NoSQL Databases (MongoDB, Cassandra), Distributed applications (micro service architectures), Cloud applications – Platform as Service (PaaS), Software as Service (SaaS), Kubernetes, Multi-Tiered applications, ETL workloads, Data analytics (AI/ML)	7

Text Books	
1	Robert Spalding, "*Storage Networks: The complete Reference*" Tata McGraw-Hill, 2017
2	Vic (J.R.) Winkler, "*Securing The Cloud: Cloud Computing Security Techniques and Tactics*" (Syngress/Elsevier) - 978-1-59749-592-9, 2017
3	TBD – online reference for each topic.

References	
1	O'Reilly, Martin Kleppmann*, "Designing Data-Intensive Applications* " 2012
2	TBD: provide more online material details and books (This can include some publicly available white-paper, solution guides etc.)

Useful Links	
1	https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html
	https://searchstorage.techtarget.com/definition/data-life-cycle-management
	https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/
2	https://www.bmc.com/blogs/data-lifecycle-management/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3												3		
CO2	3	2												3	
CO3		3													

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)

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AY 2022-23

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Open Elective - 1: Joy of Programming using Python
Desired Requisites:	Computer Programming

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

Course Objectives

1	To introduce the significance of Python in programming
2	To compare various programming paradigms in Python
3	To implement different libraries of Python

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	Implement the programming concepts in Python	III	Applying
CO2	Examine the data using python programming libraries	V	Evaluating
CO3	Design application using Python libraries	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction to Python:** The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, Functions and scoping, Specifications, Recursion, Global variables.	4
II	**Advanced features of Python:** Modules, Files, System Functions and Parameters, Strings, Tuples, Lists and Dictionaries, Lists and Mutability, Functions as Objects.	5
III	**Classes and Object-Oriented Programming:** Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding.	4
IV	**Module:** Importing module, Math module, Random module, Packages Composition. **Data Visualization:** Matplot lib, Bar Graph, Pie Chart, Box plot, Histogram, Line chart, Sub plot	5
V	**Python-Numpy Library** **NumPy:** Introduction, Numpy array, Numpy array indexing, Numpy operations.	4
VI	**Pandas Library:** **Pandas:** Series, Data frames, managing missing data, groupby, merging & concatenation, operations, data input and data output.	4

Text Books	
1	R. Nageswara Rao, "*Core Python Programming*", Dreamtech Press, 2nd Edition, 2017
2	Chun, J Wesley, "*Core Python Programming*", Pearson, 2nd Edition, 2007 Reprint 2010
References	
1	Barry, Paul, Head *First Python*, O Rielly,2nd Edition, 2010
2	Lutz, Mark, *Learning Python*, O Rielly, 4th Edition, 2009
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs32/preview
2	https://docs.python.org/3/tutorial/
3	https://www.learnpython.org/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			2										3	
CO2				2	3							2		3
CO3									1			2		3

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)

Walchand College of Engineering, Sangli
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AY 2022-23

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Open Elective - 2: Cloud Computing System
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 introduce fundamentals of virtualization
2	To impart various service and deployment model in cloud computing
3	To acquaint the significance of virtualization in data centre

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	Comprehend the fundamentals of cloud computation	II	Understanding
CO2	Choose virtualization techniques to deploy the service on cloud infrastructure	III	Applying
CO3	Analyze service models for data centre applications	IV	Analysing

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

Text Books

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

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

Useful Links	
1	Module: I, II, IV, V, VI https://nptel.ac.in/content/syllabus_pdf/106105167.pdf
2	https://aws.amazon.com/

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1		2										2		
CO2			3												
CO3	2													3	

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)

TY Sem II

Walchand College of Engineering, Sangli
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AY 2022-23

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Unix Operating System
Desired Requisites:	Operating System

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

Course Objectives

1	To introduce design, principal and philosophy of the Unix/Linux OS.
2	To impart the architecture of Unix/Linux OS.
3	To discuss 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,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Interpret design, principal and philosophy of the Unix/Linux OS	III	Applying
CO2	Analyze the architecture of Unix/Linux OS	IV	Analysing
CO3	Apply Linux/Unix system calls	III	Applying

Module	**Module Contents**	**Hours**
I	**Introduction** General Overview of the System - History, System Structure, User Perspective, Operating System Services, Assumption About Hardware. Introduction to the KERNEL: Architecture of UNIX OS, Introduction to system concepts, Kernel Data Structure, System Administration	5
II	**The Buffer Cache** Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, advantages and disadvantages of cache.	4
III	**Internal Representation of Files** Inodes, structure of the regular file, directories, conversion of a pathname to inode, super block, inode assignment to a new file, allocation of disk blocks, other file types.	4
IV	**System calls for the file System** Open, Read, write, File and Record Locking, LSEEK, Close, File Creation, Creation of Special File, Change Directory and Change Root, Change Owner and Change Mode, Stat and Fstat, Pipes, Dup, Link, Unlink.	4
V	**Structure of Process** Process stages and transitions, layout of system memory, the context of a Process, saving context of a process, manipulation of the process address space.	4
VI	**Process Control** Process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, the shell, system Boot and the Init process, Process Scheduling, system call for time, clock.	5

Text Books

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

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

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

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			3						2					
CO2		2										2	2	
CO3			2	1										1

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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Parallel Computing
Desired Requisites:	Computer Algorithm

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	1	30	20	50	100
	-	**Credits: 3**			

Course Objectives

1	To get familiar with parallel Processing.
2	To learn the GPU based parallel programming using CUDA.
3	To Understand Importance of parallelism

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	Identify parallel structures in application	IV	Analysing
CO2	Apply shared, distributed & NUMA- Address space programming methods.	III	Applying
CO3	Analyze parallel programs using different tools	IV	Analysing

Module	**Module Contents**	**Hours**
I	Parallel Computing: Motivation and scope	6
II	GPGPU Programming : OpenACC, CUDA, OpenCL	4
III	Trends in processor architecture and limitations of memory systems	4
IV	Dichotomy and organization of parallel platforms	4
V	Communication costs in parallel machines	4
VI	Routing mechanism and processor mapping techniques	4

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)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2

CO1					3							1		
CO2		1			2								1	
CO3	1	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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Unix Operating System Lab
Desired Requisites:	Operating System, (C/python) Programming language

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

Course Objectives

1	To get introduce and use various system call of Unix/Linux OS
2	To use the various IPC's available in OS.
3	To impart the IPC 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,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the difference between thread and process	III	Applying
CO2	Implement effective programing on Unix/Linux	III	Applying
CO3	Distinguishing various IPC's available in OS	IV	Analysing

List of Experiments / Lab Activities

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

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)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		2		1									1	
CO2					3							2	2	
CO3		1		2										2
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	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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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Web Technology
Desired Requisites:	Basic Programming Concepts

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

Course Objectives

1	To Practice the best technologies for solving web client/server problems
2	To inspect and design real time web applications
3	To argue about client-side or server-side applications

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	Identify the principles of coherent web coding and good visual design	III	Applying
CO2	Demonstrate the incorporation of of CSS and Java script in an HTML page	IV	Analysing
CO3	Create web pages using Django and database connectivity using MySQL	VI	Creating

Module	**Module Contents**	**Hours**
I	**HTML and CSS** HTML introduction, HTML editors, elements, attributes, headings, paragraphs, styles, formatting, lists, tables, layout, forms CSS Introduction, syntax, selectors, colors, backgrounds, borders, margins, padding, outline, text family, font family, navigation bar, dropdowns, forms, website layout and components	2
II	**Java script** Introduction to Java script, syntax, variables, operators, data types, functions, objects, events, date formats, math, control flow statements, forms, objects and its properties, object classes, components, Introduction to server-side and client-side scripting language	2
III	**PHP** Basics of PHP, installation of PHP, comments, variables, echo/print, data types, strings, numbers, math, constants, operators, control flow statements, arrays, Form handling, form validation, form required, from URL, form complete, date and time, file handling, open, read, write, upload, cookies, session,	3

IV	**Object oriented PHP** What is OOP?, classes and objects, constructor, destructor, access modifiers, inheritance, interfaces, abstract classes, static keyword	2
V	**Database Handling –** MySQL database connectivity, MySQL connect, creating database, inserting data, prepared statements, various queries used in PHP	2
VI	**Bootstrap and responsive web design** Introduction to Bootstrap, installation of bootstrap, grid system, buttons, tables, vertical forms, horizontal forms, dropdowns, responsive tabs, progress bar, alerts, pagination, badges, labels, page headers, tooltips, responsive web design: nodejs, angular js, angular, react, etc.	2

List of Experiments / Lab Activities

List of Experiments:

1. Program on HTML basic tags for text formatting.
2. Program on HTML tag to handle multimedia elements on web page.
3. Program on HTML tag to create forms and UI elements.
4. Program on CSS properties for HTML web page.
5. Program on applying event handling on HTML web page using JavaScript.
6. Program on applying layout to HTML webpage.
7. Program on PHP controls statements.
8. Program on PHP string operations.
9. Program on PHP form creation and data handling.
10. Program on session management using PHP.
11. Program on Cookies management using PHP.
12. Program on PHP to connect MySQL database for CURD operations.
13. Program on Bootstrap/ responsive web design using different components.

Text Books

1	P.J. Deitel & H.M. Deitel Pearson, "Internet and World Wide Web How to program", Pearson Education India, 4th Edition, 2009
2	Jon Duckett,"HTML and CSS: Design and Build Websites", John Wiley & Sons, Inc, 1st Edition, 2011

References

1	Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, 5th Edition, 2010
2	Ivan Bayross ,"Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP", BPB Publications, 4th Edition , 2006

Useful Links

1	https://www.coursera.org/learn/web-app#syllabus
2	https://www.coursera.org/specializations/web-applications
3	https://www.udemy.com/course/foundations-of-front-end-development/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		2		1										
CO2									2					
CO3					2									1

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

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	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 2022-23

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Mini Project - 4
Desired Requisites:	Database Engineering

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

Course Objectives

1	To plan for various activities of the project and distribute the work amongst team members
2	To develop student‘s abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project
3	To understand the importance of document design by compiling Technical Report on the Mini Project work carried out

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	Understand, plan and execute a Mini Project with team	III	Applying
CO2	Prepare a technical report based on the Mini project	IV	Analyzing
CO3	Deliver technical seminar based on the Mini Project work carried out	IV	Analyzing

List of Experiments / Lab Activities

List of Experiments:

Mini-project is to be carried out in a group of maximum 5 to 6 students. Each group will carry out a mini-project by developing any application software based on the following areas.

1. Data based application development using any trending database system like: structured and unstructured DBs (PGSQL, NoSQL, MongoDB, oracle, Maria Db, RDF, firebase, etc.)
2. Industry based problem / Sponsored application /Game/ Interdisciplinary application /socially useful application / Problem solving of previously learned complex concepts.
3. Project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing and follow software engineering practices.
5. Project reports should be prepared and submitted in soft and hard form along with the code and other dependency documents. Preferable use online code repositories (github/bitbucket)
6. Project will be evaluated continuously by the guide/panel as per assessment plan.
7. Presentation and report should use standard templates provided by department.
8. Preferably choose DB other than taught in MySQL/MSSQL.

Project report (pre-defined template) should be prepared using Latex/Word and submitted along with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or on an online repository.
Students should maintain a project log book containing weekly progress of the project.

Text Books	
1	Rajendra Kumbhar , "*How to Write Project Reports, Ph. D. Thesis and Research Articles*", Universal Prakashan, 2015
2	Marilyn Deegan, " *Academic Book of the Future Project Report*", A Report to the AHRC & the British Library, 2017
References	
1	https://www.youtube.com/watch?v=0oSDa2kf5I8 (report writing)
2	
Useful Links	
1	https://pats.cs.cf.ac.uk/wiki/lib/exe/fetch.php?media=project-report.pdf
2	http://users.iems.northwestern.edu/~hazen/Writing%20Project%20Reports%202004a.pdf
3	https://www.upgrad.com/blog/java-project-ideas-topics-for-beginners/
4	https://www.geeksforgeeks.org/computer-science-projects/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1			2							3		
CO2										2			2	
CO3							3				2			1

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

Assessment

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

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	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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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Mini Project - 5
Desired Requisites:	AIML, Web Technology, IoT

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

Course Objectives

1	To introduce latest web technology
2	To find real-world challenges by IT based Solution
3	To build the soft skills of student to work in team.

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	Implement AI based applications or Web application	III	Applying
CO2	Identify the real world problems & apply software engineering practices.	IV	Analyzing
CO3	Design software application with backend and detailed project report for submission and evaluation.	VI	Creating

List of Experiments / Lab Activities

List of Experiments:

Mini-project is to be carried out in a group of maximum 5 to 6 students. Each group will carry out a mini-project by developing any application software based on the following areas.

1. Development interdisciplinary application using any web technologies/AIML/IoT.
2. Industry based problem / Sponsored application /Game/ Interdisciplinary application /socially useful application / Problem solving of previously learned complex concepts.
3. Application area for AI/ML/IoT in Transport, Agriculture, Networking monitoring, environment, Social life Smart City Development, health, smart home, or in any engineering field other than CS/IT etc.
4. Web application development using any front end technology: PHP, NODE.JS, Django. Flask, Ruby on Rails, etc
5. Data based application development using any trending database system like: MySQL, PGSQL, NoSQL, MongoDB, etc.
6. AIML application development using PyTorch, TensorFlow ,NLTK etc
7. IoT Application development using components.
8. Project group should achieve all the proposed objectives of the problem statement.
9. The work should be completed in all aspects of design, implementation and testing and follow software engineering practices.
10. Project reports should be prepared and submitted in soft and hard form along with the code and other dependency documents. Preferable use online code repositories (github/bitbucket)
11. Project will be evaluated continuously by the guide/panel as per assessment plan.
12. Presentation and report should use standard templates provided by department.
    Project report (pre-defined template) should be prepared using Latex/Word and submitted along with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or on an online repository. Students should maintain a project log book containing weekly progress of the project.

Text Books	
1	Rajendra Kumbhar , "*How to Write Project Reports, Ph. D. Thesis and Research Articles*", Universal Prakashan, 2015
2	Marilyn Deegan, " *Academic Book of the Future Project Report*", A Report to the AHRC & the British Library, 2017
References	
1	https://www.youtube.com/watch?v=0oSDa2kf5I8 (report writing)
Useful Links	
1	https://pats.cs.cf.ac.uk/wiki/lib/exe/fetch.php?media=project-report.pdf
2	http://users.iems.northwestern.edu/~hazen/Writing%20Project%20Reports%202004a.pdf
3	https://www.upgrad.com/blog/java-project-ideas-topics-for-beginners/
4	https://www.geeksforgeeks.org/computer-science-projects/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1			2							3		
CO2										2			2	
CO3							3				2			1

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

Assessment

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

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	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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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VI
Course Code	
Course Name	Professional Elective - 2: Fundamentals of 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
	-	**Credits: 3**			

Course Objectives

1	To introduce fundamental principles of distributed systems
2	To compare various distributed system protocols
3	To deliver the concepts of communication, process, naming and synchronization

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Comprehend the fundamentals of distributed operating systems	II	Understanding
CO2	Compare different distributed file systems	IV	Analysing
CO3	Analyze distributed web-based system and applications	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction to distributed Systems** Definition and goals, Hardware and Software concepts, Design issues	6
II	**Communication & Synchronization in distributed systems:** Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems	7
III	**Processes and processors & Distributed File Systems:** Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, Real time distributed systems, Process migration and related issues Introduction, features & goal of distributed file system,	5
IV	**Distributed Shared Memory**: Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing	5

V	**Naming & Distributed Web-based Systems** Overview, Features, Basic concepts, System oriented names, Object locating mechanisms, Issues in designing human oriented names, Name caches, Naming and security, DNS Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication: Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications	7
VI	**Security &Case Study** Google FS/BigTable Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management ,Java RMI, Sun Network File System, Google case study	5

Text Books

1	Pradeep K. Sinha "*Distributed Operating Systems Concepts and Design*", Wiley–Blackwell, 1996
2	George Coulouris, Jean Dollimore,Tim Kindberg " *Distributed Systems: Concepts and Design"*, Pearson, 2011

References

1	Sunita Mahajan & Seema Shah "*Distributed Computing* " OXFORD, 2013

Useful Links

1	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1											2	2
CO2	2													2
CO3	1													1

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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Professional Elective - 2: Full Stack Development
Desired Requisites:	Web Technology

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

Course Objectives

1	To impart the design, development and implementation of static and dynamic web pages
2	To develop programs for web using Scripting Languages
3	To introduce concept of responsive web development

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Illustrate the basic elements and properties in different web applications	III	Applying
CO2	Create static and dynamic web applications	VI	Creating
CO3	Design and develop responsive web applications	VI	Creating

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

V	**Python Framework** Introduction to Django, Installation of Django, The Basics of Dynamic, Web Pages, The Django Template System, Interacting with a Database: Models, The Django Administration Site, Form Processing, File Handling Email Functionalities, Sessions and Cookies	6
VI	**Ruby On Rails** Introduction, RVM(ruby version manager), Working in Linux(Ubuntu) Platform, Ruby Operators & Ruby Shell, Ruby Data types & Variables, Ruby methods and modules, OOP in Ruby, Basic loops and iterators **Rails** Rails Installation and Ruby gems, Databases, Statements, RAILS Model, Controller, and Views	7

Text Books	
1	Benjamin Jakobus, "*Mastering Bootstrap 4*", Packt Publisher, 2nd Edition, 2018
2	Jake Spurlock, "*Bootstrap: Responsive Web Development*", O'Reilly Publication, 1st Edition, 2013
3	Ethan Brown, "*Web Development using Node and Express*", O'Really Publisher, 1st Edition, 2014.

References	
1	Daniel Rubio," *Beginning Django Web Application Development and Deployment with Python*", ApressPublication,1st Edition,2017
2	Michael Hartl," *Ruby on Rails 3 Tutorial Learn Rails by Example*", Pearson Education Publication,1st Edition,2010

Useful Links	
1	https://www.tutorialsteacher.com/nodejs/nodejs-tutorials
2	https://morioh.com/p/656c3d9c1bce
3	https://www.tutorialrepublic.com/twitter-bootstrap-tutorial/
4	https://morioh.com/p/11c3e757a913
5	https://www.djangoproject.com/start/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1									1				2	
CO2			2		2									3
CO3			2		3									3

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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year b. Tech., Sem VI
Course Code	
Course Name	Professional Elective - 2: 5G Technology
Desired Requisites:	Computer Network

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

Course Objectives

1	To introduce the evolution of mobile communication
2	To elaborate the key innovations in 5G networks
3	To design and optimize the 5G network in modern tools

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	Distinguish the evolution of 5G network and spectrum challenges	IV	Analysing
CO2	Illustrate the 5G physical and functional architecture	III	Applying
CO3	Compare various radio access technologies for 5G networks	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction Wireless Communication:** Evolution of wireless Communication Standards From 2G to 5G, Merits and Demerits of 2G, 3G, 4G	6
II	**Introduction to 5G:** Requirements and operating scenarios of 5G, 5G scenarios, Ultra reliable low latency communication, Designing 5G new radio	7
III	**Waveform Design Aspects:** Waveform Design Aspects of 2G, Waveforms in 3G, 4G, 5G, Waveforms beyond 5G, Comparison of waveforms	6
IV	**5G Carriers and Channels:** LecFrame Structure in 5G NR, Numerology in 5G and adaptive subcarrier bandwidth, Channel models for performance evaluation	7
V	**Signal Processing:** MIMO Signal Processing (Receive Diversity) and Capacity, Hybrid beam forming (mmWave)	7
VI	**Challenges in 5G:** Spectrum availability and implementation,Deploying hybrid LTE-NR is critical, Complex network architecture, Demand for extensive 5G networks testing, Scarcity in 5G devices, Investment requirements, Regulations on radiation	6

Text Books

1	Asif Oseiran, Jose F.Monserrat and Patrick Marsch, *"5G Mobile and Wireless Communications Technology"*, Cambridge University Press, 2016
2	Jonathan Rodriquez, *"Fundamentals of 5G Mobile Networks",* Wiley, 2015

References	
1	Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, *"5G System Design – Architectural and Functional Considerations and Long Term Research",* Wiley, 2018
Useful Links	
1	Module I, II, III, IV, V https://nptel.ac.in/courses/108/105/108105134/

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2		2													
CO3	2		1											1	
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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Professional Elective - 2: Data Handling and Machine Learning
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 revise mathematical background of calculus, linear algebra and relate probabilistic approaches useful in data classifications
2	To explain various data handling techniques involved in data science life cycle
3	To demonstrate working of Machine Learning functions and algorithms using open source platforms

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	Follow data pre-processing techniques to get optimized learning solutions	II	Understanding
CO2	Practice Machine Learning algorithms for data classification and clustering	III	Applying
CO3	Examine feature engineering aspects impacting the algorithmic performances	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Probability:** Conditional Probability, Bayes' Theorem, Independence, Theorem of Total Probability, Expectation and Variance, Discrete and Continuous Distributions, Joint Distributions and Covariance	6
II	**Data Handling:** Data Sources -Functional and Technical Aspects, Data-Collection, Data Cleaning, Data Preparation, Data Wrangling	7
III	**Data Transforming:** Filtering and Representing Data, Scalar/Vector / Matrix Formats, Eigenvalues and Eigenvectors Geometric Transformations	6
IV	**Feature Engineering:** Types of Features, Feature Engineering- Imputation, Discretization, Categorical Encoding Techniques, Feature Splitting (Train-Test Split), Handling ond Detecting Outliers, Variable Transformations, Scaling ond Creating Features	7
V	**Essentials of Machine Learning:** Introduction to Regression, Classification and Clustering Algorithms, Linear and Non-Linear Models, Generalization, Optimization Functions	7
VI	**Machine Learning Applications** Machine Learning Assessment Metrics, Case Studies and Hands on Practice using Tools (e.g. Jupyter Notebook, Spyder, Google Colab, Powerbi etc…)	6

Text Books

1	Tom Mitchell, "*Machine Learning*" , McGraw-Hill Series in Computer Science, 1st Edition, 1997
2	John Paul Mueller, Luca Massaron, "*Machine Learning for Dummies*", 2nd Edition, 2021
References	
1	All Modules taken from below link course. https://onlinecourses.nptel.ac.in/noc21_ma38/
Useful Links	
1	A Detailed Guide for Data Handling Techniques in Data Science https://www.analyticsvidhya.com/blog/2022/01/a-detailed-guide-for-data-handling-techniques-in-data-science/
2	Essential Mathematics for Machine Learning, NPTEL course by IIT Roorkee https://nptel.ac.in/courses/111107137
3	Preparing Data for Machine Learning https://www.coursera.org/projects/preparing-data-for-machine-learning-models

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2		2													
CO3	2		1											1	

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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
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)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	1		2										2		
CO2			3												
CO3	2										1	2		3	

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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Open Elective 3: Web Development and Applications
Desired Requisites:	Computer Programming

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

Course Objectives

1	To introduce fundamentals of web design
2	To compare client side scripting and static web page design
3	To explain server side scripting language for dynamic page development

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Use web and multimedia elements in web pages	III	Applying
CO2	Implement static and dynamic scripting for web applications	III	Applying
CO3	Compare various web services for web deployment	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction to Internet and Web:** Internet, Web, Server Client model, Internet vs. web, Web Browsers, Web Page Addresses (URLs), Anatomy of a web page, Defining web design, the medium of the web, Types of web sites, Web Design themes. Web Page Hosting	4
II	**HTML and CSS :** HTML: Elements, Attributes, , Adding text, adding images, Table markup, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, simple HTML forms, CSS: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS	5
III	**XML** Introduction to XML, uses of XML, simple XML, and XML key components, DTD and Schemas, Well formed, using XML with application. XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSL	4
IV	**PHP** Introduction to PHP, Using variables and operators, controlling program flow, Working with arrays, Using functions and classes, PHP Forms, Content management system: WordPress, Drupal, Joomla	4

V	**JavaScript:** The Basic of JavaScript: Objects, Primitives Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching ,Positioning Moving and Changing Elements	4
VI	**Web Services And Web application** Introduction to Web Service, Web Services Basics – Creating, Publishing, WSDL, SOAP, RSS, Web Application, examples of web applications.	4

Text Books	
1	Jennifer Niederst Robbins "*Learning Web Designing",* O'Reilly Publications", 5th Edition,2018
2	Thomas A. Powell "*Web Design: The Complete reference*" Mc Graw Hill/ Osborne, 1st Edition, 2000
3	Robin Nixon, "*Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites*", O'Reilly Publications, 3rd Edition, 2014

References	
1	Erik T. Ray "*Learning XML*" O'Reilly Publications, 1st Edition, 2001
2	Chris Bates, "*Web Programing Building Internet Applications*", WILEY, Dreamtech 2nd Edition, 2000

Useful Links	
1	https://www.coursera.org/learn/web-development#syllabus
2	https://www.coursera.org/learn/duke-programming-web#syllabus
3	https://www.javatpoint.com/php-tutorial
4	https://www.javatpoint.com/xml-tutorial
5	https://www.softwaretestinghelp.com/web-services-tutorial/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1									1				2	
CO2			2		2									3
CO3			2		3									3

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)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Open Elective - 4: Machine Learning
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** 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** Classification, hypothesis representation, decision boundary, cost function, simplified cost function and gradient descent, optimization, one v/s all	6
III	**Artificial Neural Networks:** Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation.	6
IV	**Support Vector Machine:** Optimization objective, mathematics behind large margin classification, kernels using as SVM	
V	**Learning Theory:** 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** 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 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)