



**JSPM's**  
**RAJARSHI SHAHU COLLEGE OF ENGINEERING**  
**TATHAWADE, PUNE-33**  
(An Autonomous Institute Affiliated to SavitribaiPhule Pune University, Pune)



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## **Department of Information Technology**

### **Structure & Syllabi**

**T. Y. B. Tech (2019 Pattern)**  
**w.e.f. Academic Year 2021-2022**

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**Dr. N. M. Ranjan**  
**BoS Chairman**

**Dr. Ram Joshi**  
**Dean of Academics**



**Dr. Rakesh K. Jain**  
**Director**



## Department of Information Technology

### **Vision**

“To create quality information technology professionals through superior academic environment.”

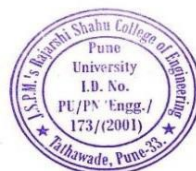
### **Mission**

- To incorporate the IT fundamentals in students to be successful in their career.
- To motivate students for higher studies, research and entrepreneurship.
- To provide IT services to society.



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**Department of Information Technology**

**Program Outcomes (POs)**

Engineering Graduates will be able to:

- 1.Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2.Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3.Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4.Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5.Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- 6.The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. JSPM's Rajarshi Shahu College of Engineering Department of IT Engineering
- 7.Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9.Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11.Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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**Program Specific Outcomes (PSOs):**

Upon successful completion of UG course in Information Technology, the students will attain following PSOs:

1. Utilize discrete principles of mathematics along with programming paradigms to expedite solution building in the IT domain.
2. Apply computational techniques using core aspects of network and system programming to deliver secured application in the arena of analytics and computing.
3. Develop team spirit with project management skills to handle multidisciplinary complex tasks proficiently and utilize these skills for entrepreneurship

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## *Highlights of the Syllabus*

Curriculum of Information Technology Department is designed in consultation with experts like:



Academic  
Experts



Industry/Corporate  
Experts



Distinguished  
Alumni

Following are the features of the curriculum of the **Information Technology Department** designed in association with the **Persistent Systems Pvt. Ltd. Pune** and **Tata Consultancy Services, Pune**



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## Unique features of the curriculum

### 1. Curriculum centered at Outcome Based Education:

The new Curriculum is based on student-centered instruction models that focus on measuring student performance through outcomes. The outcomes include subject knowledge, industry required skills and attitudes.

### 2. Emphasize on Fundamentals:

The nature of the new curriculum is rigorous and well prescribed so that the students can spend more time on preparation and self-study. The students have to learn core subjects, solve practical based assignments and must attempt periodical quizzes. This will benefit them to grasp and keep a strong hold on fundamentals of Engineering in the most effective way.

### 3. Experiential Learning:

The curriculum emphasizes on hands-on sessions along with theoretical information. The new curriculum considers Problem Based Learning (PBL) as a teaching pedagogy and includes different subjects that encourage the students for hands on learning through virtual labs, mini-projects, etc. Accordingly, the curriculum maintains good balance between theory and laboratory credits.

### 4. Promote Creativity and Innovation:

Along with experiential learning, the curriculum also motivates the students to inculcate creativity and innovation. Apart from conventional lab, the curriculum provides a freedom for students to perform industry assignments, pilot projects, innovative development, etc.

### 5. Inculcating Ethics and Values:

To improvise student's behavior, the curriculum has included systematic courses on ethics and values. The moral principles can help students to make right decisions, lead their professional lives and become ethical citizen.

### 6. Blend of Curricular and Noncurricular Activities

The curriculum also gives importance of different activities like co-curricular, extra-curricular, sports, culture, etc. This will help to do all round development of students in all possible ways.

### 7. Four Tracks in B-Tech:

The curriculum provides four tracks in the curriculum as

- |                                  |                      |
|----------------------------------|----------------------|
| I. Industry Internship           | II. Entrepreneur     |
| III. Higher Studies and Research | IV. In house Project |

### 8. Global Competence:

The curriculum provides a unique opportunity for students to learn and engage in open and effective interaction with people from diverse and interconnected world. The combination of foreign languages (German, Japanese, English) and international internships in the curriculum help the students to build a capacity to examine global and intercultural issues and to propose perspectives and views.

### 9. Industry Induced Internship Program

To support ever demanding industry requirements, the curriculum has included an industry internship with an objective to learn technologies pertaining to their discipline and enhance their technical knowledge with a support of the live platform of Industry.

### 10. Motivation for Self Learning:

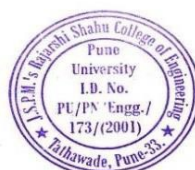
The curriculum also offers a freedom to students to take the initiatives in their learning needs and set the goals with the help of online learning platforms like MOOCs, NPTEL, Swayam, etc.



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**T. Y. B. Tech. (Department of Information Technology)**

**Semester-V- Syllabus Structure**

Course Code	Course	Teaching Scheme			Semester Examination Scheme of Marks							Credits
		TH	TU	Lab	ISE (15)	MSE (25)	TH (60)	TW	OR	PR	Total	
IT3101 / IT3115	Operating System Operating System and Design	3	-	4	15	25	60	25	-	25	150	5
IT3102 / IT3116	Computational Complexity and Algorithm Design and Analysis of Algorithm	3	-	2	15	25	60	25	-	25	150	4
IT3103 / IT3117	Cloud Computing Image Processing and Pattern Recognition	3	-	-	15	25	60	-	-	-	100	3
IT3104 / HS3102	Computational Statistics Fundamentals of Management and Strategy Formulation	3	-	-	15	25	60	-	-	-	100	3
IT3105	Elective-I	3	-	-	15	25	60	-	-	-	100	3
IT3106	Advanced Python Programming	-	-	4	-	-	-	-	-	50	50	2
IT3107	Design Thinking	-	2	-	-	-	-	50	-	-	50	2
\$\$	Audit Course-III	Non-Credit Course										
<b>Total</b>		<b>15</b>	<b>2</b>	<b>10</b>	<b>75</b>	<b>125</b>	<b>300</b>	<b>100</b>	<b>-</b>	<b>100</b>	<b>700</b>	<b>22</b>

  
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### Elective I Options

Elective I Course Code	Elective I Title
IT3105A	User Interface and User Experience Design
IT3105B	Business Analytics and Intelligence
IT3105C	Internet of Things
IT3105D	Modern Web Applications

### Audit Course 3 Options

\$\$	Audit Course III Title
HS3106	Essence of Indian Knowledge Tradition -I
HS3108	Cultural Studies
CE 3113	Urbanization and Environment



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**T. Y. B. Tech. (Department of Information Technology)**  
**Semester-VI- Syllabus Structure**

Course Code	Course	Teaching Scheme			Semester Examination Scheme of Marks							Credits
		TH	TU	Lab	ISE (15)	MSE (25)	TH (60)	TW	PR	OR	Total	
IT3108 / IT3118	Artificial Intelligence											
	Artificial Intelligence & Robotics	3	-	2	15	25	60	-	25	-	125	4
IT3109 / IT3119	Cyber Security											
	Information and Cyber Security	3	-	-	15	25	60	-	-	-	100	3
IT3110 / IT3120	Advance Software Modeling											
	Cloud Microservices and applications	3	-	2	15	25	60	-	-	25	125	4
IT3111 / IT3121	Machine Learning											
	Machine Learning and Applications	3	-	2	15	25	60	-	50	-	150	4
IT3112	Elective-II	3	-	-	15	25	60	-	-	-	100	3
IT3113	Engineering Design and Innovation-II	-	-	2	-	-	-	-	-	50	50	1
IT3114	Business Communication	-	-	2	-	-	-	-	50	-	50	1
\$\$	Audit Course-IV				Non-Credit Course							
Total		15	0	10	75	125	300	-	125	75	700	20

  
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### Elective II Options

Elective II Course Code	Elective II Title
IT3112A	High Performance Computing
IT3112B	Ethical Hacking
IT3112C	Mobile Computing
HS3103C	Financial and Cost Accounting

### Audit Course 3 Options

\$\$	Audit Course IV Title
HS3107	Essence of Indian Knowledge Tradition –II
HS3109	Introduction to Human Factors and Ergonomics
HS3110	Mind Education



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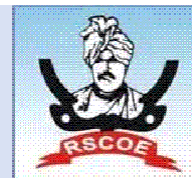
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**T. Y. B. Tech (Department of Information Technology)**  
**Semester -V**

**[IT3101]: Operating System**

<b>Teaching Scheme:</b> TH : 03 Hours/Week LAB : 04 Hours/Week	<b>Credits:</b> TH : 03 LAB : 02	<b>Examination Scheme:</b> In Sem. Evaluation: 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Exam (TW) : 25 Marks Lab Exam (PR) : 25 Marks
<b>Course Prerequisites:</b> Computer System and organization Data structures and programming languages		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To introduce basic concepts &amp; function of Modern Operating System</li> <li>To understand the basic concept of process and thread management</li> <li>To learn the scheduling of processes and threads &amp; understand the concept of concurrency control.</li> <li>To understand the concept of I/O and File management.</li> <li>To understand various Memory Management techniques.</li> </ul>		
<b>Course Outcomes: After successful completion of the course, students will able to-</b> <b>CO1:</b> Explain the role of Operating Systems in Computer System and its types <b>CO2:</b> Demonstrate the concept of process & threads, and apply user level threading for multithreading application <b>CO3 :</b> Apply process synchronization tool using mutual exclusion for solving synchronization and Apply the deadlock free solution for solving real time problem of deadlock. <b>CO4:</b> Apply and evaluate various main and virtual memory management techniques. <b>CO5:</b> Describe the concept of I/O management and File system. <b>CO6:</b> Explain the advanced operating system like Mobile OS		
<b>Course Contents</b>		
<b>UNIT-I</b>	<b>Introduction And Operating Systems Structures</b>	<b>07 Hours</b>
Evolution of operating systems: Batch, timesharing, multiprogramming, multi-tasking and distributed and real time. Operating system components, O.S. Services, System Calls, System Programs, System Structure, Virtual Machines, Special purpose operating systems, Open-source operating systems, Boot Procedure, Overview of the GNU/Linux system administration.		
<b>UNIT-II</b>	<b>Process Management And Cpu Scheduling</b>	<b>07 Hours</b>
<b>Process:</b> Concept of a Process, Process States, Process Description, Process Control (Process creation, Waiting for the process/processes, Loading programs into processes and Process Termination), Execution of the Operating System. <b>Threads:</b> Processes and Threads, Concept of Multithreading, Types of Threads, Thread programming Using Pthreads. <b>Scheduling:</b> Types of Scheduling, Scheduling Algorithms, and Thread Scheduling.		


  
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UNIT-III	Concurrency Control	07 Hours
<p><b>Process/thread Synchronization and Mutual Exclusion:</b> Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support, Operating System Support (Semaphores and Mutex), Programming Language Support (Monitors).</p> <p><b>Classical synchronization problems:</b> Readers/Writers Problem, Producer and Consumer problem, Interprocess communication (Pipes, shared memory: system V).</p> <p>Deadlock: Principles of Deadlock, Deadlock Modeling, Strategies to deal with deadlock: The Ostrich Algorithm, Deadlock Prevention, Deadlock Avoidance, Deadlock detection and recovery, An Integrated Deadlock Strategy, Example: Dining Philosophers Problem</p>		
UNIT-IV	Memory Management	07 Hours
<p>Memory Management: Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Segmentation. Virtual Memory: Hardware and Control Structures, Operating System Software</p>		
UNIT-V	Input / Output And File Management	07 Hours
<p>I/O Management and Disk Scheduling: I/O Devices, Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling(FIFO, SSTF, SCAN, C-SCAN, LOOK, CLOOK), Disk Cache. File Management: Overview, File Organization and Access, File Directories, File Sharing, Record Blocking, Secondary Storage Management.</p>		
UNIT-VI	Advanced Operating System	07 Hours
<p><b>Mobile Operating Systems:</b> ARM and Intel architectures, Power Management, Mobile OS Architectures, Underlying OS, Kernel structure and native level programming, Runtime issues, Approaches to power management</p>		
Lab Contents		
Guidelines for Lab Assessment		
<p>1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.</p> <p>2) Practical / Oral examination shall be based on the practical's performed in the lab.</p> <p>3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.</p>		
List of Laboratory Assignments		
1	Shell programming Write a program to implement an address book with options given below: a) Create address book. b) View address book. c) Insert a record. d) Delete a record. e) Modify a record. f) Exit..	
2	Process control system calls: The demonstration of FORK, EXECVE and WAIT system calls along with zombie and orphan states. Implement the C program in which main program accepts an integer array. Main program uses the FORK system call to create a new process called a child process. Parent process sorts an integer array and passes the sorted array to child process through the command line	

  
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	arguments of EXECVE system call. The child process uses EXECVE system call to load new program that uses this sorted array for performing the binary search to search the particular item in the array.
3	Thread management using pthread library. Implement matrix multiplication using multithreading. Application should have pthread_create, pthread_join, pthread_exit. In the program, every thread must return the value and must be collected in pthread_join in the main function. Final sum of row column multiplication must be done by main thread (main function).
4	Thread synchronization using counting semaphores and mutual exclusion using mutex. Application to demonstrate: producer-consumer problem with counting semaphores and mutex
5	Deadlock Avoidance Using Semaphores: Implement the deadlock-free solution to Dining Philosophers problem to illustrate the problem of deadlock and/or starvation that can occur when many synchronized threads are competing for limited resources
6	Inter process communication in Linux using following. a. Pipes: Full duplex communication between parent and child processes. Parent process writes a pathname of a file (the contents of the file are desired) on one pipe to be read by child process and child process writes the contents of the file on second pipe to be read by parent process and displays on standard output.
7	Inter-process Communication using Shared Memory using System V. Application to demonstrate: Client and Server Programs in which server process creates a shared memory segment and writes the message to the shared memory segment. Client process reads the message from the shared memory segment and displays it to the screen.

#### Text Books:

- T1.** 1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition
- T2.** Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, WILEY, ISBN 978-1-118-06333-0, 9th Edition
- T3.** Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition

#### Reference Books:

- R1.** Milan Milenkovic; Operating Systems; Tata McGraw Hill; Second Edition. ISBN: 0-07-044700-4
- R2.** Maurice J. Bach; The Design of the Unix Operating System; Prentice Hall of India; ISBN: 978-81-203-0516-8



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**T. Y. B. Tech (Department of Information Technology)**  
**Semester -V**

**[IT3115]: Operating System and Design**

<b>Teaching Scheme:</b> TH: 03 Hours/Week PR: 04 Hours/Week	<b>Credits:</b> TH:03 PR:02	<b>Examination Scheme:</b> In Sem. Evaluation: 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Exam (TW) : 25 Marks Lab Exam (PR) : 25 Marks
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**Course Prerequisites:** Data Structure and Algorithms, Computer System and Organization

**Course Objectives:**

- To understand concept of Process, Thread, IPC, Process Synchronization
- To understand Main Memory Management and virtual memory management techniques,
- To explain File, I/O and Disk Management of Operating System with the simulation.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Explain concept of basic Operating system with Process ,thread,multithreading and booting of OS

**CO2:** Analyze different process scheduling algorithms

**CO3:** Apply semaphore to solve different synchronization problems and deadlock

**CO4:** Explain different main and virtual memory management techniques

**CO5:** Illustrate concepts of File System Manipulation and I/O and Disk Management.

**CO6:** Describe secondary storage management techniques and Unix OS

**Course Contents**

UNIT-I	Introduction to OS and Process Management	07 Hours
<b>Introduction:</b> Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS. <b>Processes:</b> Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. <b>Thread:</b> Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. Self-Study: OS Booting System		
UNIT-II	Process Scheduling	07 Hours
<b>Process Scheduling:</b> Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. <b>Scheduling algorithms:</b> Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.		
UNIT-III	Process Synchronization and Deadlock	07 Hours

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**Inter-process Communication:** Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem, Barber's shop problem.

**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

**Concurrent Programming:** Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

**Self-Study: IPC using pipe**

<b>UNIT-IV</b>	<b>Memory Management</b>	<b>07 Hours</b>
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**Memory Management:** Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction.

**Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

<b>UNIT-V</b>	<b>File and I/O Management</b>	<b>07 Hours</b>
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**I/O Hardware:** I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

**File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

**Self-Study: Network File System**

<b>UNIT-VI</b>	<b>Secondary Storage Management and Unix OS</b>	<b>07 Hours</b>
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**Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

**Case study:** UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

**Self-Study: RAID Structure**


### Lab Contents


#### Guidelines for Lab Assessment

- 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
- 2) Practical / Oral examination shall be based on the practical's performed in the lab.
- 3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

#### List of Laboratory Assignments/Experiments

<b>1</b>	Process control system calls: The demonstration of <i>FORK</i> , <i>EXECVE</i> and <i>WAIT</i> system calls along with zombie and orphan states.
<b>2</b>	Implement multithreading for Matrix Multiplication using pthreads
<b>3</b>	Simulation of Scheduling algorithm. a) FCFS b) SJF c) RR.

  
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4	Thread synchronization using counting semaphores. Application to demonstrate: producer-consumer problem with counting semaphores and mutex
5	Write a Program to simulate Deadlock
6	Write a Program For Inter Process Communication using Pipe.
7	Write a Program to simulate disk Scheduling Algorithm. a) FCFS b) SSTF c) SCAN d) CSCAN e) LOOK
8	Write a Program to simulate disk Scheduling Algorithm. a) FCFS b) SSTF c)SCAN d) CSCAN e) LOOK.
9	Write a Program to implement UNIX system call –open using shell Programming.

**Text Books:**

1. Operating System Concepts Essentials. Abraham Silbers chatz, Peter Baer Galvin and Greg Gagne.
2. Operating System Design William Stallings

**Reference Books:**

- R1. Operating Systems: Internals and Design Principles. William Stallings.
- R2. Operating System: A Design-oriented Approach. Charles Patrick Crowley.
- R3. Operating Systems: A Modern Perspective. Gary J. Nutt.
- R4. Design of the Unix Operating Systems. Maurice J. Bach.
- R5. Understanding the Linux Kernel, Daniel Pierre Bovet, Marco Cesati.



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**T. Y. B. Tech (Department of Information Technology)**  
**Academic Year – 2021-2022 Semester -V**  
**[IT3102]: Computational Complexity and Algorithm**

<b>Teaching Scheme:</b> TH : 03 Hours/Week LAB : 02 Hours/Week	<b>Credits:</b> TH : 03 LAB : 01	<b>Examination Scheme:</b> In Sem. Evaluation: 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Exam (TW) : 25 Marks Lab Exam (PR) : 25 Marks
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**Course Prerequisites:** Fundamentals of Data Structures, Data Structures and Files

**Course Objectives:**

- To analyze performance of algorithms
- To choose the appropriate data structure and algorithm for a specified application
- To understand how the choice of data structures and algorithm impacts the performance of programs
- To solve problems using algorithms such as the greedy method, divide and conquer, dynamic programming, backtracking and branch and bound.
- To understand the concepts of solvable and non-solvable problems

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Explain basic concepts of algorithm and complexity for various computing problems.

**CO2:** Analyze Brute Force And Divide-And-Conquer techniques to solve given problem.

**CO3:** Apply Dynamic Programming And Greedy Techniques to solve different problems

**CO4:** Demonstrate Backtracking method for different problems like Knapsack and 8 Queens Problem

**CO5:** Compare different methods of Branch and Bound strategy.

**CO6:** Explore and Describe the concept of P, NP, NP-complete, NP-Hard and parallel algorithms

**Course Contents**

UNIT-I	Introduction	07 Hours
Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation, Analysis of Algorithm: Efficiency- Analysis framework, asymptotic notations – big O, theta and omega. Analysis Framework ,Mathematical Analysis		
UNIT-II	Brute Force And Divide-And-Conquer	07 Hours

  
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**Brute Force method:** Introduction to Brute Force method , Brute Force solution to 8 queens' problem

**Divide and conquer:** General method, applications-Binary search, Quick sort, Merge sort, Finding Max-Min, Strassen's matrix multiplication.

UNIT-III	Dynamic Programming And Greedy Techniques	07 Hours
General strategy, Principle of optimality, 0/1 knapsack Problem, Bellman-Ford Algorithm, Multistage Graph problem, Optimal Binary Search Trees, Travelling Salesman Problem.		
Greedy Method: General method, Applications - Job Sequencing., Prim's method for MST, Kruskal's method for MST, Dijkstra's Algorithm, Optimal storage on tapes, Fractional Knapsack problem.		
UNIT-IV	Backtracking	07 Hours
General method, Recursive backtracking algorithm, Iterative backtracking method. 8-Queen problem, Sum of subsets, Graph coloring, Hamiltonian Cycle , 0/1 Knapsack Problem		
UNIT-V	Branch And Bound	07 Hours
The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling sales person problem		
UNIT-VI	Computational Complexity	07 Hours
NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Cook's theorem.		


### Lab Contents


#### Guidelines for Assessment

- 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
- 2) Practical / Oral examination shall be based on the practical's performed in the lab.
- 3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

#### List of Laboratory Assignments

1	Write a program to implement Quick sort algorithm for sorting a list of integers in ascending order
2	Implement Merge sort algorithm for sorting a list of integers in ascending order.
3	Write a program to find Maximum and Minimum element in an array using Divide and Conquer strategy
4	Write a program to implement Bellman-Ford Algorithm using Dynamic Programming.
5	Write a program to solve the travelling salesman problem and to print the path and the cost using Dynamic Programming.

  
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6	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
7	Find Minimum Cost Spanning Tree of undirected graph using Prim's algorithm.
8	Write a recursive program to find the solution of placing n queens on chessboard so that no two queens attack each other using Backtracking.
9	Write a program to solve the travelling salesman problem and to print the path and the cost using Branch and Bound.
10	Write a recursive program to find the solution of placing n queens on chessboard so that no two queens attack each other using Backtracking.
11	Write a program to solve the travelling salesman problem and to print the path and the cost using Branch and Bound.

#### Text Books:

**T1.** Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia publications pvt. Ltd.

**T2.** Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave  
Publisher: Pearson

**T3.** Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia, ISBN 81-7371-612-9

#### Reference Books:

**R1.** Thomas H Cormen and Charles E.L Leiserson, Introduction to Algorithm, PHI, ISBN:81-203-2141-3.

**R2.** R. C. T. Lee, SS Tseng, R C Chang, Y T Tsai, Introduction to Design and Analysis of Algorithms, A Strategic approach, Tata McGraw Hill, ISBN-13: 978-1-25-902582-2. ISBN-10: 1-25-902582-9.

**R3.** Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson, ISBN 81- 7758-835-4.

**R4.** Steven S Skiena, The Algorithm Design Manual, Springer, ISBN 978-81-8489-865-1.

**R5.** George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Desktop Quick Reference, O'Reilly, ISBN: 9789352133611.

**R6.** Michael T. Goodrich, Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, Wiley India, ISBN: 9788126509867



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**Academic Year 2021-2022 Semester -V**

**[IT3116]: Design and Analysis of Algorithm**

<b>Teaching Scheme:</b> TH: 03 Hours/Week PR: 02 Hours/Week	<b>Credits:</b> TH:03 PR:01	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Laboratory Exam(TW) : 25 Marks Laboratory Exam(PR) : 25 Marks
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**Course Prerequisites:** Discrete Mathematics, Data Structures, Formal Language and Automata Theory

**Course Objectives:**

- To develop problem solving abilities using mathematical theories
- To know the basics of computational complexity analysis and various algorithm design strategies
- To apply algorithmic strategies while solving problems
- To develop time and space efficient algorithms
- To study algorithmic examples in concurrent and parallel environments.

**Course Outcomes:** After successful completion of the course, students will able to-

**CO1:** Describe computational complexity using asymptotic notations for various algorithms

**CO2:** Illustrate different problems using Fundamental Algorithmic Strategies like backtracking

**CO3:** Discuss Graph and Tree Algorithms.


**CO4:** Demonstrate the concept of P, NP, NP-complete, NP-Hard with real time case study.


**CO5:** Elaborate Parallel and Concurrent Algorithms.

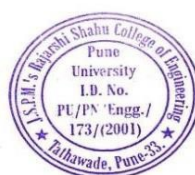
**CO6:** Analyze Approximation and Randomized algorithms.

**Course Contents**

UNIT-I	Introduction	07 Hours
Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.		
UNIT-II	Fundamental Algorithmic Strategies	07 Hours
Brute-Force, Heuristics, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, Travelling Salesman Problem		

  
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UNIT-III	Graph and Tree Algorithms	07 Hours
Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.		
UNIT-IV	Tractable and Intractable Problems	07 Hours
Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.		
UNIT-V	Parallel and Concurrent Algorithms	07 Hours
Parallel Algorithms: Sequential and parallel computing, RAM & PRAM models, Amdahl's Law, Brent's theorem, parallel algorithm analysis and optimal parallel algorithms, Concurrent Algorithms: Dining philosophers' problem		
UNIT-VI	Advanced Topics	07 Hours
Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithms.		
Lab Contents		
Guidelines for Lab Assessment		
1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.		
2) Practical / Oral examination shall be based on the practical's performed in the lab.		
3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.		
List of Laboratory Assignments/Experiments		
1.	Write a program to solve optimal storage on tapes problem using Greedy approach.	
2.	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.	
3.	Implement Knapsack problem using Dynamic Programming	
4.	Write a program to solve the travelling salesman problem and to print the path and the cost using Branch and Bound.	
5.	Implement N Queen's problem using Back Tracking.	
6.	Write a program to implement Bellman-Ford Algorithm using Dynamic Programming and verify the time complexity.	
Text Books:		
T1. Fundamental of Computer Algorithms, E. Horowitz and S. Sahni		
T2. The Design and Analysis of Computer Algorithms, A. Aho, J. Hopcroft and J. Ullman		
Reference Books:		



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**R1.** Introduction to Algorithms, T. H. Cormen, C. E. Leiserson and R. L. Rivest.

**R2.** Algorithms and Parallel Computing, Fayez Gebali, Willy, ISBN 978-0-470-90210-3 (Indian Paperback Edition)

**R3.** Computer Algorithms: Introduction to Design and Analysis, S. Baase

**R4.** The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3, .D. E. Knuth.

**R5.** Quantum Computation and Quantum Information, Michael A. Nielsen and Isaac L. Chuang.

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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -V**

**[IT3103]: Cloud Computing**

<b>Teaching Scheme:</b> TH : 03 Hours/Week	<b>Credits:</b> TH : 03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Knowledge of computer systems, programming and debugging, with a strong competency in at least one language (such as Java/Python), and the ability to pick up other languages as needed.

**Course Objectives:**

- The fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges;
- The basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations;
- Different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud; Software Defined Networks (SDN) and Software Defined Storage (SDS);
- Cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage;
- The variety of programming models and develop working experience in several of them.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Explain the core concepts of the cloud computing paradigm, their characteristics, advantages and challenges brought about by the various models and services in cloud computing

**CO2:** Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and manage single and multiple datacenters to build and deploy cloud applications that are resilient, elastic and cost-efficient.

**CO3:** Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model.

**CO4:** Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS.

**CO5:** Analyze various cloud programming models and apply them to solve problems on the cloud.

**CO6:** Analyze and compare various cloud programming models (e.g., MapReduce, serverless computing) and apply them to design and solve real-world cloud-based problems.

**Course Contents**

<b>UNIT-I</b>	<b>Basic Concepts</b>	<b>07 Hours</b>
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Concept of “Cloud Computing”, History of cloud computing, Enabling technologies in cloud computing and their significance, Advantages and Disadvantages of the cloud paradigm. Economic benefits and issues/risks of the cloud paradigm for businesses as well as cloud providers, Various layers in the cloud building blocks, cloud service models, SLAs, SLOs Various threats in cloud security. Common cloud providers and their associated cloud stacks

<b>UNIT-II</b>	<b>Cloud Infrastructure</b>	<b>07 Hours</b>
Evolution of data centers, Architecture of a modern data center. Various power requirements of a data center. Cloud-centric data center challenges and requirements, Cloud software stack, Automation and orchestration of resources, scheduling considerations in the cloud. Programming, deployment and failure considerations of cloud. Multi-tier cloud application and its latency implications, Cloud pricing models, Cloud management techniques, Cloud software deployment considerations		
<b>UNIT-III</b>	<b>Virtualization</b>	<b>07 Hours</b>
Virtualization, Isolation types and Security isolations provided by Virtualization, Levels of abstractions and well-defined interfaces, and their applicability to virtualization and the cloud. resource sharing as provided by virtualization, Types of virtual machines Conditions for virtualizing CPUs, difference between full virtualization and para virtualization,		
<b>UNIT-IV</b>	<b>Cloud Resource Management</b>	<b>07 Hours</b>
Difference between classical OS virtual memory and system memory virtualization, multiple levels of page mapping as imposed by memory virtualization, Communication of CPU and I/O devices with and without virtualization, Three main interfaces with I/O virtualization, I/O virtualization to Xen. Recent developments in software defined networking and software defined storage from the cloud computing perspective.		
<b>UNIT-V</b>	<b>Cloud Storage</b>	<b>07 Hours</b>
Overall organization of data and storage in cloud, Data taxonomy in cloud computing, Problems of scale and management in big data and its storage abstractions. File systems and their design considerations. Hadoop Distributed File System (HDFS) with Ceph File System (CephFS). Cloud object storage, and different types of block devices used in data storage.		
<b>UNIT-VI</b>	<b>Programming Models</b>	<b>07 Hours</b>
Fundamental aspects of parallel and distributed programming models. Basic definitions: cluster, grid, meta-computing, middleware etc., examples of representative applications. Programming models: shared memory, message passing, and peer-to-peer. Development of parallel and distributed applications, Design phases, Common parallel patterns, Performance metrics and profiling Cloud programming models (Map Reduce, Spark, Graph Lab and Spark Streaming).		

**Text Books:**

**T4.** David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach .



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**T5.** Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008.

**T6.** “Grid Computing a Research Monograph” by D. Janakiram, Tata McGraw hill publications

**Reference Books:**

- R1.** Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
- R2.** Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
- R3.** Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester - V**

**[IT3117]: Image Processing and Pattern Recognition**

<b>Teaching Scheme:</b> TH: 03 Hours/Week	<b>Credits:</b> TH:03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
<b>Course Prerequisites :</b> Computer Graphics and Animation, Machine Learning		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>Imparts knowledge in the area of image and image processing.</li> <li>Understand fundamentals of digital image processing.</li> <li>Provide knowledge of the applications of the theories taught in digital image processing.</li> <li>Learn the fundamentals of pattern recognition and to choose an appropriate feature.</li> </ul>		
<b>Course Outcomes: After successful completion of the course, students will able to-</b> <b>CO1:</b> Describe basics of image formation and transformation using sampling and quantization. <b>CO2:</b> Discuss different types of signal processing techniques used for image sharpening and smoothing. <b>CO3:</b> Demonstrate different color image processing techniques. <b>CO4:</b> Describe three-dimensional image analysis techniques. <b>CO5:</b> Discuss the fundamentals of different color models. <b>CO6:</b> Summarize the basics of pattern recognition using different approaches.		
<b>Course Contents</b>		
<b>UNIT-I</b>	<b>Introduction to Image Processing</b>	<b>07 Hours</b>
Image processing systems and its applications. Basic image file formats, Fundamental steps in digital image processing, Geometric and photometric models, Digitization - Sampling, Quantization, Image definition and its representation, Neighborhood metrics, Preprocessing - Techniques of preprocessing. Case Study: Sampling techniques.		
<b>UNIT-II</b>	<b>Intensity Transformations and Spatial Filtering</b>	<b>07 Hours</b>
Basics of intensity transformations and Spatial filtering, Intensity transformation functions, Enhancement, Contrast stretching, Histogram specification, Local contrast enhancement, Smoothing, Linear and order statistic filtering, Sharpening, Spatial convolution, Gaussian smoothing, DoG, LoG.		
<b>UNIT-III</b>	<b>Segmentation</b>	<b>07 Hours</b>
Pixel classification, Grey level thresholding, Global/local thresholding, Optimum thresholding - Bayes		

  
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analysis, Otsu method, Derivative based edge detection operators, Edge detection/linking, Canny edge Detector, Region growing, Split/merge techniques, Line detection, Hough transform.

UNIT-IV	Image/Object Feature Extraction	07 Hours
Textural features - Grey level co-occurrence matrix, Moments, Connected component analysis, Convex hull, Distance transform, Medial axis transform, Skeletonization/thinning, Shape properties. Registration - Mono-modal/multimodal image registration, Global/local registration, Transform and similarity measures for registration, Intensity/pixel interpolation.		
UNIT-V	Color Image Processing	07 Hours
Fundamentals of different color models - RGB, CMY, HSI, YCbCr, Lab, False color, Pseudo colour, Enhancement, Segmentation. Morphological Filtering Basics - Dilation and Erosion Operators, Top Hat Filters. Case Study: Shading algorithms.		
UNIT-VI	Pattern Recognition	07 Hours
Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Bayesian decision theory, Pattern classification by distance functions, Minimum distance pattern classifier.		

**Text Books:**

**T1.** Digital Image Processing – Gonzalez and Wood, Addison Wesley, 1993.

**T2.** Pattern Classification – R.O. Duda, P.E. Hart and D.G. Stork, Second Edition John Wiley, 2006.

**Reference Books:**

**R1.** Digital Picture Processing – Rosenfeld and Kak, Vol.I&Vol.II, Academic,1982.

**R2.** Computer Vision – Ballard and Brown, Prentice Hall, 1982.

**R3.** An Introduction to Digital Image Processing – Wayne Niblack, Prentice Hall, 1986.

**R4.** Pattern Recognition and Machine Learning – C. M. Bishop, Springer, 2009.

**R5.** Pattern Recognition – S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press,2009.



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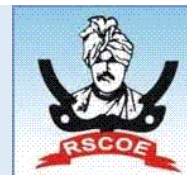
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**T. Y. B. Tech (Department of Information Technology)**  
**Academic Year – 2021-2022 Semester -V**  
**[IT3104]: Computational Statistics**

<b>Teaching Scheme:</b> TH : 03 Hours/Week	<b>Credits:</b> TH : 03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Introductory topics in Statistics, Probability and Calculus, Linear Algebra

**Course Objectives:**

- To imbibe strong foundation of probability and statistics in students for implementation in computation
- To be able to appropriately apply computational methodologies to real world statistical problems.
- To understand and apply different data pre-processing techniques.
- To understand the concept of dimensionality reduction and importance of feature selection techniques.


**Course Outcomes:**


After successful completion of the course, students will able to:

- CO1:** Apply appropriate statistical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts.
- CO2:** Analyze different probability distribution functions.
- CO3:** Apply hypothesis testing to real world scenarios.
- CO4:** Apply suitable statistical method required as pre-processing technique for finding the solution of machine learning algorithm.
- CO5:** Formulate computing problem using correlation, and resampling using regression models to solve real life problems.
- CO6:** Apply feature selection and extraction technique for a given problem..

**Course Contents**

UNIT-I	Statistics And Linear Algebra	08 Hours
What is statistics, Statistical Data- Categorical, Numerical (Continuous), Univariate, Bivariate, Multivariate Analysis, Mean, Median, Mode, Standard Deviation, Harmonic Mean, variance, covariance, Pearson's correlation, Linear Algebra: Matrix and vector algebra, systems of linear equations using matrices, linear independence, Eigen values and eigenvectors.		

  
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<b>UNIT-II</b>	<b>Probability Distribution</b>	<b>06 Hours</b>
Probability Distributions, Characterizing a Distribution, Discrete Distributions, Normal Distributions, Continuous Distributions Derived from the Normal Distribution, Poisson Distribution, Z score		
<b>UNIT-III</b>	<b>Hypothesis Test and Statistical Tests</b>	<b>07 Hours</b>
Typical Analysis procedures, Hypothesis Concept, formulation of hypothesis, Type I and Type II errors, p-Value, t-test, Confusion Matrix, Sensitivity and Specificity, ROC-AUC Curve F distributions and Sample Size, Test on Numerical Data- Distribution of a Sample.		
<b>UNIT-IV</b>	<b>Statistical Methods</b>	<b>07 Hours</b>
Standard Deviation, Normalization- Feature Scaling, Min-Max scaling, Bias, Variance, Regularization, Ridge Regression, Lasso Regression, Cross Validation Techniques- K-fold, LOOCV, Stratified K-fold, Grid Search CV, CV Error		
<b>UNIT-V</b>	<b>Statistical Processing</b>	<b>07 Hours</b>
Random sampling, Sampling from finite and infinite populations, Standard error of sampling with and without replacement, Sampling distribution of sample mean and proportion, stratified random sampling. Outliers detection methods		
<b>UNIT-VI</b>	<b>Feature Selection and Extraction</b>	<b>07 Hours</b>
Introduction to feature extraction, Dimensionality Reduction Techniques- Principal Component Analysis, Linear Discriminant Analysis, Factor analysis, Feature Selection- Chi2 square method, Variance Threshold, Recursive Feature Elimination		
<b>Text Books:</b>		
<b>T1.</b> Thomas Haslwanter, "An Introduction to Statistics with Python with Applications in the Life Sciences", Springer International Publishing Switzerland 2016, ISBN 978-3-319-28315-9, ISBN 978-3-319-28316-6 (eBook) <b>T2.</b> Allen B. Downey, "Think Stats", Second Edition, O'Reilly Media, ISBN: 978-1-491-90733-7 <b>T3.</b> Alvin C. Rencher, "Methods of Multivariate Analysis", Second Edition, Wiley Publication		
<b>Reference Books:</b>		
<b>R1.</b> Thomas Haslwanter, "An Introduction to Statistics with Python with Applications in the Life Sciences", Springer International Publishing Switzerland 2016, ISBN 978-3-319-28315-9, ISBN 978-3-319-28316-6 (eBook) <b>R2.</b> Magnus Lie Hetland "Beginning Python: From Novice to Professional" Edition, 2005 <b>R3.</b> Alvin C. Rencher, "Methods of Multivariate Analysis", Second Edition, Wiley Publication <b>R4.</b> Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers Second Edition <b>R4.</b> Claus Weihs, Olaf Mersmann, Uwe Ligges, "Foundations of Statistical Algorithms", CRC Press, ISBN-978-1-4398-7887-3 (eBook - PDF)		



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -V**

**[HS3102]: - Fundamentals of Management and Strategy Formulation**

<b>Teaching Scheme:</b> TH: 03 Hours/Week	<b>Credits:</b> TH:03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Basics of Management

**Course Objectives:**

- To prepare the students for various forms of the Management Systems and its application in organizations.
- To expose the students to the managerial issues relating to Organization help them identify and evaluate various options in Management Systems.
- To prepare engineering students for the inter-relationships of business to individuals, other organizations, government and society.

**Course Outcome:**

**After successful completion of the course, students will able to:**

**CO1:** Understand the need, usage and importance of Management basics.

**CO2:** Understand the activities that are undertaken while planning, Organizing, staffing, directing and controlling of management.

**CO3:** understand the activities and culture of organization.


**CO4:** learn and understand the concepts of strategic management.


**CO5:** understand the fundamental principles of and interrelationships among business functions.

**CO6:** understand the inter-relationships of business to individuals, other organizations, government and society.

**Course Contents**

UNIT-I	Introduction of Management Theories	07 Hours
Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word). Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc		
UNIT-II	Functions of Management	07 Hours
Planning, Organizing, Staffing, Directing, Controlling		
UNIT-III	Organization Behavior	07 Hours

  
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Introduction, Personality, Perception, Learning and Reinforcement, Motivation, Group Dynamics, Power & Influence, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making, Organizational Culture, Managing Cultural Diversity.

<b>UNIT-IV</b>	<b>Introduction to Strategic Management</b>	<b>07 Hours</b>
Importance of Strategic Management, Vision and Objectives, Schools of thought in Strategic Management, Strategy Content, Process, and Practice, Fit Concept and Configuration Perspective in Strategic Management		
<b>UNIT-V</b>	<b>Internal Environment of Firm- Recognizing a Firm's Intellectual Assets</b>	<b>07 Hours</b>
Core Competence as the Root of Competitive Advantage, Sources of Sustained Competitive Advantage, Business Processes and Capabilities-based Approach to Strategy		
<b>UNIT-VI</b>	<b>External Environments of Firm- Competitive Strategy</b>	<b>07 Hours</b>
Five Forces of Industry Attractiveness that Shape Strategy, The concept of Strategic Groups, and Industry Life Cycle, Generic Strategies, Generic Strategies and the Value Chain		
<b>Text Books:</b> <b>T1.</b> Richard L. Daft, Understanding the Theory and Design of Organizations.		
<b>Reference Books:</b> <b>R1.</b> Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behavior.		



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -V**

**[IT3105A]: User Interface and User Experience Design**

<b>Teaching Scheme:</b> TH : 03 Hours/Week	<b>Credits:</b> TH : 03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Human Computer Interface

**Course Objectives:**

- Develop an appreciation for concepts and sensibilities of user experience design
- Develop skills in the use and application of specific methods in user experience design
- Improve individual and collaborative skills in design problem solving

**Course Outcomes:** After successful completion of the course, students will able to- Discuss and

**CO1:** Discuss and apply the basics of User Interface Design.

**CO2:** Elaborate and use the concepts of design thinking

**CO3:** Summarize and apply the elements of UX Design and Design process.

**CO4:** Analyze the user experience design process.

**CO5:** Create a prototype by applying various prototyping and testing methods.

**CO6:** Develop UI with complete User Experience with the help of advance tools.

**Course Contents**

<b>UNIT-I</b>	<b>Introduction to User Interface Design</b>	<b>07 Hours</b>
Introduction, Brief History of UI Design, UI Design Methodology, User Centered Design, User Roles, Responsibilities, Capabilities, Principles for Designing UI's, Testing the UI, User Experience design component in Interface Design, Visual Communication design component in Interface Design.		
<b>UNIT-II</b>	<b>Foundations of UI Design</b>	<b>07 Hours</b>
UIvsUX Design, Core Stages of Design Thinking, Divergent and Convergent Thinking, Brainstorming and Game storming, Observational Empathy, Information Architecture, UI Elements and Patterns, Interaction Behaviors and Principles, Understanding Brand Platforms, Style Guides.		
<b>UNIT-III</b>	<b>Elements of UX Design</b>	<b>07 Hours</b>
User Interaction, Cognitive Model, Mental Model, User Experience (UX) Design and its used, Elements used in User Experience Design, Defining the UX Design Process and its Methodology, Flow Chart,		

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User Map, Research in User Experience Design, Tools and Method used for Research, User Needs and its Goals.

UNIT-IV	UX Design Process	07 Hours
Design Principles, Information Design and Data Visualization, Information Architecture, Wire framing & Storyboarding, Elements and Widgets, Screen Design and Layouts, Design Testing Methods and Techniques, complete UX Process for designing Mobile App Experience.		

UNIT-V	Prototyping & Testing	07 Hours
Building a Prototype, Other Evaluative User Research Methods, Prototype Iteration, Usability Testing-Types and Process, create plan for the Usability, Various Prototyping Tools, preparation of Usability Testing, Interaction Design, Usability Principles, Platform Guidelines and create prototypes with medium fidelity wireframes using Adobe XD, Understand & refine Usability Test Results.		

UNIT-VI	Advance Tools	07 Hours
Google Tools for UX, HTML 5 & CSS 3, Responsive website coding with bootstrap, SEO, Photoshop & Illustrator, Figma & Sketch, Logo and Icon design with Colour, Composition & Typography, Intro to Invision, Balsamic & UX Pin.		

#### Text Books:

**T7.** Wilbent. O. Galitz, "The Essential Guide To User Interface Design", John Wiley & Sons, 2001.

**T8.** Buxton, B. Sketching User Experiences: Getting the Design Right and the Right Design. Morgan Kaufmann, (2007)

**T9.** Raskin, Jef. The Humane Interface: New Directions for Designing Interactive Systems. Addison-Wesley Professional, 2000.

#### Reference Books:

**T1.** Alan Cooper, "The Essential of User Interface Design", Wiley – Dream Tech Ltd., 2002.

**T2.** Shneiderman, Ben, and Catherine Plaisant. Designing the User Interface: Strategies for Effective Human-Computer Interaction. 4th ed. Addison Wesley, 2004. ISBN: 9780321197863.

**T3.** Olsen, Dan R. Developing User Interfaces (Interactive Technologies). Morgan Kaufmann, 1998. ISBN: 9781558604186

**T4.** Johnson, Jeff. GUI Bloopers: Don'ts and Do's for Software Developers and Web Designers (Interactive Technologies). Morgan Kaufmann, 2000. ISBN: 9781558605824.



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -V**

**[IT3105B]: Business Analytics and Intelligence**

<b>Teaching Scheme:</b> TH : 03 Hours/Week	<b>Credits:</b> TH : 03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:**

1. Fundamentals of Database Management System.
2. Data Mining techniques

**Course Objectives:**

- Understand the emergence of business analytics as a competitive strategy
- Understand the applications of data mining and intelligent systems in managerial work.
- Apply conceptual knowledge on how business intelligence is used within organizations
- Select software tools for knowledge management systems in business organizations
- Manage business processes using analytical and management tools.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Describe the Business Intelligence and Decision support system

**CO2:** Explain the Data warehouse Architecture.

**CO3:** Analyze different Data visualization techniques

**CO4:** Evaluate the performance of intelligent systems

**CO5:** Analyze the role and application of business system

**CO6:** Analyze the Market Research and Operations Analytics

**Course Contents**

UNIT-I	Introduction to Business Intelligence	07 Hours
Definition and History of BI, Transaction processing versus analytical processing, BI implementation, Decision Support Systems (DSS): The role of computerized support for decision making and its importance. Types of decisions managers face, and the process through which they make decisions. Decision making styles, the four stages of Simon's decision-making process, and common strategies. approaches of decision makers. The role of Decision Support Systems (DSS), its main components, the various DSS types and classification.		

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<b>UNIT-II</b>	<b>Data warehousing</b>	<b>07Hours</b>
Data Warehousing Definition and concepts, Data warehouse architecture, ETL process, data warehouse development, Top down vs. Bottom up, Data Mart vs. EDW, Implementation issues, Real-time data warehousing, Different types of OLAP and their applications, and the differences between OLAP and OLTP.		
<b>UNIT-III</b>	<b>Data Visualization</b>	<b>07 Hours</b>
Introduction to data science, Different types of data, Data summarization and visualization methods, the top job responsibilities of BI analysts by focusing on creating data visualizations and dashboards, Common characteristics of dashboard, the types of dashboards, and the list attributes of metrics usually included in dashboards, The guidelines for designing dashboard and the common pitfalls of dashboard design.		
<b>UNIT-IV</b>	<b>Business Performance Management Systems</b>	<b>07 Hours</b>
How BI is used for Business Performance Management (BPM). The main components of BPM as well as the four phases of BPM cycle and how organizations typically deploy BPM. The purpose of Performance Measurement System and how organizations need to define the key performance indicators (KPIs) for their performance management system. Four balanced scorecards perspectives and the differences between dashboards and scorecards.		
<b>UNIT-V</b>	<b>BI role in Application, Integration and emerging trends</b>	<b>07Hours</b>
The role of visual and business analytics (BA) in BI and how various forms of BA are supported in practice. ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications, BI Applications in Fraud Detection, BI Applications in Retail Industry, Emerging trends in BI, Social Networking and BI		
<b>UNIT-VI</b>	<b>Market Research and Operations Analytics</b>	<b>07 Hours</b>
Market Research and Operations Analytics: Principal component analysis, Factor analysis, Conjoint analysis, Discriminant analysis-ARCH and GARCH, Monte Carlo simulation Supply chain analytics: Six Sigma as a problem-solving methodology, DMAIC and DMADV methodology.		
<b>Text Books:</b> <b>T10.</b> Sabherwal, R. and Becerra-Fernandez, I. (2011). Business Intelligence: Practices, Technologies and Management. <b>T11.</b> John Wiley T2. Turban, E. and Volonino, L. (2011). Information Technology for Management: Improving Strategic and Operational Performance. 8th edn. Wiley		
<b>Reference Books:</b> <b>R1.</b> Efraim Turban, Ramesh Sharda, Dursun Delen, and David King, Business Intelligence: A Managerial Approach, 2nd Edition, PEARSON 2012, ISBN-10: 0-13-610066-X, ISBN13: 978-0-13-610066-9		



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- R2.** Simon Miller and William Hutchinson , Oracle Business Intelligence Applications, McGraw Hill Education 2013, ISBN-10: 93-5134-153-4, ISBN-13: 978-93-5134-153-6
- R3.** Avison, D. and Fitzgerald, G. (2006). Information Systems development: Methodologies, techniques and tools. 4th ed. McGraw-Hill
- R4.** Anderson-Lehman, R., Watson, H.J., Wixom, B.H., & Hoffer, J.A., 2004, Continental Airlines Flies High with Real-Time Business Intelligence, MIS Quarterly Executive, 3, 4, pp 163-176
- R5.** Gangadharan, G.R., & Swami, N., 2004, Business Intelligence Systems: Design and Implementation Strategies, Proceedings of the 2nd International conference on Technology Interfaces, June 7-10, Cavtat, Croatia, pp 139-144
- R6.** Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw-Hill, 2007.



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -V**

**[IT3105C]: Internet of Things**

<b>Teaching Scheme:</b> TH : 3 Hours/Week	<b>Credits:</b> TH : 03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Computer Network and Applications

**Course Objectives:**

- To assess the genesis and impact of IoT applications, architectures in real world.
- To illustrate diverse methods of deploying smart objects and connect them to network.
- To compare different Application protocols for IoT.
- To infer the role of Data Analytics and Security in IoT.
- To identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Explain the concept of IoT.

**CO2:** Analyze various protocols for IoT.

**CO3:** Build simple IoT Systems using Arduino and Raspberry Pi.

**CO4:** Apply data analytics and use cloud offerings related to IoT.

**CO5:** Analyze applications of IoT in real time scenario.

**CO6:** Develop IoT infrastructure for popular applications.

**Course Contents**

UNIT-I	Basics of IoT	07 Hours
Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects		
UNIT-II	IoT Protocols	07 Hours
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over		

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Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

<b>UNIT-III</b>	<b>Design and Development</b>	<b>07 Hours</b>
Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.		
<b>UNIT-IV</b>	<b>Data Analytics and Supporting Services</b>	<b>07 Hours</b>
Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management		
<b>UNIT-V</b>	<b>Trust Management in IoT</b>	<b>07 Hours</b>
Introduction, Trust management life cycle, Identity and trust, Third party approach, Public key infrastructure, Attribute certificates, Web of trust models, Web services security, SAML approach, Fuzzy approach for Trust, Access control in IoT, Different access control schemes, Authentication and Access control policies modeling		
<b>UNIT-VI</b>	<b>Case Studies/Industrial Applications</b>	<b>07 Hours</b>
Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control		
<b>Text Books:</b> <b>T3.</b> David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743) <b>T4.</b> Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017		
<b>Reference Books:</b> <b>R7.</b> Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547) <b>R8.</b> Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224) <b>R9.</b> Arshdeep Bahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press, 2015 <b>R10.</b> Olivier Hersent, David Boswarthick, Omar Elloumi, —The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).		



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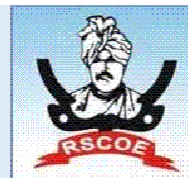



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester --V**

**[IT3105D]: - Modern Web Applications**

<b>Teaching Scheme:</b> TH: 03 Hours/Week	<b>Credits:</b> TH:03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Database Management Systems, Computer Networks

**Course Objective:**

- To understand the principles and methodologies of web-based applications development process
- To understand current client side and server-side web technologies
- To understand current client side and server-side frameworks
- To understand web services and content management

**Course Outcome:**

After successful completion of the course, students will be able to:

**CO1:** Describe the concepts of WWW including browser and HTTP protocol.

**CO2:** Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications

**CO3:** Develop the modern Web applications using the client and server-side technologies and the web design fundamentals.


**CO4:** Demonstrate server side scripting with PHP to generate the web pages dynamically using the database connectivity.


**CO5:** Design web application using Client and Server Side Frameworks like Angular JS

**CO6:** Demonstrate different Web Services like Joomla.

**Course Contents**

<b>UNIT-I</b>	<b>Fundamentals of Web Technologies</b>	<b>07 Hours</b>
Concept of WWW, Internet and WWW, HTTP Protocol : Request and Response, Web browser and Web servers, Features of Web 2.0, Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation		
<b>UNIT-II</b>	<b>Web Application Development Tools</b>	<b>07 Hours</b>
Introduction to web technology, internet and www, Web site planning and design issues, HTML: structure of html document, HTML elements: headings, paragraphs, line break, colors & fonts, links, frames, lists, tables, images and forms, Difference between HTML and HTML5. CSS: Introduction to Style Sheet, Inserting CSS in an HTML page, CSS selectors, XML: Introduction to XML, XML key component, Transforming XML into XSLT, DTD: Schema, elements, attributes, Introduction to JSON.		

  
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UNIT-III	Client Side Technologies	07 Hours
JavaScript: Overview of JavaScript, using JS in an HTML (Embedded, External), Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS, DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM, JQuery: Introduction to JQuery, Loading JQuery, Selecting elements, changing styles, creating elements, appending elements, removing elements, handling events.		
UNIT-IV	Server Side Technologies	07 Hours
Introduction to Server Side technology and TOMCAT, Servlet: Introduction to Servlet, need and advantages, Servlet Lifecycle, Creating and testing of sample Servlet, session management. JSP: Introduction to JSP, advantages of JSP over Servlet, elements of JSP page: directives, comments, scripting elements, actions and templates, JDBC Connectivity with JSP. PHP and MySQL : Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, AJAX: Introduction, Working of AJAX, AJAX processing steps, coding AJAX script.		
UNIT-V	Client and Server Side Frameworks	07 Hours
Angular JS : Overview, MVC architecture, directives, expression, controllers, filters, tables, modules, forms, includes, views, scopes, services, dependency injection, custom directives, Internationalization, Introduction to NodeJS. Struts: Overview, architecture, configuration, actions, interceptors, result types, validations, localization, exception handling, annotations.		
UNIT-VI	Web Services	07 Hours
Web Services: Overview, types of WS, difference between SOAP and REST, EJB: types of EJB, benefits, Architecture, EJB technology, JNDIlookup, Introduction to Content Management System(CMS), Wordpress/ Joomla, Advanced Technology: Bootstrap, JSF, Spring.		
<b>Text Books:</b> <b>T1.</b> Achyut Godbole & Atul Kahate, Web Technologies: TCP/IP to Internet Application Architectures, McGraw Hill Education publications, ISBN, 007047298X, 9780070472983 <b>T2.</b> Ralph Moseley & M. T. Savaliya, Developing Web Applications, Wiley publications, ISBN 13 : 9788126538676		
<b>Reference Books:</b> R1:Black Book, Struts 2, Dreamtech Press, ISBN 13, : 9788177228700 R2:Black Book, JDBC 4.2, Servlet 3.1 & JSP 2.3, Dreamtech Press, ISBN-13: 978-8177228700 R3:Giulio Zambon, Beginning JSP, JSF and Tomcat, Apress Publication, ISBN-10: 1430246235; ISBN-13: 978-1430246237 R4:Robin Nixon, Learning PHP, Mysql and Javascript with JQuery, CSS & HTML5, O'REILLY, ISBN: 13:978-93-5213-015-3 R5: Giulio Zambon, Beginning JSP, JSF and Tomcat, Apress Publication, ISBN-10: 1430246235; ISBN-13: 978-1430246237 R6:Sandeep Panda, Angular JS: Novice To Ninja, SPD, First Edition 2014, ISBN-13: 978-0992279455		



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -V**

**[IT3106]: Advanced Python Programming**

<b>Teaching Scheme:</b> LAB: 04 Hours/Week	<b>Credits:</b> LAB: 02	<b>Examination Scheme:</b> Lab Exam(PR): 50 Marks
<b>Course Prerequisites:</b> Programming fundamentals, Problem solving skills, Python Programming (IT2106)		
<b>Laboratory Objective:</b> <ul style="list-style-type: none"> <li>To understand different built-in functions available in libraries like numpy, pandas, sklearn, scikit learn, seaborn, Sci-py.</li> <li>To learn different built-in functions required for computational statistics.</li> </ul>		
<b>Laboratory Outcomes:</b> <ul style="list-style-type: none"> <li><b>LO1:</b> Demonstrate the use of built-in functions available in libraries like numpy, pandas, sklearn, scikit learn, seaborn, Sci-py.</li> <li><b>LO2:</b> Compute Estimators of the main statistical measures like Mean, Variance, Standard Deviation, Covariance, normal distributions.</li> <li><b>LO3:</b> Apply the concept of dimension reductions for sample dataset using PCA algorithm.</li> <li><b>LO4:</b> Compare different analysis tools for data visualizations and feature extraction.</li> </ul>		
<b>Lab Contents</b>		
<b>Guidelines for Assessment</b>		
1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance. 2) Practical / Oral examination shall be based on the practical's performed in the lab. 3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.		
<b>PART-A Python Libraries</b>		
1.	Study and implement functions of python NumPy library.	
2.	Study and implement functions of python Pandas library.	
3.	Study and implement functions of python Matplotlib library.	
4.	Study and implement functions of python Scikit-learn library.	
5.	Study and implement functions of python SciPy library.	
6.	Study and implement functions of Seaborn library.	
7.	Study and implement functions of Tensorflow library.	

  
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### Part B- Python Assignments on Computational Statistics

- |    |   |
|----|---|
| 1  | Compute Estimators of the main statistical measures like Mean, Variance, Standard Deviation, Covariance, Correlation and Standard error with respect to any example. Display graphically the distribution of samples. |
| 2. | Plot the Normal Distribution for class test result of a particular subject. Identify the Skewness and Kurtosis  |
| 3  | Demonstrates how to do data correlation, rescaling and dimensionality reduction is done through PCA   |
| 4  | Using a suitable tool, perform data visualization, feature extraction analysis  |

#### Text Books:

**T1.** Charles Severance, "Python for Everybody: Exploring Data in Python 3", 2nd Edition, Elliott Hauser, Sue Blumenberg, ISBN 9781530051120, 1530051126.

**T2.** Allen Downey, "Think Python How to Think Like a Computer Scientist", 2<sup>nd</sup> Edition, ISBN 9781491939420, 1491939427

**T3.** José Unpingco, "Python for Probability, Statistics, and Machine Learning", Springer International Publishing Switzerland, ISBN 978-3-319-30715-2, DOI 10.1007/978-3-319-30717-6, ISBN 978-3-319-30717-6 (eBook)

#### Reference Books:

**R1.** Wes McKinney —Python for Data Analysis, ISBN: 9781449319793, 1449319793. O'Reilly Media

**R2.** Mark Lutz, Programming Python, O'Reilly, 4th Edition, 2010.



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**T. Y. B. Tech (Information Technology Engineering)**

**Academic Year – 2021-2022 Semester -V**

**[IT3107]: Design Thinking**

<b>Teaching Scheme:</b> TH: - 2 Hours/Week	<b>Credit</b> TH:02	<b>Examination Scheme:</b> Lab Exam(TW) : 50 Marks
<b>Course Prerequisites :</b> Software Engineering, Problem Solving		
<b>Course Objective:</b> <ul style="list-style-type: none"> <li>To learn the Design thinking basic concepts.</li> <li>To identify the opportunities and challenges for design thinking innovation.</li> <li>To describe the define and ideate process of design thinking.</li> <li>To summarize the prototyping techniques.</li> <li>To enlist the activities carried out in Test and reflect phase of design thinking.</li> <li>To Interpret Design Thinking in IT.</li> </ul>		
<b>Course Outcome:</b> After successful completion of the course, students will able to: <b>CO1:</b> Identify need and features of design thinking. <b>CO2:</b> Identify the opportunities and challenges for design thinking innovation. <b>CO3:</b> Learn the process of design thinking using various tools. <b>CO4:</b> Summarize and learn the various prototyping techniques. <b>CO5:</b> Enlist the activities carried out in Test and reflect phase of design thinking. <b>CO6:</b> Interpret the design thinking in IT.		
<b>Course Contents</b>		
<b>UNIT-I</b>	<b>Introduction to Design Thinking</b>	<b>4 Hours</b>
<b>Introduction to Design and Design Thinking, Need of Design Thinking, Problem Solving and Design, Use of Design Thinking, Design Thinking-Attributes, The Principles of Design Thinking, The Five-step Process of Design Thinking (Empathize, Define, Ideate, Prototype, Test).</b>		
<b>UNIT-II</b>	<b>Explore and Empathize</b>	<b>4 Hours</b>
<b>Explore- STEEP Analysis, Activity Systems, Stakeholder Analysis, Framed Opportunities Empathise- Observation, Problem statement, User Interviews- Interview for Empathy</b>		
<b>UNIT-III</b>	<b>Define And Ideate</b>	<b>3 Hours</b>
<b>Define- Define Point of view, Storytelling, Ideate- Purpose, Methods &amp; Tools, User Experience Journey</b>		
<b>UNIT-IV</b>	<b>Prototype</b>	<b>3 Hours</b>
<b>Get Visual, Design Principals, Determine What to Prototype, Storyboard</b> – Critical Experience Prototype (CEP) & Critical Function Prototype (CFP), Prototyping –Types of Paper Prototyping		
<b>UNIT-V</b>	<b>Test and Reflect</b>	<b>3 Hours</b>

  
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**Test- Testing Sheet**, Feedback Capture Grid, Solution interview Structured Usability Testing, Design Testing with Users, Usability Testing,  
**Reflect-** Road map for implementation, Evolve- Concept Synthesis, Viability Analysis (Impact Evaluation)

UNIT-VI	Design Thinking in IT	3 Hours
Design Thinking to Business Process modeling – Agile in Virtual collaboration environment – Scenario based Prototyping		

**Text Books:**

**T1.** Michael Lewrick, Patrick Link, Larry Leifer, “The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods”, March 2020 edition, ISBN: 978-1-119-62921-4, WILEY Publication.

**T2.** Mr Lee Chong Hwa (Lead Facilitator), “The Design Thinking: Guidebook”

**Reference Books:**

**R1.** IDEO (Firm), “The Field Guide to Human-centered Design: Design Kit”, 1st edition, ISBN-978099140631-9, IDEO 2015.

**R2.** Russ Unger, Carolyn Chandler, “A Project Guide to UX Design For user experience designers in the field or in the making (Voices That Matter)”, 2nd Edition, ISBN 13: 978-0-321-81538-5

**R3.** Karl T Ulrich, “Design – Creation of Artifacts in Society”, 1st edition, ISBN 978-0-9836487-0-3, University of Pennsylvania.

**R4.** Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, ISBN- 9780061937743, Harper Collins, 2009.

**R5.** Eli Woolery, “Design Thinking Handbook”, In-Vision publisher.

**R6.** Jeanne Liedtka, Andrew King, Kevin Bennett, “Solving Problems with Design Thinking: Ten Stories of

What Works”, Columbia Business School Publishing, E-ISBN 978-0-231-53605-9

**R7.** Jake Knapp, John Zeratsky, Braden Kowitz, “Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days”, ISBN 9780593076118, Bantam Press, 2016.



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# Semester VI



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester –VI**

**[IT3108] Artificial Intelligence**

<b>Teaching Scheme:</b> TH : 03 Hours/Week LAB :02 Hours/Week	<b>Credits:</b> TH : 03 PR : 01	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Exam (PR) : 25 Marks
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**Course Prerequisites:** Basic knowledge of Problem Solving concept

**Course Objectives:**

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

**Course Outcomes:** After successful completion of the course, students will able to-

**CO1:** Understand the fundamental concepts, history, and applications of Artificial Intelligence (AI) and Robotics.

**CO2:** Apply search algorithms and problem-solving techniques to AI-based decision- making.

**CO3:** Implement various knowledge representation techniques such as semantic networks, frames, and production rules.

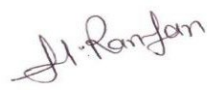
**CO4:** Describe concepts of Analyze reasoning mechanisms like forward chaining, backward chaining, and resolution for automated inference.


**CO5:** Identify and apply concepts of Planning in AI.

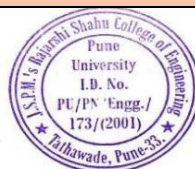
**CO6:** Introduce the concepts of Expert Systems and Machine learning..

**Course Contents**

UNIT-I	Introduction of AI	07 Hours
Introduction, History, Foundations and Mathematical treatments, Problem solving with AI, AI models, learning aspects in AI, what is an intelligent Agents, Rational agent, Environments types, types of Agents, Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Specialized productions system.		
UNIT-II	Problem Solving in AI	07 Hours
Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions - Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms.		

  
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Heuristic Search Best- A\* search methods, Heuristic Functions, AO\*, Local Search Algorithms and optimization problems, Constraint Satisfaction Problem, CSP as search problem.

<b>UNIT-III</b>	<b>Knowledge Representation</b>	<b>07 Hours</b>
Game playing – Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.		
<b>UNIT-IV</b>	<b>Knowledge Inference</b>	<b>07 Hours</b>
Knowledge representation -Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory.		
<b>UNIT-V</b>	<b>Planning and Machine Learning</b>	<b>07 Hours</b>
Basic plan generation systems – Strips -Advanced plan generation systems – K strips - Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.		
<b>UNIT-VI</b>	<b>Expert System</b>	<b>07 Hours</b>
Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.		

### Lab Contents

#### Guidelines for Lab Assessment


- 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
- 2) Practical / Oral examination shall be based on the practical's performed in the lab.
- 3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.


#### List of Laboratory Assignments

1.	Study of Prolog.
2.	Write simple fact for the statements using PROLOG.
3.	Solve any problem using depth first search
4.	Solve any problem using best first search
5.	Write a program to solve the Monkey Banana problem.
6.	Write a program to solve traveling salesman problem.
7.	Write a program to solve water jug problem .
8.	Study of LISP.

#### Text Books:

- T1. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008.  
T2. Artificial Intelligence: A Modern Approach,. Russell & Norvig. 1995, Prentice Hall.

  
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**T12.** Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007. (Unit-III).

**Reference Books:**

**R1.** Peter Jackson, “Introduction to Expert Systems”, 3rd Edition, Pearson Education, 2007.

**R2.** Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007.

**R3.** Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.

**R4.** <http://nptel.ac.in>.

  
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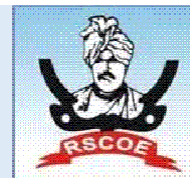
  
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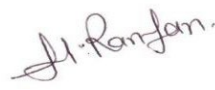



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**B. Y. B. Tech (Department of Information Technology)**  
**Academic Year – 2021-2022 Semester -VI**  
**[IT3118]: Artificial Intelligence & Robotics**

<b>Teaching Scheme:</b> TH: 03 Hours/Week PR: 02 Hours/Week	<b>Credits:</b> TH:03 PR:01	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Laboratory Exam(PR) : 25 Marks
<b>Course Prerequisites:</b> Principles of Programming Languages, Problem Solving Concepts.		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To understand the concept of Artificial Intelligence.</li> <li>To learn various peculiar search strategies for AI.</li> <li>To acquaint with the fundamentals of mobile robotics.</li> <li>To develop a mind to solve real world problems unconventionally with optimality.</li> </ul>		
<b>Course Outcomes: After successful completion of the course, students will able to-</b> <b>CO1:</b> Understand the fundamental concepts, history, and applications of AI and Robotics. <b>CO2:</b> Apply search algorithms and problem-solving techniques to AI-based decision-making. <b>CO3:</b> Implement various knowledge representation techniques such as semantic networks, frames, and production rules. <b>CO4:</b> Describe concepts of Analyze reasoning mechanisms like forward chaining, backward chaining, and resolution for automated inference. <b>CO5:</b> Understand the fundamental concepts of robotics and its integration with AI. <b>CO6:</b> Apply AI-based algorithms for perception, planning, and decision-making in robotic systems.		
<b>Course Contents</b>		
<b>UNIT-I</b>	<b>Introduction of AI</b>	<b>07 Hours</b>
Introduction, History, Foundations, Problem solving with AI, AI models, Learning aspects in AI, What is an intelligent Agents, Rational agent, Environments types, types of Agents Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized productions system.		
<b>UNIT-II</b>	<b>Problem Solving in AI</b>	<b>07 Hours</b>
Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions - Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms. Heuristic Search Best- A* search methods, Heuristic Functions, AO*, Local Search Algorithms and optimization problems, Constraint Satisfaction Problem, CSP as search problem.		
<b>UNIT-III</b>	<b>Knowledge Representation and Knowledge Inference</b>	<b>07 Hours</b>

  
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Game playing – Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.  
Knowledge representation -Production based system, Frame based system. Inference – Backward chaining, Forward chaining.

UNIT-IV	Planning and Expert System	07 Hours
Basic plan generation systems – Strips -Advanced plan generation systems – K strips - Strategic explanations - Why, Why not and how explanations. Learning- Machine learning, adaptive Learning. Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells		

UNIT-V	Robotics	07 Hours
Natural Language Processing: Introduction, Stages in natural language Processing, Application of NLP in Machine Translation, Information Retrieval and Big Data Information Retrieval. Learning: Supervised, Unsupervised and Reinforcement learning. Artificial Neural Networks (ANNs): Concept, Feed forward and Feedback ANNs, Error Back Propagation, Boltzmann Machine.		

UNIT-VI	Robots in Practice	07 Hours
Robot Pose Maintenance and Localization: Simple Landmark Measurement, Servo Control, Recursive Filtering, Global Localization. Mapping: Sensorial Maps, Topological Maps, Geometric Maps, Exploration. Robots in Practice: Delivery Robots, Intelligent Vehicles, Mining Automation, Space Robotics, Autonomous Aircrafts, Agriculture, Forestry, Domestic Robots.		

### Lab Contents

#### Guidelines for Lab Assessment

- 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
- 2) Practical / Oral examination shall be based on the practical's performed in the lab.
- 3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.


#### List of Laboratory Assignments/Experiments


1	Study of Prolog.
2	Write simple fact for the statements using PROLOG.
3	Solve any problem using depth first search
4	Solve any problem using Breadth first search
5	Solve any problem using best first search
6	Write a program to solve the Monkey Banana problem
7	Write a program to solve water jug problem
8	Study of LISP.

#### Text Books:

**T3.** . Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill Education(India), 2013, ISBN : 978-1-25-902998-1

**T4.** Elaine Rich, Kevin Knight and Nair, “Artificial Intelligence”, TMH, ISBN-978-0-07- 0087705.

  
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- T5.** Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Third edition, Pearson, 2003, ISBN :10: 0136042597
- T6.** Michael Jenkin, Gregory, “ Computational Principals of Mobile Robotics”, Cambridge University Press, 2010, ISBN : 978-0-52-187157-0

**Reference Books:**

- R1.** Nilsson Nils J , “Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4
- R2.** Patrick Henry Winston, “Artificial Intelligence”, Addison-Wesley Publishing Company, ISBN: 0-201-53377-4
- R3.** Andries P. Engelbrecht-Computational Intelligence: An Introduction, 2nd Edition-Wiley India-ISBN: 978-0-470-51250-0



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -VI**

**[IT3109]: Cyber Security**

<b>Teaching Scheme:</b> TH : 03 Hours/Week LAB : 00 Hours/Week	<b>Credits:</b> TH : 03 LAB : 00	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Computer Network and Data Communication

**Course Objectives:**

- To understand computer, network and information security basics
- To study operating system security and malwares.
- To study security issues in internet protocols.
- To study network defense tools.
- To learn forensics and investigation techniques.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Understand security fundamentals including common threats and security model.

**CO2:** Apply cryptography techniques using symmetric and asymmetric algorithms like DES, AES, RSA, ECC etc.

**CO3:** Analyze various security protocols at network layer.

**CO4:** Analyze risk management strategies with code of ethics and security laws.

**CO5:** Evaluate security system with various cybercrimes and it's countermeasures.

**CO6:** Apply security counter measures to various portable devices like Micro ATM, POS.

**Course Contents**

UNIT-I	Introduction to Security	07 Hours
Information Security Concepts, Security Threats and Vulnerabilities, Security Architectures and Operational Models, Types of Security attacks, Goals of Security, Malicious code, Intrusion detection system (IDS): Need, Types, Limitations and Challenges, security and privacy.		
UNIT-II	Symmetric Key Cryptography	07 Hours
Introduction, Classical Encryption Techniques, DES, Triple DES, Block Ciphers and Data Encryption standards, Advanced Encryption standard, Public Key Cryptography and RSA, ECC, Key Distribution, Attacks		
UNIT-III	Integrity, Authentication and Non-Repudiation	07 Hours
Cryptographic Hash Functions SHA5, MD5 MAC, Digital Signatures RAC DSA signatures IP Security: Architecture Protocols IPv4, IPv6, AH, EPS, ISAKMP, Web Security: SSL, HTTPS, Mail Security: PGP, S/MIME		

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<b>UNIT-IV</b>	<b>Legal, Ethical, And Professional Issues in Information Security, Risk Management</b>	<b>07 Hours</b>
Overview, Risk identification, Risk Assessment, Risk Control Strategies, Quantitative vs. Qualitative Risk Control Practices. Risk Management. Laws and Ethics in Information Security, Codes of Ethics, Protecting programs and data.		
<b>UNIT-V</b>	<b>Introduction to Cyber Laws</b>	<b>07 Hours</b>
Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective, Global perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyber stalking, Cloud Computing and Cybercrime.		
<b>UNIT-VI</b>	<b>Micro ATM, e-wallet and POS Security and Misc. Topics</b>	<b>07 Hours</b>
Security of Micro ATMs e-wallet Security Guidelines Security Guidelines for Point of Sales(POS) Case studies of worms and viruses, Email Viruses Internet worms' Mobile viruses Hackers-Attacker-Countermeasures Web Application Security, Digital Infrastructure Security		

**Text Books:**

- T1.** William Stallings, Computer Security : Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13-335469-0
- T2.** Nina Godbole, Sunit Belapure , Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiely India Pvt.Ltd, ISBN- 978-81-265-2179-1
- T3.** Bernard Menezes, Network Security and Cryptography, Cengage Learning , ISBN-978-81-315-1349-1  
Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978-81-203-5082-3

**Reference Books:**

- R1.** Cyber Smart: Five Habits to Protect Your Family, Money, and Identity from Cyber Criminals 1st Edition, Kindle Edition by Bart R. McDonough
- R2.** Next Level Cybersecurity: Detect the Signals, Stop the Hack Kindle Edition by Sai Hunda
- R3.** CCNA Security Study Guide, Tim Boyle, Wiley



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**Academic Year – 2021-2022 Semester - VI**  
**[IT3119]: Information and Cyber Security**

<b>Teaching Scheme:</b> TH: 03 Hours/Week	<b>Credits:</b> TH:03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Computer Network

**Course Objectives:**

- To understand information security parameters
- To study encryption technique along with access control
- To study security issues in internet protocols.
- To learn forensics and investigation techniques with cyber laws
- To apply security to operating system, databases and application

**Course Outcomes:** After successful completion of the course, students will able to-

**CO1:** Use basic cryptographic techniques in application development.

**CO2:** Apply methods for authentication, access control, intrusion detection and prevention.

**CO3:** Apply the scientific method to digital forensics and perform forensic investigations.


**CO4:** Develop secure application by applying security constraints.


**CO5:** Ability to use computer forensics tools.

**CO6:** Apply Database and OS Security techniques.

**Course Contents**

UNIT-I	Overview of Security Parameters	07 Hours
Overview of Security Parameters: Information Security Concepts, Confidentiality, integrity and availability; Security violation and threats; Types of Security attacks, Goals of Security, Security Architectures and Operational Models, Implementation and Operational Issues; Security policy and procedure, Assumptions and Trust; Security Assurance, Implementation and Operational Issues; Security Life Cycle		
UNIT-II	Access Control Models & Symmetric Key Cryptography	07 Hours
Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatio-temporal models. Introduction, Classical Encryption Techniques, DES , Triple DES, Block Ciphers and Data Encryption standards, Advanced Encryption standard, Public Key Cryptography and RSA, ECC, Key Distribution		
UNIT-III	Hash Functions & Security Protocols	07 Hours

  
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Cryptographic Hash Functions SHA5, MD5 MAC, Digital Signatures RAC DSA signatures IP Security: Architecture Protocols IPv4, IPv6, AH, EPS, ISAKMP, Web Security: SSL, HTTPS, Mail Security: PGP, S/MIME

UNIT-IV	Introduction to Cyber Laws	07 Hours
Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective, Global perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyber stalking, Cloud Computing and Cybercrime,		
UNIT-V	Logic-based System & Risk Management	07 Hours
Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security. Special Topics: Data privacy, introduction to digital forensics, enterprise security specification. Risk identification, Risk Assessment, Risk Control Strategies, Quantitative vs. Qualitative Risk Control Practices. Risk Management		
UNIT-VI	Operating Systems & Database Security	07 Hours
Security Architecture, Analysis of Security in Linux/Windows. Database Security: Security Architecture, Enterprise security, Database auditing. Special Topics: Data privacy, introduction to digital forensics, enterprise security specification. Laws and Ethics in Information Security, Codes of Ethics, Protecting programs and data.		

#### Text Books:

- T7.** William Stallings, Computer Security : Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13-335469-0
- T8.** Nina Godbole, Sunit Belapure , Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiely India Pvt.Ltd, ISBN- 978-81-265-2179-1
- T9.** Security Engineering, Ross Anderson
- T10.** Computer Security: Art and Science, M. Bishop, Pearson Education.
- T11.** Information Security: Principles and Practice, M. Stamp.

#### Reference Books:

- R1.** Cyber Smart: Five Habits to Protect Your Family, Money, and Identity from Cyber Criminals 1st Edition, Kindle Edition by Bart R. McDonough
- R2.** Next Level Cyber security: Detect the Signals, Stop the Hack Kindle Edition by Sai Hunda
- R3.** Security in Computing, C.P. Pfleeger, S.L. Pfleeger, J. Margulies.
- R4.** Secure Programming HOWTO, David Wheeler
- R5.** Browser Security Handbook, Michael Zalewski.
- R6.** Handbook of Database Security, M. Gertz, S. Jajodia.



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**S. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -VI**

**[IT3110]: Advance Software Modeling**

<b>Teaching Scheme:</b> TH: - 03 Hours/Week LAB: -02 Hours/Week	<b>Credit</b> TH:03 LAB: 01	<b>Examination Scheme:</b> In Sem. Evaluation:15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Practical Exam(OR): 25 Marks Total :125 Marks
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**Course Prerequisites:** Problem-Solving, Object-Oriented Paradigm, Software Engineering and Agile Development

**Course Objective:**

- Understand how to create a requirement model using UML class notations and use-cases based on user requirements
- Learn to create an OO design of a system from the requirements model in terms of a high level design description, and low-level models of structural organization and dynamic behavior using relevant UML diagrams.
- Learn to validate software implementation for its correctness and quality using appropriate testing.

**Course Outcome:**

**After successful completion of the course, students will able to:**

**CO1:** Describe the basics of UML to build a model.

**CO2:** Design and build domain/class model for an application.

**CO3:** Design and build State model for an application.


**CO4:** Design and build use case model, activity and sequence diagram for an application.


**CO5:** Apply object oriented design for an application.

**CO6:** Apply different types of software Testing.

**Course Contents**

UNIT-I	Introduction To Modeling	07- Hours
Modeling as a design technique, abstraction, three models. Unified Approach: Object Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modeling Based on UML, Layered Approach, Unified Modeling Language: Introduction to Modeling & UML, MDA, UML		

  
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Structure, UML Building Blocks, UML Common Mechanisms, Introduction to all UML Diagram Notational Techniques, 4+1 View.		
<b>UNIT-II</b>	<b>Class Modeling</b>	<b>07- Hours</b>
Object and class concepts, links and association concepts, <b>Domain / Class Modeling:</b> Approaches For Identifying Classes (Noun-Phase Approach, Common Class Pattern Approach, Class Responsibilities Collaboration Approach, Naming Classes, Class Associations and Identification of Associations, Generalization/Specialization Relationship, Aggregation and Composition Relationships, Attributes and Methods Identification. UML diagrams: Object, class, package diagram.		
<b>UNIT-III</b>	<b>State Modeling</b>	<b>07- Hours</b>
Events, states, transitions and conditions, state diagram behavior, nested state diagram, nested states, signal generalization, concurrency, <b>State Diagram:</b> State Machine, Triggers and Ports, Transitions, Initial and Final State, Composite States, Submachine States. State model case study, relation of class and state model.		
<b>UNIT-IV</b>	<b>Interaction Model</b>	<b>07- Hours</b>
<b>Use Case Modeling:</b> Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use Case realizations <b>Activity Diagram</b> : Activity and Actions, Initial and Final Activity, Activity Edge, Decision and Merge Points, Fork and Join, Input and Output Pins, Activity Group, Activity Partitions, Constraints on Action, Swim Lanes. <b>Sequence Diagram:</b> Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions.		
<b>UNIT-V</b>	<b>Object Oriented Design</b>	<b>07- Hours</b>
Object Oriented Design Process Designing Business Layer : Object Oriented Constraints Language (OCL), Designing Business Classes : The Process, Designing Well Defined Class Visibility, Attribute Refinement, Method Design Using UML Activity Diagram, Packaging and Managing Classes. Designing Access Layer: Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table – Inherited Classes Mapping, Designing the Access Layer Classes: The Process, Designing View Layer: View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process, and Prototyping the User Interface. Component and Deployment Design using Component and Deployment Diagram		
<b>UNIT-VI</b>	<b>Software Testing</b>	<b>07- Hours</b>
Testing Terminologies: Verification and validation, Fault, error, bugs and failure, test case and test suite, white box testing and black box testing. V-test model: User Acceptance testing, integration testing, unit testing, and Introduction to test driven development.		
<b>Lab Contents</b>		
<b>Guidelines for Assessment</b>		



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- 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
- 2) Practical / Oral examination shall be based on the practical's performed in the lab.
- 3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

#### List of Laboratory Assignments/Experiments

1	Prepare a class diagram from the given problem description using UML2.0 notations. and implement the class diagram with a suitable object oriented language
2	Prepare a use case model from analysis model in the form of UML 2 class diagram. And implement the use case diagram with a suitable language
3	Prepare a state model from the given problem description and draw a state diagram using UML2 notations and implement the state model with a suitable object oriented language
4	Prepare a sequence model from the given description using UML 2 notations.
5	Prepare a activity model from the given description using UML 2 notations.
6	Understand the concept of Test driven Development and implement a design level class diagram (given as an input) with Test Driven Development approach

#### Text Books:

- T1. Michael R Blaha, James Rumbaugh, "Object Oriented Modeling and Design with UML", Second Edition, Pearson Education System.
- T2. Dennis, Wixom, Tegarden, "System Analysis and design - an Object oriented approach with UML", 5th Edition, Wiley publication.
- T3. M G Limaye, "Software Testing Principle, Techniques and Tools", TMH

#### Reference Books:

- R1. Grady Booch, "Object oriented analysis and design with application, third edition", Pearson Education.
- R2. Dan Pilone, "UML 2.0 in a Nutshell", O'Reilly.
- R3. Grady Booch, James Rumbaugh, Ivor Jacobson, "The Unified Modeling Language User Guide", Second Edition, Addison Wesley Object Technology Series.
- R4. Jim Arlow, "UML 2 and the Unified Process: Practical Object Oriented Analysis and design", Second Edition, , Addison Wesley Object Technology Series.
- R5. Hasan Gomma, Software Modeling and Design, Cambridge University Press India.



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**T. Y. B.Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester - VI**

**[IT3120]: Cloud Microservices and Applications**

<b>Teaching Scheme:</b> TH: 03 Hours/Week PR: 02 Hours/Week	<b>Credits:</b> TH:03 PR:01	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Laboratory Exam(OR) : 25 Marks
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**Course Prerequisites : Object Oriented Programming**

**Course Objectives:**

- Understand concepts of cloud computing
- Develop applications using various services.
- Deploy Applications on cloud by using cloud native services
- To apply security to cloud applications

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Understand the evolution of cloud computing paradigm and its architecture.

**CO2:** Explain and characterize different cloud deployment models and service models.

**CO3:** Identify the technological drivers of cloud computing paradigm.

**CO4:** Develop and design web services .

**CO5:** Learn the security aspects in cloud computing

**CO6:** Implement and manage cloud-based solutions using modern cloud platforms, focusing on scalability, availability, and performance.

**Course Contents**

<b>UNIT-I</b>	<b>Cloud Fundamentals</b>	<b>07 Hours</b>
Introduction to Enterprise Software, multi-user interface like ERP or CRM and works on basis of shared data or transactional data (like an HR system where employee data is circulated via multiple departments), Cloud Service Components, Cloud service/Deployment Models. Cloud components Guiding Principle with respect to utilization/Security/Pricing. Applications of Cloud. Public Cloud Platforms overview and their usage.		
<b>UNIT-II</b>	<b>Application architectures</b>	<b>07Hours</b>
Monolithic & Distributed, Microservice fundamental and design approach, Cloud Native applications12 Factors App. Application integration process/Amplification Process, API Fundamental. Microservice /API management, Spring boot Fundamental and design of microservice, API tools. Developer Portal. Develop and design RESTful web services with Spring Boot, Implement Exception Handling, Validation, HATEOAS and filtering for RESTful Web Services.		
<b>UNIT-III</b>	<b>Devops fundamentals</b>	<b>07 Hours</b>

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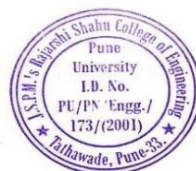
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Devops Tools and their usage in cloud application development. Containers, Difference between VMs and Containers, Docker Architecture and Components, Image Distribution using Docker Hub, Working with Containers and Docker Hub, Docker and Containerization Process. Tools and Applications.		
UNIT-IV	AWS	07 Hours
Overview, AWS, Use cases for cloud application development, EC2, Simple DB, S3, Simple Queue, Simple Relational Database, Elastic Map Reduce, Virtual Amazon Cloud. S3 Command Line tool		
UNIT-V	Cloud Application development	07 Hours
Cloud Application development/Deployment/Execution steps. Design and developing solution steps using containers-containerization of application and deployment using Kubernetes, Orchestrate micro services with KUBERNETES Create containers for micro services with DOCKER,		
UNIT-VI	Security Aspects	07 Hours
Data Security, Virtualization Security, Network Security Platform Related Security, Security Issues in Cloud Service Models, Software-as-a-Service Security Issues, Platform-as-a-Service Security Issues, Infrastructure-as-a-Service Security Issues ,Cloud Security and Monitoring Tools		
Lab Contents		
Guidelines for Lab Assessment		
1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.		
2) Practical / Oral examination shall be based on the practical's performed in the lab.		
3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.		
List of Laboratory Assignments/Experiments		
1	Working with Docker, Docker Commands, Docker Images and Containers	
2	Installing software packages on Docker, Working with Docker Volumes and Networks.	
3	Working with Docker Swarm	
4	Creating Microservice	
5	Working with Kubernetes	
6	Building real-time Microservice	
7	Creating Banking Service	
8	Build streaming data microservices with Spring Cloud Stream	
Text Books:		
T12. Fundamentals of cloud application development Siddhartha Gupta, Soumya Chatterjee ,Ashok Mishra , Siddhartha Ghoshal , Rohit Malik , Ankan Ganguly , Jasvinder Singh Bhatia , Ganesh Baviskar , Sandeep Sadhukhan, Avijit Das and Sumedh Waikar		
T13. K. Chandrasekaran, Essentials of Cloud Computing, CRC Press, 2015 Computer Security: Art and Science, M. Bishop, Pearson Education.		
T14. Information Security: Principles and Practice, M. Stamp.		
Reference Books:		

  
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**R1.** Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010

**R2.** Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011

**R3.** Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems and Applications, Springer, 2012

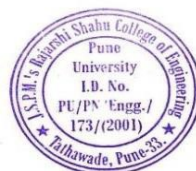
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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -VI**

**[IT3111]: Machine Learning**

<b>Teaching Scheme:</b> TH : 03 Hours/Week LAB : 02 Hours/Week	<b>Credits:</b> TH : 03 LAB : 01	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Exam : 50 Marks
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**Course Prerequisites:** Linear Algebra and Calculus, Probability Basics

**Course Objectives:**

- Understanding Human learning aspects
- Understanding of the Supervised and Unsupervised learning techniques
- Understanding nature of problems solved with Machine Learning.
- Understanding recent trends in Machine Learning.

**Course Outcomes: After successful completion of the course, students will able to-**

**CO1:** Apply the concepts of machine learning to illustrate problems and differentiate between training and testing phases.

**CO2:** Apply classification methods to predict the categorical label for given data and measure the performance of classification model.

**CO3:** Apply regression methods to determine and analyze relationships between multiple variables


**CO4:** Illustrate logic based models, rule based models and solves problems based on this.


**CO5:** Describe probabilistic models and solve problems on probabilistic model.

**CO6:** Tackle real world problems in the domain of Computer vision, Linguistics and Bioinformatics.

**Course Contents**

<b>UNIT-I</b>	<b>Introduction to Machine Learning</b>	<b>07 Hours</b>
Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Cross-validation, Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning, reinforcement learning , predictive task, descriptive task		
<b>UNIT-II</b>	<b>Classification</b>	<b>07 Hours</b>
Binary and Multiclass Classification: Assessing Classification Performance, Multiclass Classification- One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity		
<b>UNIT-III</b>	<b>Regression</b>	<b>07 Hours</b>

  
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Regression: Least Square method, Univariate Regression, Multivariate Linear Regression ,Assessing performance of Regression – Error measures, Overfitting and Underfitting, VC Dimensions, Bias and Variance Dilemma.

<b>UNIT-IV</b>	<b>Distance and Rule based Models</b>	<b>07 Hours</b>
Distance metrics, K-means clustering algorithm, KNN classification algorithm, Hierarchical clustering, Apriori Algorithm, Confidence and Support parameters, Impurity Measures-Gini Index and Entropy.		
<b>UNIT-V</b>	<b>Probabilistic Models</b>	<b>07 Hours</b>
Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Expectation-Maximization methods, Gaussian Mixture Model.		
<b>UNIT-VI</b>	<b>Recent Trends in Machine Learning</b>	<b>07 Hours</b>
Ensemble Learning: Bagging, Boosting, Stacking Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties Deep Learning: The Neuron, Feed Forward Neural Networks, Multiplayer perceptron, Activation functions-Sigmoid, Tanh and ReLU Neurons.		


#### Lab Contents


#### Guidelines for Lab Assessment

- 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
- 2) Practical / Oral examination shall be based on the practical's performed in the lab.
- 3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

#### List of Laboratory Assignments

<b>1</b>	Implement SVM for performing classification and find its accuracy on the given data
<b>2</b>	Load the dataset: birthwt Risk Factors Associated with Low Infant Birth Weight at <a href="https://raw.githubusercontent.com/neurospin/pystatsml/master/datasets/birthwt.csv">https://raw.githubusercontent.com/neurospin/pystatsml/master/datasets/birthwt.csv</a> 1. Test the association of mother's (bwt) age and birth weight using the correlation test and linear regression. 2. Test the association of mother's weight (lwt) and birth weight using the correlation test and linear regression. 3. Produce two scatter plot of: (i) age by birth weight; (ii) mother's weight by birth weight. Elaborate the Conclusion .
<b>3</b>	Implement K-Means algorithm for clustering to create a Cluster on the given data.
<b>4</b>	Text classification for Sentimental analysis using KNN Note: Use twitter data
<b>5</b>	Create Association Rules for the Market Basket Analysis for the given Threshold.
<b>6</b>	Creating & Visualizing Neural Network for the given data.
<b>7</b>	Recognize optical character using ANN

  
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- |   |   |
|---|---|
| 8 | Perform clustering of the iris dataset based on all variables using Gaussian mixture models. Use PCA to visualize clusters. |
|---|---|

**Text Books:**

- T1.**Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.  
**T2.**Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.  
**T3.**Tom M Mitchell, —Machine Learning, First Edition, McGraw Hill Education, 2013

**Reference Books:**

- R1.**C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.  
**R2.**Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.  
**R3.**Parag Kulkarni: Reinforcement Learning and Systemic Machine Learning for Decision Making, IEEE Press, Reprint 2015.  
**R4.**Nikhil Buduma: Fundamentals of Deep Learning, O'Reilly Media, June 2017.  
**R5.**Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012.  
**R6.**Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.



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**B. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester --VI**

**[IT3121]: - Machine Learning and Applications**

<b>Teaching Scheme:</b> TH : 03 Hours/Week LAB : 02 Hours/Week	<b>Credits:</b> TH : 03 LAB : 01	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Exam(PR) : 50 Marks
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**Course Prerequisites:** Linear Algebra and Calculus, Probability Basics

**Course Objectives:**

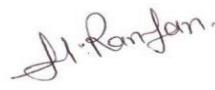
- Understanding Human learning aspects
- Understanding of the Supervised and Unsupervised learning techniques
- Understanding nature of problems solved with Machine Learning.
- Understanding recent trends in Machine Learning.


**Course Outcomes:** After successful completion of the course, students will able to-

- CO1:** Illustrate machine learning problems, distinguish between training and testing.  
**CO2:** Apply classification methods to predict the categorical label for given data and measure the performance and accuracy of classification model.  
**CO3:** Apply regression methods to analyze the correlation of several variables and measure the performance and accuracy.  
**CO4:** Illustrate logic-based models, rule-based models and solve problems based on this.  
**CO5:** Describe probabilistic and HMM model and solve problems on probabilistic model.  
**CO6:** Design and develop neural network for given problem.

**Course Contents**

<b>UNIT-I</b>	<b>Introduction to Machine Learning</b>	<b>07 Hours</b>
Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Cross-validation, Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning, reinforcement learning, predictive task, descriptive task		
<b>UNIT-II</b>	<b>Classification</b>	<b>07 Hours</b>
Binary and Multiclass Classification: Assessing Classification Performance, Multiclass Classification- One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity		
<b>UNIT-III</b>	<b>Regression</b>	<b>07 Hours</b>

  
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Regression: Least Square method, Univariate Regression, Multivariate Linear Regression ,Assessing performance of Regression – Error measures, Overfitting and Underfitting, VC Dimensions, Bias and Variance Dilemma.

<b>UNIT-IV</b>	<b>Distance and Rule based Models</b>	<b>07 Hours</b>
Distance metrics, K-means clustering algorithm, KNN classification algorithm, Hierarchical clustering, Apriori Algorithm, Confidence and Support parameters, Impurity Measures-Gini Index and Entropy.		
<b>UNIT-V</b>	<b>Probabilistic Models &amp; Hidden Markov Models</b>	<b>07 Hours</b>
Naïve Bayes Classifier, Expectation-Maximization methods, Gaussian Mixture Model, Hidden Markov Models (HMM) with forward-backward and Viterbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification such as part-of-speech tagging.		
<b>UNIT-VI</b>	<b>Recent Trends in Machine Learning</b>	<b>07 Hours</b>
Ensemble Learning: Bagging, Boosting, Stacking, Decision Tree and Random Forests, Deep Learning: the neuron, Feed Forward Neural Networks, Activation Functions-Sigmoid, Tanh and ReLU Neurons.		


#### Lab Contents


#### Guidelines for Lab Assessment

- 1) Continuous assessment shall be based on experiments performed, submission of results of practical assignments in the form of journal / reports, timely completion, attendance, understanding, performance.
- 2) Practical / Oral examination shall be based on the practical's performed in the lab.
- 3) Lab assessment marks shall be based on continuous assessment and performance in Practical/Oral examination.

#### List of Laboratory Assignments

<b>1</b>	Implement SVM for performing classification and find its accuracy on the given data
<b>2</b>	Load the dataset: birthwt Risk Factors Associated with Low Infant Birth Weight at <a href="https://raw.githubusercontent.com/neurospin/pystatsml/master/datasets/birthwt.csv">https://raw.githubusercontent.com/neurospin/pystatsml/master/datasets/birthwt.csv</a> 1. Test the association of mother's (bwt) age and birth weight using the correlation test and linear regression. 2. Test the association of mother's weight (lwt) and birth weight using the correlation test and linear regression. 3. Produce two scatter plot of: (i) age by birth weight; (ii) mother's weight by birth weight. Elaborate the Conclusion.
<b>3</b>	Implement K-Means algorithm for clustering to create a cluster on the given data.
<b>4</b>	Text classification for Sentimental analysis using KNN Note: Use twitter data
<b>5</b>	Create Association Rules for the Market Basket Analysis for the given Threshold.
<b>6</b>	Create and visualize Neural Network for the given data.
<b>7</b>	Recognize optical characters using ANN.

  
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8	Perform clustering of the iris dataset based on all variables using Gaussian mixture models. Use PCA to visualize clusters.
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### Text Books:

- T1.** Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.  
**T2.** Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.  
**T3.** Tom M Mitchell, —Machine Learning, First Edition, McGraw Hill Education, 2013

### Reference Books:

- R1.** C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.  
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**R3.** Parag Kulkarni: Reinforcement Learning and Systemic Machine Learning for Decision Making, IEEE Press, Reprint 2015.  
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**R6.** Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.



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**T. Y. B. Tech (Department of Information Technology)**  
**Academic Year – 2021-2022 Semester -VI**  
**[IT3112A]: High Performance Computing**

<b>Teaching Scheme:</b> TH : 3 Hours/Week	<b>Credits:</b> TH : 03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Computer Organization and Architecture, Operating System, Design and Analysis of Algorithms

**Course Objectives:**

- Learn the concepts of parallel processing as it pertains to high-performance computing.
- Learn to design parallel programs on high performance computing.
- Discuss issues of parallel programming.
- Learn the concepts of message passing paradigm using open-source APIs.
- Learn different open-source tools.
- Learn the concepts of Multi-core processor.

**Course Outcomes: After successful completion of the course, students will able to- CO1:**

**CO1:** Explain and classify different architectures of parallel systems.

**CO2:** Describe parallel algorithms and evaluate the performance of various Parallel Algorithms.

**CO3:** Use different message passing Paradigm with building blocks

**CO4:** Apply different Programming Shared Address Space Platforms like POSIX threads

**CO5:** Analyze and optimize performance parameters.

**CO6:** Demonstrate General Purpose Graphics Processing Unit(GPGPU) using Cuda Programming

**Course Contents**

UNIT-I	Parallel Processing Concepts	07 Hours
Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Levels of parallelism (instruction, transaction, task, thread, memory, function), Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand- driven Computation), Multiprocessor Architectures: N-wide superscalar architectures, multi-core, multi-threaded.		
UNIT-II	Parallel Programming	07Hours
Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models.		
UNIT-III	Message Passing Programming	07Hours

  
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Programming Using the Message-Passing Paradigm: Principles of Message Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topology and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations

<b>UNIT-IV</b>	<b>Programming Shared Address Space Platforms</b>	<b>07Hours</b>
Programming Shared Address Space Platforms: Thread Basics, The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, OpenMP: a Standard for Directive Based Parallel Programming		
<b>UNIT-V</b>	<b>Performance Measures</b>	<b>07Hours</b>
Performance Measures : Speedup, execution time, efficiency, cost, scalability, Effect of granularity on performance, Scalability of Parallel Systems, Amdahl's Law, Gustavson's Law, Performance Bottlenecks		
<b>UNIT-VI</b>	<b>General Purpose Graphics Processing Unit(GPGPU)</b>	<b>07Hours</b>
CUDA enabled GPGPU, GPGPU architecture, GPGPU programming using CUDA, Introduction to CUDA Programming		

#### Text Books:

**T1.** Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar , “Introduction to Parallel Computing”, Pearson Education, Second Edition, 2007.

**T2.** Kai Hwang, Naresh Jotwani, “Advanced Computer Architecture: Parallelism, Scalability, Programmability”, McGraw Hill, Second Edition, 2010.

Edward Kandrot and Jason Sanders, “CUDA by Example – An Introduction to General Purpose GPU Programming”, Addison-Wesley Professional, 2010.

#### Reference Books:

**R1.** Michael J. Quinn, —Parallel Programming in C with MPI and OpenMP, McGraw-Hill International Editions, Computer Science Series, 2008.

**R2.** Kai Hwang, Zhiwei Xu, —Scalable Parallel Computing: Technology, Architecture, Programming McGraw Hill, 1998.

**R3.** Introduction to Parallel Computing: Design and Analysis of Algorithms by A. Grama, A. Gupta, G. Karypis and V. Kumar.



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**Academic Year – 2021-2022 Semester -VI**

**[IT3112B]: Ethical Hacking**

<b>Teaching Scheme:</b> TH : 03 Hours/Week	<b>Credits:</b> TH : 03	<b>Examination Scheme:</b> In Sem. Evaluation: 15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam : 60 Marks
<b>Course Prerequisites:</b> Computer Network and Cyber Security		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To prepare students with the technical knowledge and skills needed to protect and defend cyber-attacks and understand ethical hacking methodology</li> <li>To analyze and understand security attacks.</li> <li>To understand and analyze web server vulnerabilities and prevention techniques to avoid exploitation.</li> <li>To analyze and understand web security.</li> </ul>		
<b>Course Outcomes: After successful completion of the course, students will able to-</b> <b>CO1:</b> Understand ethical hacking fundamentals, key terminologies, processes, and the ethical and legal implications of hacking. <b>CO2:</b> Master information gathering, foot printing and scanning techniques to identify active machines, open ports, and network vulnerabilities. <b>CO3:</b> Conduct vulnerability assessments using tools like Nmap to scan for and identify security weaknesses in target systems. <b>CO4:</b> Apply exploitation techniques using tools such as Metasploit and SET to hack and secure systems ethically. <b>CO5:</b> Understand and defend against malware threats, covert communications, and DoS/DDoS attacks to enhance system security. <b>CO6:</b> Gain expertise in wireless and web application hacking, including exploiting encryption vulnerabilities and performing SQL injection and XSS attacks.		
<b>Course Contents</b>		
<b>UNIT-I</b>	<b>Introduction to Ethical Hacking</b>	<b>07 Hours</b>
Important Terminologies, Ethical hacking process, Hacker's behaviormindset, Hacking Methodology, Information Gathering, Active and Passive Sniffing, Physical security vulnerability sand counter measures. Security Fundamental, Security testing, Hacker and Cracker, Ethical and Legality.		
<b>UNIT-II</b>	<b>Foot printing and scanning</b>	<b>07 Hours</b>
Information Gathering, Determining the Network Range, Identifying Active Machines, Finding Open Ports and Access Points, OS Fingerprinting Services, Mapping the Network Attack Surface.		
<b>UNIT-III</b>	<b>Vulnerability Assessment</b>	<b>07 Hours</b>
Scanning the target for vulnerabilities with the information gathered, Ping and Ping Sweeps, Port Scanning with N-map, scanning for the services on a target server, Finding vulnerable service.		
<b>UNIT-IV</b>	<b>Exploitation</b>	<b>07 Hours</b>



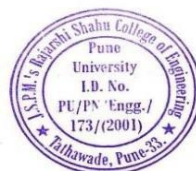
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**Director**



Introduction, Introduction to Metasploit (Hack like a Pro with Metasploit), Sniffing the network traffic, Spying on network, Hacking a remote system with SET (Social Engineering Toolkit).Exploitation,

#### UNIT-V

#### Malware Threats

07 Hours

Viruses and Worms, Trojans, Covert Communication, Keystroke Logging and Spyware, Malware Counter measures 6 Sniffers, Session Hijacking and Denial of Service : Sniffers, Session Hijacking, Denial of Service and Distributed Denial of Service

#### UNIT-VI

#### Wireless and Web Hacking

07 Hours

Wireless Hacking – Introducing Aircrack- Cracking the WEP – Cracking a WPA/WPA2 Wireless Network Using Aircracking, Web Hacking – Attacking the Authentication – Brute Force and Dictionary Attacks – Types of Authentication – Log-In Protection Mechanisms –Testing for the Vulnerability – Automating It with Burp Suite – Session Attacks – SQL Injection Attacks – XSS (Cross-Site Scripting) -Types of Cross-Site Scripting – Cross-Site Request Forgery (CSRF) – SSRF Attacks.

#### Text Books:

**T1.** Hands On Ethical Hacking and Network Defense – By Michael T. Simpson, Kent Backman, James Corley

**T2.** The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy by Patrick Engebretson, Syngress Media, 2011.

**T3.** Hacking the Hacker, Roger Grimes, Wiley

#### Reference Books:

**R1.** The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy (Syngress Basics Series)

**R2.** Ethical Hacking and Penetration Testing Guide by Rafay Baloch, CRC Press, 2015.

**R3.** Hands on Ethical Hacking and Network Defense [Print Replica] [Kindle Edition]



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**T. Y. B. Tech (Department of Information Technology)**

**Academic Year – 2021-2022 Semester -VI**

**[IT3112C]: Mobile Computing**

<b>Teaching Scheme:</b> TH : 03 Hours/Week	<b>Credits:</b> TH : 03	<b>Examination Scheme:</b> In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
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**Course Prerequisites:** Basic knowledge of Computer Networks.

**Course Objectives:**

- To understand the fundamentals involved in technologies of Mobile computing.
- To study GSM Architecture and Services.
- To learn about different architectures of mobile application development.
- To know recent and future trends in mobile computing

**Course Outcomes:** After successful completion of the course, students will able to-

**CO1:** Describe the fundamentals involved in technologies of Mobile computing.

**CO2:** Elaborate the concepts of GSM architecture and mobility management.

**CO3:** Describe GSM Services and Mobile Number Portability.


**CO4:** Elaborate the concepts of General Packet Radio Service, Wireless Application Protocol and Third-Generation Mobile Services.


**CO5:** Describe Mobile Application Architectures.

**CO6:** Describe recent trends and emerging technologies.

**Course Contents**

UNIT-I	Introduction	07 Hours
<b>Introduction</b> – PCS Architecture, Cellular Telephony, Mobile Computing Architecture <b>Mobile devices:</b> Device Overview, Input mechanism, Wireless communication, Mobile Device classification, Device Manufacturers <b>Mobile Generations:</b> Devices and Applications for: 1G, 2G, 2.5G, 3G <b>Handoff Management</b> :Handoff ,Handoff Detection, Strategies for Handoff Detection, Channel Assignment, LinkTransfer Types, Hard Handoff, Soft Handoff		
UNIT-II	GSM and Mobility Management	07 Hours
<b>GSM System Overview:</b> GSM Architecture, Data Services, Unstructured Supplementary Service Data <b>Mobility Management</b> : GSM Location Update, Mobility Databases, Failure Restoration, VLR Identification Algorithm, VLR Overflow Control		
UNIT-III	GSM Services	07 Hours
<b>GSM Service:</b> SMS Architecture, SMS Protocol Hierarchy, Mobile-Originated Messaging, Mobile –		

  
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Terminated Messaging

**International Roaming for GSM:** International GSM, Call Setup, Reducing the International Call Delivery Cost

**Mobile Number Portability:** Fixed Network Number Portability, Number Portability for Mobile Networks, Mobile Number Portability Mechanisms, Implementation Costs for Mobile Number Mobile prepaid service: Wireless intelligent network approach, service node approach, hot billing approach, handset based approach

**UNIT-IV**

**GSM Data Layer**

**07 Hours**

**General Packet Radio Service (GPRS):** GPRS Functional Groups, GPRS Architecture GPRS Network Nodes, GPRS Interfaces, GPRS Procedures, GPRS Billing.

**Wireless Application Protocol (WAP):** WAP Model, WAP Gateway, WAP Protocols WAP UAPProf and Caching, Wireless Bearers for WAP, WAP Developer Toolkits.

**Third-Generation Mobile Services:** Paradigm Shifts in Third-Generation Systems W-CDMA and cdma2000, Improvements on Core Network, Quality of Service in 3G Wireless Operating System for 3GHandset

**UNIT-V**

**Mobile Application Architectures**

**07 Hours**

**Choosing the right architecture:** Application architecture, Device type, Enterprise connectivity, Enterprise data, Enterprise integration, User notification, security, battery life **Application Architectures:** Wireless internet, Smart Client, messaging

**Smart Client Overview:** architecture

**Smart Client Development process:** Need analysis phase, design phase, implementation and testing phase, deployment phase

**UNIT-VI**

**Recent and Future Trends**

**07 Hours**

Android OS and its Architecture, Mobile Applications, User Interface design for mobile Applications, Managing Application Data, Performance, Scalability, Modifiability, Availability and Security of Mobile Applications, Testing Methodologies for Mobile Applications.

**Text Books:**

**T1.**Yi Bang Lin, “Wireless and Mobile Network Architectures”, Wiley Publications.

**T2.**Martyn Mallick, “Mobile and Wireless design essentials”, Wiley Publications.

**Reference Books:**


**R1.**Johen Schiller, “Mobile communications”, Pearson Publications.


**R2.** AsokeTalukder and RoopaYavagal”, Mobile Computing Technology, Applications and Service Creation”, Second Edition, ISBN-13: 978-0-07-014457-6, Tata McGraw Hill

**R3.** Iti Shah Mishra, “Wireless Communication and Networks 3G and Beyond”, Second Edition, ISBN-13: 978-1-25-906273-5, McGraw Hill Education

**R4.** Theodore S. Rappaport, “Wireless Communications principles and practice”, 2nd edition, Pearson Education, ISBN – 978-81-317-3186-4.

**R5.** Ke-Lin Du & M.N. S. Swamy, “Wireless Communication Systems, From RF Subsystems to 4G Enabling Technologies, ISBN: 978-0-521-18736-7, Cambridge University Press,

  
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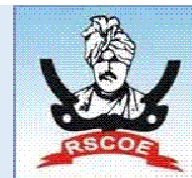


  
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**T. Y. B. Tech (Department of Information Technology)**  
**Academic Year – 2021-2022 Semester --VI**  
**[HS3103C]: - Financial & Cost Accounting**

<b>Teaching Scheme:</b> TH: 03 Hours/Week	<b>Credits:</b> TH:03	<b>Examination Scheme:</b> In Sem. Evaluation: 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks
<b>Course Prerequisites:</b> Fundamentals of Management and Strategy Formulation		
<b>Course Objective:</b> <ul style="list-style-type: none"> <li>To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications.</li> <li>To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements.</li> <li>To create an awareness about cost accounting, different types of costing and cost management.</li> </ul>		
<b>Course Outcome:</b> <b>After successful completion of the course, students will able to:</b> <b>CO1:</b> Understand and explain the conceptual framework of Cost & Management accounting. <b>CO2:</b> Explain the basic concepts and processes in determination of products and services cost. <b>CO3:</b> Interpret cost accounting statements. <b>CO4:</b> Identify and apply the concepts of Financial Management.		
<b>Course Contents</b>		
<b>UNIT-I</b>	<b>Accounting Concepts</b>	<b>07 Hours</b>
Evolution of cost accounting, Cost accounting concepts, Cost accounting principles, Techniques and Conventions, Cost accounting standards, Financial Statements- Understanding and Interpreting Financial Statements.		
<b>UNIT-II</b>	<b>Accounting Process</b>	<b>07 Hours</b>
Book keeping and record maintenance, Fundamental principles and double entry, Journal, Ledger, Trial balance, Balance sheet, Final accounts, Cash book and subsidiary books, Rectification of errors.		
<b>UNIT-III</b>	<b>Financial Statements</b>	<b>07 Hours</b>
Financial Statements: Form and Contents of Financial Statements, Types of financial statements, Analyzing and interpreting financial statements, Accounting standards.		

  
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<b>UNIT-IV</b>	<b>Cost Accounting</b>	<b>07 Hours</b>
Decision Tree and Random Forests; AdaBoost, Gradient Tree Boosting, Voting Classifier, k-Nearest neighbor classification; Applications of classifications; Concepts of Weak and eager learner, Ensembles of classifiers including bagging and boosting, Evaluation Matrices in classification.		
<b>UNIT-V</b>	<b>Short Term Business Decision Techniques – Marginal Costing</b>	<b>07 Hours</b>
Meaning, Principles, Advantages and Limitations, Contribution, P/V Ratio, Break-Even Point (BEP), Cost Volume Profit (CVP) Analysis, Short Term Business Decisions–Product Mix Decisions, Make or Buy (Outsourcing) Decisions, Accept or Reject Special Order Decisions, Shutting Down Decisions.		
<b>UNIT-VI</b>	<b>Company Accounts and Annual Reports</b>	<b>07 Hours</b>
Company annual report- Purpose, Contents, Types of readers of an annual report and their purpose, Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls.		
<b>Text Books:</b> <b>T1.</b> Financial Accounting by Kimmel and Weygandt and Kieso, John Wiley, 7th Edition. <b>T2.</b> A Textbook of Financial Cost and Management Accounting, by P. Periasamy, Himalaya Pub. House, 2010.		
<b>Reference Books:</b> R1. Accounting: Texts and Cases, by Robert N Anthony, David Hawkins and Kenneth Marchant, McGraw-Hill, 1995. R2. Financial Intelligence: A Manager's Guide to Knowing What the Numbers Really Mean, by Joe Knight and Karen Berman, Harvard Business Review Press, 2006. R3. Cost Accounting: Text, Problems and Cases, by Jawahar Lal, Manisha Singh, and Seema Srivastav, McGraw-Hill Education, 2019. R4. Financial Policy And Management Accounting, By Bhabatosh Banerjee, PHI Learning Pvt. Ltd, 2012.		



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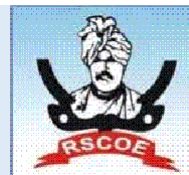
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**T. Y. B. Tech (Information Technology)**  
**Academic Year – 2021-2022 Semester -VI**  
**[IT3113]: Engineering Design and Innovation-II**

<b>Teaching Scheme:</b> PR: -02 Hours/Week	<b>Credit</b> PR: 01	<b>Examination Scheme:</b> Lab Evaluation(OR): 50 Marks
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**Course Prerequisites :** Basic Communication, reading and writing skills

**Course Objective:**

1. To perform focused study of technical and research literature relevant to a specific topic.
2. To study, interpret and summarize literature scientifically.
3. To build independent thinking on complex problems.
4. To build collaborative work practices.
5. To communicate scientific information to a larger audience in oral and written form.
6. To use presentation standards and guidelines effectively.

**Course Outcome:**

After successful completion of the course, students will able to:

**CO1:** Gather, organize, summarize and interpret technical literature with the purpose of formulating a project proposal.

**CO2:** Write a technical report summarizing state-of-the-art on an identified topic.

**CO3:** Present the study using graphics and multimedia presentations.

**CO4:** Define intended future work based on the technical review.

**CO5:** Explore and enhance the use of various presentation tools and techniques.

**CO6:** Understand scientific approach for literature survey and paper writing.

**Guidelines for Project Based Seminars**

1. A project group consisting of 3 to 4 students shall identify problem(s) in Computer Engineering / Information Technology referring to recent trends and developments in consultation with institute guide.
2. The group must review sufficient literature (reference books, journal articles, conference papers, white papers, magazines, web resources etc.) in relevant area on their project topic as decided by the guide.
3. Internal guide shall define a project statement based on the study by student group.
4. Students should identify individual seminar topic based on the project undertaken in consultation with guide.

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5. Seminar topics should be based on project undertaken. Guide should thoughtfully allocate seminar topics on different techniques to solve the given problem (project statement), comparative analysis of the earlier algorithms used or specific tools used by various researchers.
6. Research articles could be referred from IEEE, ACM, Science direct, Springer, Elsevier, IETE, CSI freely available digital libraries like Digital Library of India (dli.ernet.in), National Science Digital Library, JRD Tata Memorial Library, citeseerx.ist.psu.edu, getcited.org, arizona.openrepository.com, Open J-Gate, Research Gate, worldwidescience.org etc.
7. The group shall present the study as individual seminars in 20 – 25 minutes.

#### **Guidelines for Seminar Report**

1. Each student shall submit two copies of the seminar report in a prescribed format duly signed by the guide and Head of the department/Principal.
2. First chapter of a project group may talk about the project topic. At the end of the first chapter individual students should begin with introduction of seminar topic and its objectives.
3. Broad contents of review report (20-25 pages) shall be
  - i) Introduction of Project Topic
  - ii) Motivation, purpose and scope of project and seminar
  - iii) Related work (of the seminar title) with citations
  - iv) Discussion ( your own reflections and analysis)
  - v) Conclusions
  - vi) Project definition. (Short version of RUP's vision document if possible).
  - vii) References in IEEE Format
4. Students are expected to use open source tools for writing seminar report, citing the references and plagiarism detection. (Latex, Lex for report writing ; Mendeley, Zatero for collecting, organizing and citing the resources; DupliChecker , PaperRater, PlagiarismChecker and Viper for plagiarism detection)

#### **Guidelines for Seminar Evaluation**

1. A panel of examiners appointed by University will assess the seminar externally during the presentation.
2. Attendance for all seminars for all students is compulsory.
3. Criteria for evaluation :
  - Relevance of topic - 05 Marks
  - Relevance + depth of literature reviewed- 10 Marks
  - Seminar report (Technical Content) - 10 Marks
  - Seminar report (Language) - 05 Marks
  - Presentation Slides - 05 Marks
  - Communication Skills - 05 Marks
  - Question and Answers - 10 Marks

#### **Guidelines for Seminar Presentation**



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1. A panel of examiner will evaluate the viability of project scope and seminar delivery.
2. Oral examination in the form of presentation will be based on the project and seminar work completed by the candidates.
3. Seminar report must be presented during the oral examination.

**References:-**

- R1. Sharon J. Gerson, Steven M. Gerson, Technical Writing: Process and Product, Pearson Education Asia, ISBN: 130981745, 4 th Edition.
- R2. Andrea J. Rutherford, Basic Communication Skills for Technology, Pearson Education Asia, 2<sup>nd</sup> Edition.
- R3. Lesikar, Lesikar's Basic Business Communication, Tata McGraw, ISBN :256083274, 1 st Edition.



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**T. Y. B. Tech (Information Technology)**  
**Academic Year – 2021-2022 Semester -VI**  
**[IT3114]: Business Communication**

<b>Teaching Scheme:</b> PR: -02 Hours/Week	<b>Credit</b> PR: 01	<b>Examination Scheme:</b> Lab Evaluation (PR): 50 Marks
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Course Prerequisites: Basic Knowledge of English (verbal and written)

**Course Objective:**

Develop technical writing skills.

Introduce students to Self-analysis techniques like SWOT & TOWS.

Introduce students to key concepts of:

- Pluralism & cultural spaces
- Cross-cultural communication
- Science of Nation building

**Course Outcome:**

After successful completion of the course, students will able to:

**CO1:** Summarize the basic principles of SWOT and apply in real life scenarios / any domain


**CO2:** Apply social media knowledge for real life time problem of business


**CO3:** Analyze various eminent scientists and mathematicians of ancient India with their contribution

**CO4:** Design / Prepare report on mentioned topic with vision

**Course Contents**

UNIT-I	SWOT and Life Positions	08Hours
<p>Meet Dananjaya: Meet Dananjaya Hettiarachchi The World Champion of Public Speaking 2014 who made the winning speech which was rated amongst the “Most talked-about speeches of 2014”.</p> <p>Activity: Give story of an individual* and divide people into 4 groups S W O T and ask them to jot down the SWOT. Start with a different nomenclature (demystifying SWOT)</p> <p>Presentation on what are the strengths they have identified to survive in the VUCA World. Group presentations of 10 mins each.</p> <p>Motivation Stories YouTube videos on Maslow’s Theory</p>		
UNIT-II	Pluralism in Cultural Spaces	08 Hours
<ol style="list-style-type: none"> <li>Rivers of India :Divide participants into groups of 5. Each group should assign themselves a name from the Indian Rivers. These groups will continue throughout this Unit.</li> <li>Learn and Exchange: Group activity in which participants need to learn the following four greetings of a state (different from their own) and exchange it with another group:</li> </ol>		

  
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- Good morning
- Thank you
- Sorry
- Good night

Indicative only

c) Gender awareness campaign: Groups to present the detailed plan of Gender awareness campaigns with four different themes.

- College
- Workplace
- Family

Friends

UNIT-III	Role of Science in Nation Building	08Hours
<p>Introduce the topic and discuss the role of scientists and mathematicians from ancient India. Break the students into groups and give them ten minutes to access internet and get information about ten eminent scientists and mathematicians of ancient India. Groups will be given five minutes to present on the next day. Groups will also frame two questions which they will ask after presenting.</p>		
UNIT-IV	Technical Writing and the Importance of AI	08Hours
<p>Introduction to technical writing. Basic rules of technical writing through examples. Assessment on technical writing on the following topic: Explain the following to a visually impaired person:</p> <ul style="list-style-type: none"> <li>• DNA</li> <li>• Rings of Saturn</li> <li>• Structure of an oxygen atom</li> <li>• Structure of heart</li> </ul> <p>Design your college in the year 2090: Groups need to create the college of future with the future teachers, teaching methods, types of students, etc. End the session with the questions</p>		

#### Web References:

1. Examples of Technical Writing for Students  
<https://freelance-writing.lovetoknow.com/kinds-technical-writing>
2. 11 Skills of a Good Technical Writer  
<https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/>
3. 13 benefits and challenges of cultural diversity in the workplace  
<https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/>



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**Online****Resources:**

R5. <https://youtu.be/CsaTslhSDI>

R6. [https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8\\_T95M](https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M)

R7. <https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y>

R8. [https://m.youtube.com/watch?v=dT\\_D68RJ5T8&feature=youtu.be](https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be)

R9. <https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be>

PROOF



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**T. Y. B. Tech (Information Technology)**  
**Academic Year – 2021-2022 Semester -V**  
**Audit Course-III**

Teaching Scheme:	Credit	Examination Scheme:
-	-	-

List of Courses to be opted (Any one) under Audit Course III

Code	Name of Course	Link
HS3106	Essence of Indian Knowledge Tradition -I	<a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-2/ug-vol2.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-2/ug-vol2.pdf</a>
HS3108	Cultural Studies	<a href="https://onlinecourses.swayam2.ac.in/aic19_as04/preview">https://onlinecourses.swayam2.ac.in/aic19_as04/preview</a>
CE 3113	Urbanization and Environment	<a href="https://onlinecourses.nptel.ac.in/noc21_hs96/preview">https://onlinecourses.nptel.ac.in/noc21_hs96/preview</a>

**GUIDELINES FOR CONDUCTION OF AUDIT COURSE**

A student shall be awarded the bachelor's degree if he/she earns 170 credits and clears all the audit courses specified in the syllabus. The student shall be awarded grade as AP (Audit Course Pass) on successful completion of audit course. The student may opt for one of the audit courses per semester, starting from second year first semester. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course shall be done. Method of conduction and method of assessment for audit courses are suggested.


**Using NPTEL Platform:**


NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website [www.nptel.ac.in](http://www.nptel.ac.in)

- Student can select any one of the courses mentioned above and has to register for the corresponding online course available on the NPTEL platform as an Audit course.
- Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with certificate.

**Guidelines for Assessment:**

The assessment of the course will be done at the institute level. The department has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.

  
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- During the course students will be submitting the online assignments. A copy of same students can submit as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments, the institute can mark as “Present” and the student will be awarded the grade AP on the marksheet.

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**T. Y. B. Tech (Information Technology)**  
**Academic Year – 2021-2022 Semester –VI**  
**Audit Course-IV**

Teaching Scheme:	Credit	Examination Scheme:
-	-	-

List of Courses to be opted (Any one) under Audit Course IV

Code	Name of Course	Link
HS3107	Essence of Indian Knowledge Tradition -II	<a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-2/ug-vol2.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-2/ug-vol2.pdf</a>
HS3109	Introduction to Human Factors and Ergonomics	<a href="https://onlinecourses.swayam2.ac.in/aic20_ed03/preview">https://onlinecourses.swayam2.ac.in/aic20_ed03/preview</a>
HS3110	Mind Education	<a href="https://onlinecourses.swayam2.ac.in/aic19_as05/preview">https://onlinecourses.swayam2.ac.in/aic19_as05/preview</a>


**GUIDELINES FOR CONDUCTION OF AUDIT COURSE**


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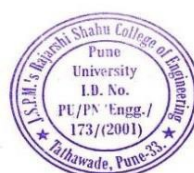
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**Guidelines for Assessment:**

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- During the course students will be submitting the online assignments. A copy of same students can submit as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments, the institute can mark as “Present” and the student will be awarded the grade AP on the marksheet.

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