Department of Information Technology
Structure & Syllabi

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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

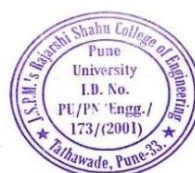# Department of Information Technology

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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

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.

Dr. Ram Joshi
BoS Chairman&
**Dean of Academics**

Dr. Rakesh K. Jain
Director

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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
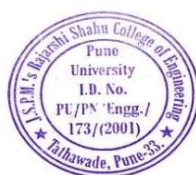
Dr. Rakesh K. Jain
Director

Highlights of the Syllabus

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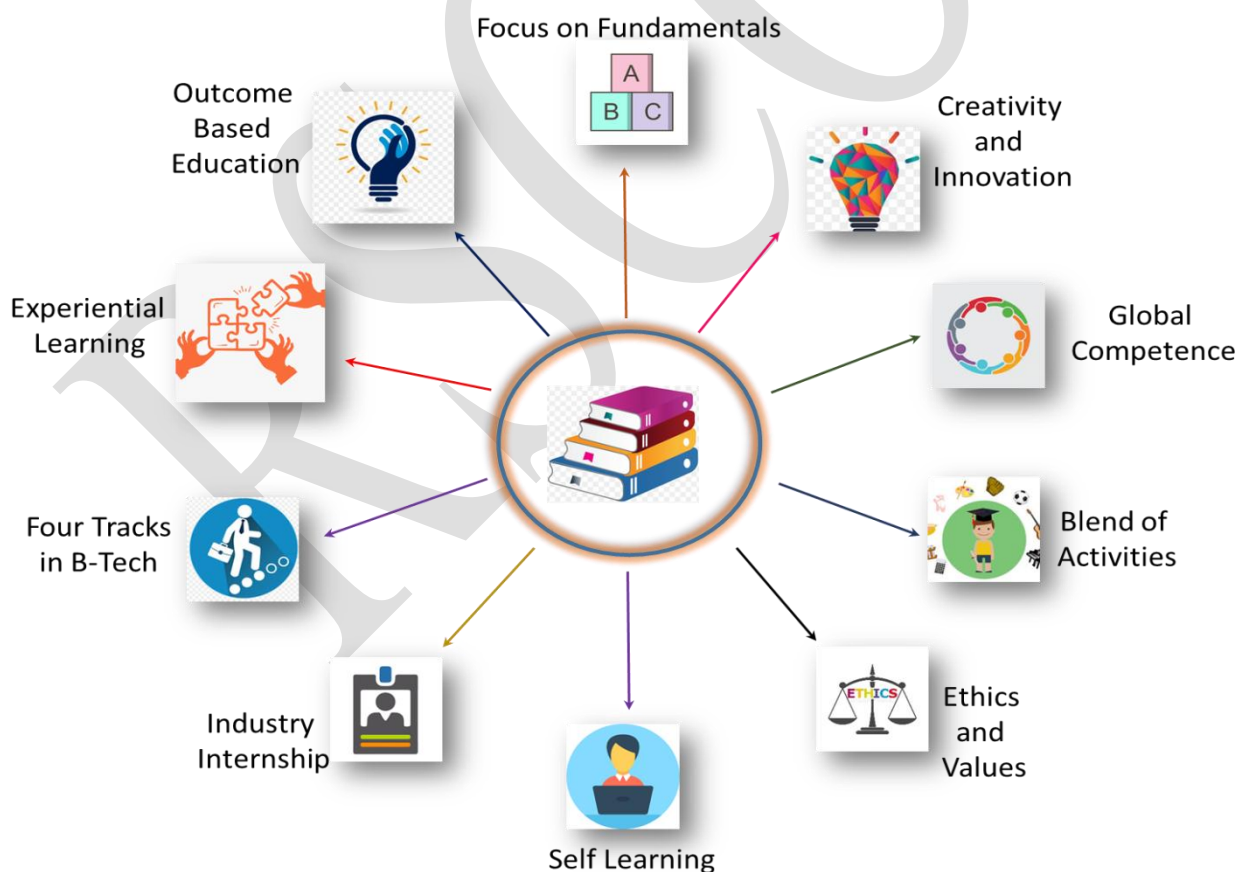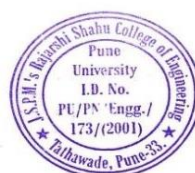

Academic Experts

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**

Focus on Fundamentals

Outcome Based Education

Creativity and Innovation

Experiential Learning

Global Competence

Four Tracks in B-Tech

Blend of Activities

Industry Internship

Ethics and Values

Self Learning

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

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
   II. 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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
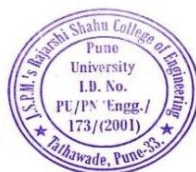
Dr. Rakesh K. Jain
Director

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	TU	Lab	Total	
IT3101	Operating System	3	0	4	15	25	60	-	50	150	5
IT3102	Computational Complexity and Algorithm	3	0	2	15	25	60	-	50	150	4
IT3103	Cloud Computing	3	0	0	15	25	60	-	-	100	3
IT3104	Computational Statistics	3	0	0	15	25	60	-	-	100	3
IT3105	Elective-I	3	0	0	15	25	60	-	-	100	3
IT3106	Advanced Python Programming	0	0	4	-	-	-	-	50	50	2
IT3107	Design Thinking	0	2	0	-	-	-	-	50	50	2
$$	Audit Course-III	Non Credit Course									
Total		**15**	**2**	**10**	**75**	**125**	**300**	**-**	**200**	**700**	**22**

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

Audit Course 3 Options

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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

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

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	TU	Lab	Total	
IT3108	Artificial Intelligence	3	0	2	15	25	60	-	25	125	4
IT3109	Cyber Security	3	0	-	15	25	60	-	-	100	3
IT3110	Advance Software Modeling	3	0	2	15	25	60	-	25	125	4
IT3111	Machine Learning	3	0	2	15	25	60	-	50	150	4
IT3112	Elective-II	3	0	0	15	25	60	-	-	100	3
IT3113	Engineering Design and Innovation-II	0	0	2	-	-	-	-	50	50	1
IT3114	Business Communication	0	0	2	-	-	-	-	50	50	1
$$	Audit Course-IV	Non Credit Course									
Total		**15**	**0**	**10**	**75**	**125**	**300**	**-**	**200**	**700**	**20**

Elective II Options

Elective II Course Code	Elective II Title
IT3112A	High Performance Computing
IT3112B	Ethical Hacking
IT3112C	Mobile Computing

Audit Course 4 Options

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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
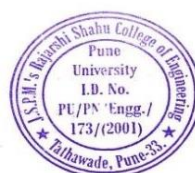
Dr. Rakesh K. Jain
Director

T. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester -V
[IT3101]:Operating System

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week LAB : 04 Hours/Week	TH : 03 LAB : 02	In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Exam : 50 Marks

Course Prerequisites: Computer System and organization

Data structures and programming languages

Course Objectives:

● To introduce basic concepts & function of Modern Operating System
● To understand the basic concept of process and thread management
● To learn the scheduling of processes and threads & understand the concept of concurrency control.
● To understand the concept of I/O and File management.
● To understand various Memory Management techniques.

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

CO1: Explain the role of Operating Systems in Computer System and its types

CO2: Demonstrate the concept of process/threads,

CO3 : Apply process synchronization tool using mutual exclusion for solving synchronization and

Apply the deadlock free solution for solving real time problem of deadlock.

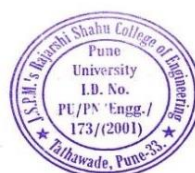**CO4**: Apply and evaluate various main and virtual memory management techniques .

CO5: Describe the concept of I/O management and File system.

CO6: Explain the advanced operating system like Mobile OS

Course Contents		
UNIT-I	**Introduction And Operating Systems Structures**	**07 Hours**

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.

UNIT-II	**Process Management And Cpu Scheduling**	**07 Hours**

Process: 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.

Threads: Processes and Threads, Concept of Multithreading, Types of Threads, Thread programming Using Pthreads.

Scheduling: Types of Scheduling, Scheduling Algorithms, and Thread Scheduling.

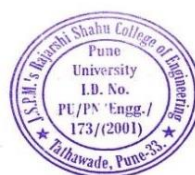**Dr. Ram Joshi**
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

UNIT-III	Concurrency Control	07 Hours

Process/thread Synchronization and Mutual Exclusion: Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support, Operating System Support (Semaphores and Mutex), Programming Language Support (Monitors).

Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Interprocess communication (Pipes, shared memory: system V).

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

UNIT-IV	Memory Management	07 Hours

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

UNIT-V	Input / Output And File Management	07 Hours

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.

UNIT-VI	Advanced Operating System	07 Hours

Mobile Operating Systems: ARM and Intel architectures, Power Management, Mobile OS Architectures, Underlying OS, Kernel structure and native level programming, Runtime issues, Approaches to power management

Lab Contents
Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

	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:

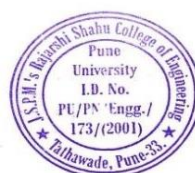**T1.** 1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition

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 Opearating System; Prentice Hall of India; ISBN: 978-81-203-0516-8

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

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

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week LAB : 02 Hours/Week	TH : 03 LAB : 01	In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Exam : 50 Marks

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: Design algorithm for various computing problems.
CO2: Critically analyze the different algorithm design techniques for a given problem.
CO3: Modify existing algorithm to improve efficiency.
**CO4:** To illustrate different problems using Backtracking.
CO5: To compare different methods of Branch and Bound strategy
CO6: To explore 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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
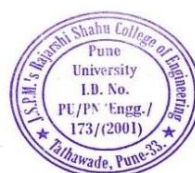
Dr. Rakesh K. Jain
Director

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

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

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, SatrajSahni 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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
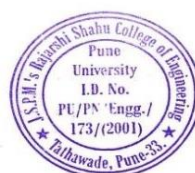
Dr. Rakesh K. Jain
Director

T. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester -V
[IT3103]: Cloud Computing

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

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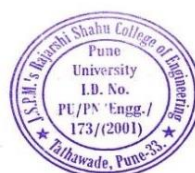
CO4: Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS.

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

Course Contents

UNIT-I	Basic Concepts	07 Hours

Dr. Ram Joshi BoS Chairman& Dean of Academics		**Dr. Rakesh K. Jain** Director

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

UNIT-II	Cloud Infrastructure	07 Hours

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

UNIT-III	Virtualization	07 Hours

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,

UNIT-IV	Cloud Resource Management	07 Hours

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.

UNIT-V	Cloud Storage	07 Hours

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.

| UNIT-VI	Programming Models	07 Hours

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 .

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
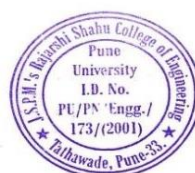
Dr. Rakesh K. Jain
Director

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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
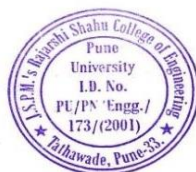
Dr. Rakesh K. Jain
Director

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

Teaching Scheme: TH : 03 Hours/Week	Credits: TH : 03	Examination Scheme: In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

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:
CO 1: Apply appropriate statistical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts.
CO 2: Analyze different probability distribution functions.
CO 3: Apply hypothesis testing to real world scenarios.
CO 4: Apply suitable statistical method required as pre-processing technique for finding the solution of machine learning algorithm.
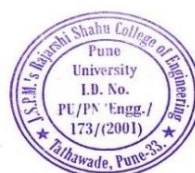**CO 5:** Formulate computing problem using correlation, and resampling using regression models to solve real life problems.
CO 6: Apply feature selection and extraction technique for a given problem.

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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

UNIT-II	Probability Distribution	06 Hours

Probability Distributions, Characterizing a Distribution, Discrete Distributions, ,Normal Distributions, Continuous Distributions Derived from the Normal Distribution, Poisson Distribution, Z score

UNIT-III	Hypothesis Test and Statistical Tests	07 Hours

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.

UNIT-IV	Statistical Methods	07 Hours

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

UNIT-V	Statistical Processing	07 Hours

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

UNIT-VI	Feature Selection and Extraction	07 Hours

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

Text Books:
   T1. 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)
   T2. Allen B. Downey, "Think Stats", Second Edition, O'Reilly Media, ISBN: 978-1-491-90733-7
   T3. Alvin C. Rencher, "Methods of Multivariate Analysis", Second Edition, Wiley Publication

Reference Books:
   R1. 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)
   R2. Magnus Lie Hetland "Beginning Python: From Novice to Professional" Edition, 2005
   R3. Alvin C. Rencher, "Methods of Multivariate Analysis", Second Edition, Wiley Publication
   R4. Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers Second Edition
   R4. Claus Weihs, Olaf Mersmann, Uwe Ligges, "Foundations of Statistical Algorithms", CRC Press, ISBN-978-1-4398-7887-3 (eBook - PDF)

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
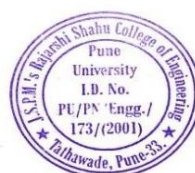
Dr. Rakesh K. Jain
Director

T. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester -V

[IT3105A]: User Interface and User Experience Design

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

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-

CO1: Understand the basics of User Interface Design.

CO2: Describe Elements of UX Design and Design process.

CO3: Understand the differences between usability and user experience.

CO4: Analyze an interaction design problem and propose a user-centered process, justifying the process and identifying the trade-offs.

CO5: Develop UI with complete User Experience.

Course Contents		
UNIT-I	**Introduction to User Interface Design**	**07 Hours**
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.		
UNIT-II	**Foundations of UI Design**	**07 Hours**
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.		
UNIT-III	**Elements of UX Design**	**07 Hours**
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,		

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
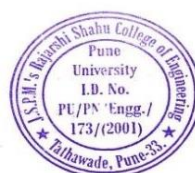
Dr. Rakesh K. Jain
Director

Flow Chart, 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.
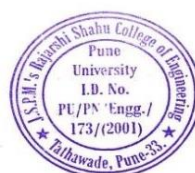
Text Books:

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

T4Jhonson, Jeff. GUI Bloopers: Don'ts and Do's for Software Developers and Web Designers (Interactive Technologies). Morgan Kaufmann, 2000. ISBN: 9781558605824.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

T. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester -V
[IT3105B]: Business Analytics and Intelligence

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

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: Explain fundamental of business intelligence.
CO2: Describe Data warehousing.
CO3: Propose the Framework for business intelligence.
CO4: Get acquainted with the Theories, techniques, and mathematical concept related to analytics.
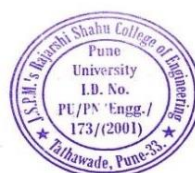**CO5:** Align business intelligence with business strategy.
CO6: Apply the techniques of optimization for market research and finance.

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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

UNIT-II	Data warehousing	07Hours

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.

UNIT-III	Data Visualization	07 Hours

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.

UNIT-IV	Business Performance Management Systems	07 Hours

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.

UNIT-V	BI role in Application, Integration and emerging trends	07Hours

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

UNIT-VI	Market Research and Operations Analytics	07 Hours

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.

Text Books:
T10. Sabherwal, R. and Becerra-Fernandez, I. (2011). Business Intelligence: Practices,
Technologies
and Management.
T11. John Wiley T2. Turban,E. and Volonino, L.(2011). Information Technology for Managment: Improving Strategic and Operational Performance. 8th edn.Wiley

Reference Books:
R1.EfraimTurban, Ramesh Sharda, DursunDelen, and David King , Business Intelligence: A Managerial Approach, 2nd Edition, PEARSON 2012, ISBN-10: 0-13-610066-X, ISBN13: 978-0-13-610066-9
R2.Simon Miller and William Hutchinson , Oracle Business Intelligence Applications, McGraw Hill

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

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. CindiHowson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw-Hill, 2007.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
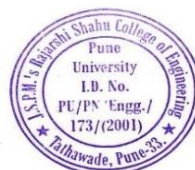
Dr. Rakesh K. Jain
Director

T. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester -V
[IT3105C]: Internet of Things

Teaching Scheme:	Credits:	Examination Scheme:
TH : 3 Hours/Week	TH : 03	In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

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 identifysensor 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 Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
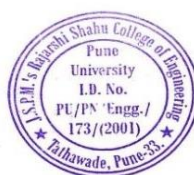
Dr. Rakesh K. Jain
Director

Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT-III	Design and Development	07 Hours

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.

UNIT-IV	Data Analytics and Supporting Services	07 Hours

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

UNIT-V	Trust Management in IoT	07 Hours

Introduction, Trust management life cycle, Identity and trust, Third party approach,Public key infrastructure, Attribute certificates, Web of trust models, Web servicessecurity, SAML approach, Fuzzy approach for Trust, Access control in IoT, Differentaccess control schemes, Authentication and Access control policies modeling

UNIT-VI	Case Studies/Industrial Applications	07 Hours

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
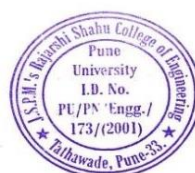
Text Books:

T3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet ofThings", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)

T4. Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017

Reference Books:

R7. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1stEdition, VPT, 2014. (ISBN: 978-8173719547)

R8. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition,McGraw Hill Education, 2017. (ISBN: 978-9352605224)

R9. ArshdeepBahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, 2015

R10. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

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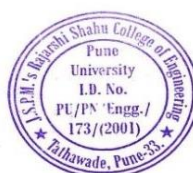## (An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

T. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester -V
[IT3106]: Advanced Python Programming

Teaching Scheme:	Credits:	Examination Scheme:
LAB: 04 Hours/Week	LAB: 02	Lab Exam: 50 Marks

Course Prerequisites: Programming fundamentals, Problem solving skills,Python Programming (IT2106)

Laboratory Objective:
- To understand different built in functions available in libraries like numpy, pandas, sklearn, scikit learn, seaborn, Sci-py.
- To learn different built in functions required for computational statistics.

Laboratory Outcomes:
- **LO1:** Demonstrate the use of built-in functions available in libraries like numpy, pandas, sklearn, scikit learn, seaborn, Sci-py.
- **LO2:** Compute Estimators of the main statistical measures like Mean, Variance, Standard Deviation, Covariance, normal distributions.
- **LO3:** Apply the concept of dimension reductions for sample dataset using PCA algorithm.
- **LO4:** Compare different analysis tools for data visualizations and feature extraction.

Lab Contents
Guidelines for Assessment
Continuous assessment of laboratory work is to be done based on overall performance and lab practicals /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

	PART-A Python Libraries
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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

6.	Study and implement functions of Seaborn library.
7.	Study and implement functions of Tensorflow library.
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 ",, 2nd 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)
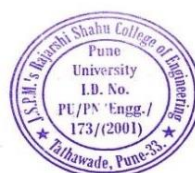
Reference Books:

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

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

Dr. Ram Joshi
BoS Chairman&
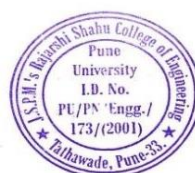**Dean of Academics**

Dr. Rakesh K. Jain
Director

T. Y. B. Tech (Information Technology Engineering)
Academic Year – 2020-2021 Semester -V
[IT3107]: Design Thinking

Teaching Scheme: TH: - 2 Hours/Week	Credit TH:02	Examination Scheme: Lab Exam : 50 Marks

Course Prerequisites : Software Engineering,Problem Solving

Course Objective:

- To learn the Design thinking basic concepts.
- To identify the opportunities and challenges for design thinking innovation.
- To describe the define and ideate process of design thinking.
- To summarize the prototyping techniques.
- To enlist the activities carried out in Test and reflect phase of design thinking.
- To Interpret Design Thinking in IT.

Course Outcome:

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

CO1: Identify need and features of design thinking.

CO2: Identify the opportunities and challenges for design thinking innovation.

CO3: Learn the process of design thinking using various tools.

CO4: Summarize and learn the various prototyping techniques.

CO5: Enlist the activities carried out in Test and reflect phase of design thinking.

CO6: Interpret the design thinking in IT

Course Contents

UNIT-I	INTRODUCTION TO DESIGN THINKING	4 Hours

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).

UNIT-II	EXPLORE AND EMPATHIZE	4 Hours

Explore- STEEP Analysis, Activity Systems, Stakeholder Analysis, Framed Opportunities
Empathise- Observation, Problem statement, User Interviews- Interview for Empathy

UNIT-III	DEFINE AND IDEATE	3 Hours

Define- Define Point of view, Storytelling,
Ideate- Purpose, Methods & Tools, User Experience Journey

UNIT-IV	PROTOTYPE	3 Hours

Get Visual, Design Principals, Determine What to Prototype, Storyboard

**Dr. Ram Joshi**
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

	– Critical Experience Prototype (CEP) & Critical Function Prototype (CFP), Prototyping –Types of Paper Prototyping	
UNIT-V	**TEST AND REFLECT**	**3 Hours**

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:

T4. 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.

T5. 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 inthe 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: TenStories 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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
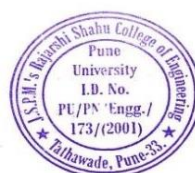
Dr. Rakesh K. Jain
Director

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

T. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester –VI
[IT3108] Artificial Intelligence

Teaching Scheme: TH : 03 Hours/Week LAB :02 Hours/Week	Credits: TH : 03 PR : 01	Examination Scheme: In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Exam : 25 Marks

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 concepts of Artificial Intelligence.

CO2: Learn problems solving methods using Artificial Intelligence.

CO3: Understand concepts of knowledge representation.

**CO4**: Understand concepts of knowledge inferences.

CO5: Understand 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 solvingwith 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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
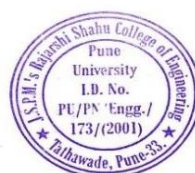
Dr. Rakesh K. Jain
Director

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.

UNIT-III	Knowledge Representation	07 Hours

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.

UNIT-IV	Knowledge Inference	07 Hours

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.

UNIT-V	Planning and Machine Learning	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.

UNIT-VI	Expert System	07 Hours

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 Assessment

Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weight age. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
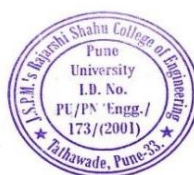
Dr. Rakesh K. Jain
Director

T2. Artificial Intelligence: A Modern Approach,. Russell & Norvig. 1995, Prentice Hall.

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.
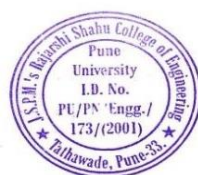**R2.** Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.
R3. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.
R4. http://nptel.ac.in.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

T. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester -VI
[IT3109]: Cyber Security

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation : 15 Marks
LAB : 00 Hours/Week	LAB : 00	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Lab Exam : 00 Marks

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: 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 computer forensics awareness.

CO5: Ability to use computer forensics tools.

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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

UNIT-IV	Legal, Ethical, And Professional Issues in Information Security, Risk Management	07 Hours

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.

UNIT-V	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-VI	Micro ATM, e-wallet and POS Security and Misc. Topics	07 Hours

Security of Micro ATMs   e-wallet Security GuidelinesSecurity 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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
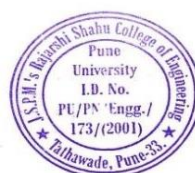
Dr. Rakesh K. Jain
Director

S. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester -VI
[IT3110]: Advance Software Modeling

Teaching Scheme:	Credit	Examination Scheme:
TH: - 03 Hours/Week LAB: -02 Hours/Week	TH:03 LAB: 01	In Sem. Evaluation:15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Practical Exam : 25 Marks Total :125 Marks

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,

Dr. Ram Joshi
**BoS Chairman&**
Dean of Academics
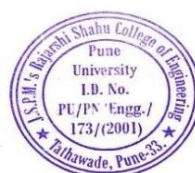
Dr. Rakesh K. Jain
Director

UML Structure, UML Building Blocks, UML Common Mechanisms, Introduction to all UML Diagram Notational Techniques, 4+1 View.

UNIT-II	Class Modeling	07- Hours

Object and class concepts, links andassociation concepts, **Domain / Class Modeling**: 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.

UNIT-III	State Modeling	07- Hours

Events, states, transitions and conditions, state diagram behavior, nested state diagram, nested states, signal generalization, concurrency, **State Diagram**: State Machine, Triggers and Ports, Transitions, Initial and Final State, Composite States, Submachine States. State model case study, relation of class and state model.

UNIT-IV	Interaction Model	07- Hours

Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use Case realizations **Activity Diagram** : 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. **Sequence Diagram**: Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions.

UNIT-V	Object Oriented Design	07- Hours

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

UNIT-VI	Software Testing	07- Hours

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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
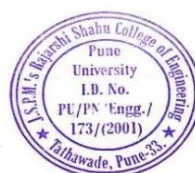
Dr. Rakesh K. Jain
Director

Lab Contents

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performanceof student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

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

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

Academic Year – 2021-2022 Semester -VI

[IT3111]: Machine Learning

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation : 15 Marks
LAB : 02 Hours/Week	LAB : 01	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Lab Exam : 50 Marks

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: To 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

UNIT-I	Introduction to Machine Learning	07 Hours

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

UNIT-II	Classification	07 Hours

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

UNIT-III	Regression	07 Hours

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
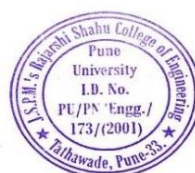
Dr. Rakesh K. Jain
Director

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

UNIT-IV	Distance and Rule based Models	07 Hours

Distance metrics, K-means clustering algorithm, KNN classification algorithm, Hierarchical clustering, Apriori Algorithm, Confidence and Support parameters, Impurity Measures-Gini Index and Entropy.

UNIT-V	Probabilistic Models	07 Hours

Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Expectation-Maximization methods, Gaussian Mixture Model.

UNIT-VI	Recent Trends in Machine Learning	07 Hours

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 Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

List of Laboratory Assignments

1	Implement SVM for performing classification and find its accuracy on the given data
2	Load the dataset: birthwt Risk Factors Associated with Low Infant Birth Weight at https://raw.github.com/neurospin/pystatsml/master/datasets/birthwt.csv 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 .
3	Implement K-Means algorithm for clustering to create a Cluster on the given data.
4	Text classification for Sentimental analysis using KNN Note: Use twitter data
5	Create Association Rules for the Market Basket Analysis for the given Threshold.
6	Creating & Visualizing Neural Network for the given data.
7	Recognize optical character using ANN

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

| 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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
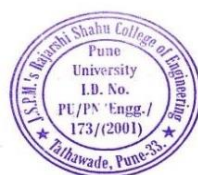
Dr. Rakesh K. Jain
Director

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

Teaching Scheme:	Credits:	Examination Scheme:
TH : 3 Hours/Week	TH : 03	In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

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: Explain and classify different architectures of parallel systems.
CO2: Describe parallel algorithms and evaluate the performance of various Parallel Algorithms.
CO3: Use different Parallel Programming models and Parallel Programming tools.
**CO4:** Analyze and optimize performance parameters.
CO5: Demonstrate parallel programming for different applications using CUDA.

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

Programming Using the Message-Passing Paradigm: Principles of Message Passing

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
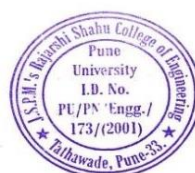
Dr. Rakesh K. Jain
Director

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

UNIT-IV	Programming Shared Address Space Platforms	07Hours

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

UNIT-V	Performance Measures	07Hours

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

UNIT-VI	General Purpose Graphics Processing Unit(GPGPU)	07Hours

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,NareshJotwani, "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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
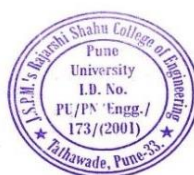
Dr. Rakesh K. Jain
Director

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

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

Academic Year – 2021-2022 Semester -VI

[IT3112B]: Ethical Hacking

Teaching Scheme: TH : 03 Hours/Week	Credits: TH : 03	Examination Scheme: In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

Course Prerequisites: Computer Network and Cyber Security

Course Objectives:
- To prepare students with the technical knowledge and skills needed to protect and defend cyber-attacks and understand ethical hacking methodology
- To analyze and understand security attacks.
- To understand and analyze web server vulnerabilities and prevention techniques to avoid exploitation.
- To analyze and understand web security.

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

CO1: Describe and understand the basics of the ethical hacking

CO2: Perform the foot printing and scanning

**CO3:**Demonstrate the techniques for system hacking

CO4: Describes various types of securities and vulnerabilities

CO5: Detect and prevent the security attacks in different environments

Course Contents

UNIT-I	Introduction to Ethical Hacking	07 Hours

Important Terminologies, Ethical hacking process, Hacker's behaviormindset,HackingMethodology,InformationGathering, Active and Passive Sniffing,Physicalsecurityvulnerabilitiesand countermeasures.Security Fundamental, Security testing, Hacker and Cracker, Ethical and Legality.

UNIT-II	Foot printing and scanning	07 Hours

Information Gathering, Determining the Network Range, IdentifyingActive Machines, Finding Open Ports and Access Points, OS Fingerprinting Services, Mapping theNetwork Attack Surface.

UNIT-III	Vulnerability Assessment	07 Hours

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.

UNIT-IV	Exploitation	07 Hours

Introduction, Introduction to Metasploit (Hack like a Pro with Metasploit), Sniffing the network traffic, Spying

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
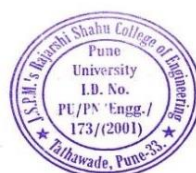
Dr. Rakesh K. Jain
Director

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
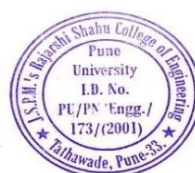
Reference Books:

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]

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

T. Y. B. Tech (Department of Information Technology)
Academic Year – 2021-2022 Semester -VI
[IT3112C]:Mobile Computing

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

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
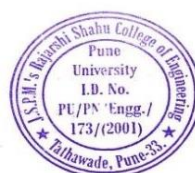
CO5: Describe Mobile Application Architectures

CO6: Describe recent trends and emerging technologies

Course Contents

UNIT-I	Introduction	07 Hours

Introduction – PCS Architecture, Cellular Telephony, Mobile Computing Architecture
Mobile devices: Device Overview, Input mechanism, Wireless communication, Mobile Device classification, Device Manufacturers **Mobile Generations:** Devices and Applications for: 1G, 2G, 2.5G, 3G **Handoff Management :**Handoff ,Handoff Detection, Strategies for Handoff Detection, Channel Assignment, LinkTransfer Types, Hard Handoff, Soft Handoff

UNIT-II	GSMand Mobility Management	07 Hours

GSM System Overview: GSM Architecture, Data Services, Unstructured Supplementary Service Data **Mobility Management :** GSM Location Update, Mobility Databases, Failure Restoration, VLR Identification Algorithm, VLR Overflow Control

UNIT-III	GSM Services	07 Hours

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

GSM Service: SMS Architecture, SMS Protocol Hierarchy, Mobile-Originated Messaging, Mobile – 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 MobileNetworks, Mobile Number Portability Mechanisms, Implementation Costs for Mobile NumberMobile prepaid service: Wireless intelligent network approach, service node approach, hot billingapproach, handset based approach

UNIT-IV	GSM Data Layer	07 Hours

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

Wireless Application Protocol (WAP): WAP Model, WAP Gateway, WAP Protocols WAP UAProf andCaching, 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 lifeApplication 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, "Wirless Communication Systems, From RF Subsystems to 4G Enabling Technologies, ISBN: 978-0-521-18736-7, Cambridge University Press,

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
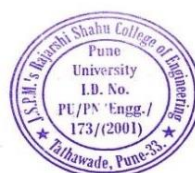
Dr. Rakesh K. Jain
Director

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

Teaching Scheme:	Credit	Examination Scheme:
PR: -02 Hours/Week	PR: 01	Lab Evaluation: 50 Marks

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. To Gather, organize, summarize and interpret technical literature with the purpose of formulating a project proposal.
CO2. To 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. To explore and enhance the use of various presentation tools and techniques.
CO6. To 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.
5. Seminar topics should be based on project undertaken. Guide should thoughtfully allocate

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
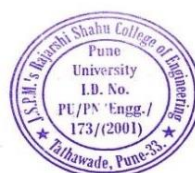
Dr. Rakesh K. Jain
Director

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.
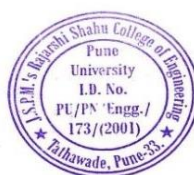
Guidelines for Seminar Report

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

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

| Guidelines for Seminar Presentation |
|---|
| 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, 2nd Edition.

R3. Lesikar, Lesikar's Basic Business Communication, Tata McGraw, ISBN :256083274, 1 st Edition.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
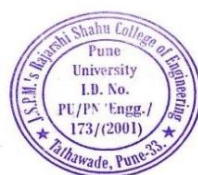
Dr. Rakesh K. Jain
Director

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

Teaching Scheme:	Credit	Examination Scheme:
PR: -02 Hours/Week	PR: 01	Lab Evaluation: 50 Marks

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:
   a) Pluralism & cultural spaces
   b) Cross-cultural communication
c) Science of Nation building

Course Outcome:
After successful completion of the course, students will able to:
CO1: Summarize the basic principles of SWOT and Life Positions and Apply SWOT in real life scenarios
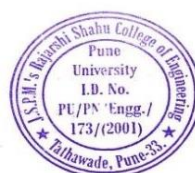CO2: Identify pluralism in cultural spaces.
CO3:Summarize the role of science in nation building.
CO4: Apply technical writing in real-life scenarios. Recognize the importance of AI..

Course Contents		
UNIT-I	**SWOT and Life Positions**	**08Hours**

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".
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)
Presentation on what are the strengths they have identified to survive in the VUCA World. Group presentations of 10 mins each.
Motivation Stories YouTube videos on Maslow's Theory

UNIT-II	**Pluralism in Cultural Spaces**	**08 Hours**

   a) 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.
   b) Learn and Exchange: Group activity in which participants need to learn the following four

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

greetings of a state (different from their own) and exchange it with another group:

- 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

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.

UNIT-IV	Technical Writing and the Importance of AI	08Hours

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:

- DNA
- Rings of Saturn
- Structure of an oxygen atom
- Structure of heart

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

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/

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
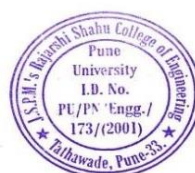
Dr. Rakesh K. Jain
Director

Online Resources:
R5.https://youtu.be/CsaTslhSDI
R6.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
R9.https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be
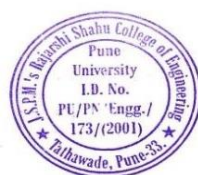
Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director

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	https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-2/ug-vol2.pdf
HS3108	Cultural Studies	https://onlinecourses.swayam2.ac.in/aic19_as04/preview
CE 3113	Urbanization and Environment	https://onlinecourses.nptel.ac.in/noc21_hs96/preview

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

• 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

Dr. Ram Joshi
BoS Chairman&
**Dean of Academics**
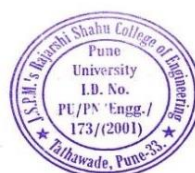
Dr. Rakesh K. Jain
Director

be interdisciplinary.
- 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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
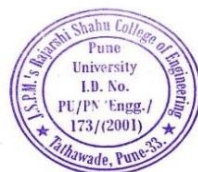
Dr. Rakesh K. Jain
Director

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	https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-2/ug-vol2.pdf
HSHS3109	Introduction to Human Factors and Ergonomics	https://onlinecourses.swayam2.ac.in/aic20_ed03/preview
HS3110	Mind Education	https://onlinecourses.swayam2.ac.in/aic19_as05/preview

### GUIDELINES FOR CONDUCTION OF AUDIT COURS

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

- 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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics
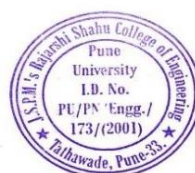
Dr. Rakesh K. Jain
Director

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.
- 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.

Dr. Ram Joshi
BoS Chairman&
Dean of Academics

Dr. Rakesh K. Jain
Director