Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

Curriculum for S. Y. B. Tech. Sem-II

Computer Engineering (Software Engineering)

(2023 NEP Pattern)

College Vision and Mission

Vision:
To be a globally acclaimed Institute in Technical Education and Research for holistic socio-economic development

Mission:

- To ensure that 100% of students are employable and employed in industry, higher studies, entrepreneurship, civil or defence services, government jobs, and other areas like sports and arts.
- To strengthen Academic Practices in Curriculum, Pedagogy, Assessment and Faculty Competence.
- To Promote Research Culture among Students and Faculty through Projects and Consultancy
- To make students Socially Responsible Citizens

Department Vision and Mission

Vision:

- Empowering Industry through Comprehensive Software Engineering Services to Achieve Excellence.

Mission:

- To produce industry-ready software engineering graduate with a blend of technical expertise and ethical responsibility
- To provide software engineering students with the utmost quality in developing technical, social, innovative, and entrepreneurial skills

Knowledge and Attitude Profile (WK)

- WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
- WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
- WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
- WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
- WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes (POs)

- PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
- PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
- PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
- PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSO)

- PSO 1 – Software Design & Development
  Analyze, design, and implement reliable, efficient, and scalable software solutions by applying software engineering principles, modern programming tools, and innovative methodologies to solve real-world problems.
- PSO 2 – Professional Growth & Innovation
  Demonstrate professionalism, ethics, effective communication, and teamwork, while engaging in lifelong learning, research, Industry and entrepreneurial activities to contribute to emerging areas.

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week))			Examination scheme									Total	Credits
			Theory	Lab	Tut	CVV	CP	LAB CA	GD/ PPT/ HA	MSE (W/O)	T1 (W/O)	T2 (W/O)	ESE (W/O)	PRACT /CVV		
S01	SE2009	DESIGN & ANALYSIS OF ALGORITHM	2	2	-	-	30	10	-	-	-	-	-	40+20	100	3
S02	SE2010	COMPUTER NETWORKS	2	2	-	20	30	10	-	-	-	-	40 (W)	-	100	3
S03	SE2011	BIG DATA ANALYTICS	2	2	-		30	10	20	-	-	-	40 (O)	-	100	3
S04	SE2012	SOFTWARE ENGINEERING	2	-	1	30	-	-	30	-	-	-	40(W)	-	100	3
S05	MM0802	PROBABILITY & STATISTICS	2	-	1	-	-	-	30	-	35 (0)	35 (0)	-	-	100	3
S06	HS2003	FROM CAMPUS TO CORPORATE - 2	2	-	-	-	-	-	-	50 (O)	-	-	50 (O)	-	100	2
S07	HS2004	REASONING AND APTITUDE DEVELOPMENT - 4	1	-	-	-	-	-	-	-	-	-	100(O)	-	100	1
S08	SE2013	DESIGN THINKING -2	-	-	1	-	-	-	-	-	-	-	100	-	100	1
S09	SE2014	ENGINEERING DESIGN AND INNOVATION - II	-	2	-	-	-	-	-	30	-	-	70	-	100	2
Total			13	8	3	50	90	30	80	50	35	35	470	60	900	21

Nomenclature for Teaching and Examination Assessment Scheme

Sr No.	Category	Head of Teaching/ Assessment	Abbreviation used
1	Teaching	Theory	Th
2	Teaching	Laboratory	Lab
3	Teaching	Tutorial	Tut
4	Teaching	Open Elective	OE
5	Teaching	Multi-Disciplinary	MD
6	Teaching	Computer Science	CS
7	Assessment	Laboratory Continuous Assessment	LAB CA
8	Assessment	Mid Semester Assessment	MSA
9	Assessment	End Semester Assessment	ESE
10	Assessment	Home Assignment	HA
11	Assessment	Course Project	CP
12	Assessment	Group Discussion	GD
13	Assessment	PowerPoint Presentation	PPT
14	Assessment	Test –1 Written/online	T1
15	Assessment	Test –2 Written/online	T2
16	Assessment	Mid Semester Examination (W/O) Written/online	MSE
17	Assessment	End Semester Examination	ESE
18	Assessment	Written Examination	W
19	Assessment	Multiple Choice Questions	MCQ
20	Assessment	Comprehensive Viva Voce	CVV

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

SE2009: Design and Analysis of Algorithms

Teaching Scheme	**Examination Scheme**
Credits: 3	CP: 30 Marks
Lectures: 2 Hrs/week	Lab CA: 10 Marks
Practical: 2 Hrs/week	CVV:20 Marks
Tutorial: 0 Hrs/week	Practical: 40 Marks

Prerequisites:	
•	Problem Solving and programming
•	Linear Algebra
•	Data Structures
Course Objectives:	
•	Understand algorithm fundamentals, design principles, and complexity analysis techniques.
•	Understand algorithm fundamentals, design principles, and complexity analysis techniques.
•	Use Greedy algorithm techniques to solve optimization and graph-based problems efficiently.
•	Apply Dynamic Programming approaches to solve problems with optimal substructure and overlapping subproblems.
•	To equip students with the knowledge and skills to understand and apply classical and AI-driven algorithms
Course Outcomes:	
	After completion of the course, student will be able to
1.	Explain the fundamentals of algorithms and methods for analysing time and space complexity.
2.	Design and analyse algorithms using the Divide and Conquer paradigm
3.	Apply Greedy algorithm techniques to solve optimization and graph-based problems
4.	Solve problems using Dynamic Programming approaches by identifying optimal substructure and overlapping subproblems.
5.	To understand and apply classical and AI-driven software engineering algorithms

Section1:	**Topics/Contents**
INTRODUCTION What is an Algorithm, use of algorithm in various fields, need of algorithms, characteristics of algorithm, advantage and disadvantages of algorithms. How to design an algorithm: Fulling the pre-requisites, designing the algorithm, testing the algorithm by implementing it. How to find algorithm complexity: Time complexity and space complexity. Analyze an algorithm: priori analysis and posterior analysis	

DIVIDE AND CONQUER ALGORITHM

Working of Divide and Conquer Algorithm: Divide, Conquer, merge. Characteristics of Divide and Conquer Algorithm: Dividing the problem, Independence of subproblems, conquering each subproblem, Combining solutions.
Examples of Divide and Conquer Algorithm: Binary Search, Quick sort, Merge sort.
Applications of Divide and Conquer Algorithm: Closest Pair of points, Strassen's algorithm, Cooley–Tukey FFT algorithm, Karatsuba algorithm for fast multiplication.

GREEDY METHOD

Basics of Greedy algorithm: working of Greedy algorithm, Greedy Algorithms General Structure, Fractional Knapsack Problem, Assign Maximum Cookies, Assign Holes to Mice
Job Sequencing Problem, Policemen catch thieves, Dijkstra's Algorithm
Minimum cost spanning trees: Prim's algorithm, Kruskal's algorithm.

Section2:	**Topics/Contents**

DYNAMIC PROGRAMMING

Dynamic programming basics: how dynamic programming will work when to use dynamic programming: optimal substructure, overlapping subproblems, example as Fibonacci series.
Approaches of dynamic programming: Top-Down Approach (Memorization), Bottom-Up Approach (Tabulation).

Recent Algorithms in Software Engineering

Evolution from Classical Algorithms to AI-Driven Software Engineering, Why New Algorithms Are Needed, Categories of Modern Algorithms in Software Engineering: AI/ML Algorithms: Bug detection, localization Code completion & synthesis Performance prediction Refactoring recommendations, Graph-Based Algorithms: Represent code as AST/CFG/PDG Use GNNs to detect defects and vulnerabilities, Formal Verification & SMT Solving:Z3, CVC5 solvers, Symbolic, execution, Model checking, Static & Dynamic Analysis: Abstract interpretation, Taint analysis, Data flow analysis, Introduction to SonarLint: a static code analysis tool that detects bugs, vulnerabilities, and code quality issues in real time inside the IDE without executing the program

Text Books: ***(As per IEEE format)***

1	T. H. Cormen, *Introduction to Algorithms*, 3rd ed. Cambridge, MA, USA: MIT Press, 2009.
2	E. Horowitz, S. Sahni, and S. Rajasekaran, *Fundamentals of Computer Algorithms*, Hyderabad, India Universities Press, 2007.
3	S. Ajorloo, A. Jamarani, M. Kashfi, M. H. Kashani, and A. Najafizadeh, *A systematic review of machine learning methods in software testing*, Applied Soft Computing, vol. 162, p. 111805, 2024, doi: 10.1016/j.asoc.2024.111805.

Reference Books: ***(As per IEEE format)***

1	A. Levitin, *Introduction to the Design and Analysis of Algorithms*, 3rd ed. Boston, MA, USA: Pearson, 2012.
2	J. Kleinberg and É. Tardos, *Algorithm Design*, Boston, MA, USA: Pearson, 2005.

3	M. A. Weiss, *Data Structures and Algorithm Analysis in C*, 2nd ed. Boston, MA, USA: Pearson, 1997.
URL for Self-Study:	
1	MIT OpenCourseWare – *Introduction to Algorithms* https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020
2	NPTEL / SWAYAM – *Design and Analysis of Algorithms* *https://nptel.ac.in/courses/106106131*
3	***Algorithms* by Jeff Erickson** https://jeffe.cs.illinois.edu/teaching/algorithms/
4	Free Lecture Notes Collections https://freecomputerbooks.com/Lecture-Notes-for-the-Algorithms.html
5.	Scribd – Free NPTEL Notes https://www.scribd.com/document/420133409/NPTEL-Design-and-Analysis-of-algorithm

List of Practical's:

1. Design and implement an algorithm to find the maximum and minimum elements in an array.
   Tasks:
   i) Write algorithm steps (pseudocode)
   ii) Implement in C++
   iii) Perform a priori analysis
   iv) Measure execution time for different input sizes (posterior analysis)
   v) Analyze time and space complexity
2. Implement Binary Search on a sorted array.
   Tasks:
   i) Recursive and iterative implementations
   ii) Count number of comparisons
   iii) Compare best, worst, and average cases
3. Implement Merge Sort using divide and conquer technique.
   Tasks:
   i) Recursive divide and merge steps
   ii) Trace recursion tree
   iii) Analyze time and space complexity
4. Implement Quick Sort and compare with Merge Sort.
   Tasks:
   i) Use different pivot selection strategies
   ii) Compare execution time for sorted, reverse-sorted, and random data

5. Solve the Fractional Knapsack Problem using the greedy approach.
   Tasks:
   i) Sort items based on profit/weight ratio
   ii) Calculate maximum profit
   iii) Show step-by-step selection
6. Implement Job Sequencing Problem to maximize profit.
   Tasks:
   i) Sort jobs based on profit
   ii) Schedule jobs within deadlines
   iii) Display selected job sequence and total profit
7. Find Minimum Cost Spanning Tree using Prim's Algorithm.
   Tasks:
   i) Represent graph using adjacency matrix
   ii) Display selected edges and total cost
8. Demonstrate Dynamic Programming approaches.
   Tasks:
   i) Fibonacci using:
      1. Top-Down (Memorization)
      2. Bottom-Up (Tabulation)
   ii) 0/1 Knapsack using DP table
9. Solve the N Queens problem using backtracking.
   Tasks:
   i) Print all possible solutions
   ii) Count total solutions
   iii) Explain backtracking steps
10. Implement Graph Coloring or Hamiltonian Cycle Problem using backtracking.
    Tasks:
    i) Check feasibility of color assignment / cycle formation
    ii) Print solution if exists

11. To analyze a buggy Python program using SonarLint for automated bug detection and compare AI-assisted results with manual code inspection.

List of Project areas:

1. Algorithm Performance & Complexity Analyzer
2. AI/Big-Data Sorting and Search Optimization System
3. Cloud Resource Allocation using Greedy Algorithms
4. Smart Traffic Route Optimization (Dijkstra, MST)
5. Fast Cryptographic Computation using Divide & Conquer
6. Energy-Efficient Computing Optimization System
7. Smart Inventory & Budget Optimization using Dynamic Programming
8. Delivery Route Optimization System (DP / Greedy)
9. Automated Timetable Scheduling using Backtracking
10. Smart City Optimization Toolkit (Traffic, Energy, Network)

CO-PO Mapping

CO												PSO	
CO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3
CO5	2	2	2	2	3	-	-	2	2	2	2	2	2
Average	2.8	2.6	2.25	2	3	-	-	2	2	2	2	2.6	2.8

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

SE2010: COMPUTER NETWORKS

Teaching Scheme	**Examination Scheme**
Credits: 3	CP: 30 Marks
Lectures: 2 Hrs/week	CVV: 20 Marks
Practical: 2 Hrs/week	Lab CA: 10 Marks
Tutorial: 0 Hrs/week	ESE (W): 40Marks

Prerequisites:	
•	Basic understanding of computer organization, Fundamentals of programming
Course Objectives:	
•	To introduce fundamental concepts of computer networks, layered architectures, and networking devices used in data communication systems.
•	To understand the principles of data transmission, switching techniques, and protocol operations across different layers of the network.
•	To explain network layer design issues, IP addressing, routing algorithms, and routing protocols for efficient data delivery.
•	To enable learners to apply networking concepts and protocols in designing, analyzing, and troubleshooting basic networked systems.
Course Outcomes:	
	After completion of the course, student will be able to
1.	Explain basic networking concepts, reference models, and network devices used in computer networks.
2.	Analyze data transmission techniques, error control mechanisms, and data link layer protocols.
3.	Understand network layer functionalities including IP addressing, routing algorithms, and routing protocols.
4.	Apply transport and application layer protocols to design simple client–server and network communication applications.

Section1:	**Topics/Contents**

Networking Fundamentals:
Introduction to computer network, Types of Networks, Network Architectures: Client-Server, Peer to Peer, Network Topologies: Bus, ring, tree, star, mesh, hybrid. Reference Models: OSI Model, TCP/IP Model, Network Devices, International Standards

Physical Layer: Transmission media- Guided media, unguided media. Transmission Modes: Simplex, Half-Duplex and Full-Duplex. Modulation & Multiplexing.

Data Link Layer: Design issues, Framing Techniques, Error detection, Error correction, Data Link layer Protocols: Simplex, Stop and Wait, Sliding Window Protocol. MAC: Access Control Protocols (ALOHA, CSMA, CSMA/CD), Ethernet, Wireless LAN: Architecture, Protocol Stack

Section2:	**Topics/Contents**

Network Layer

Network Layer Design issues, Functions of Network layer. Switching Techniques: Circuit switching, Message Switching, Packet Switching. IP Protocol: Classes of IP, IPv4, IPv6, NAT, Sub-netting, CIDR. Network layer Protocols: ARP, RARP, ICMP, IGMP. Network Routing Concepts: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. Routing Protocols: RIP, OSPF, BGP, IGRP. Quality of Service

Transport Layer:

Transport services, Elements of Transport Protocol, UDP, TCP, Socket Programming (TCP & UDP), TCP Flow control, TCP Congestion Control.

Application Layer: Application Layer Protocols, Application layer protocols interaction with end-user applications, Presentation and Session layers. Well-Known Application Protocols and Services, Domain Name System (DNS), HyperText Transfer Protocol (HTTP).

Text Books: ***(As per IEEE format)***

1	A. S. Tanenbaum and D. J. Wetherall, *Computer Networks*, 5th ed. New Delhi, India: Pearson Education, 2014, **ISBN: 978-9332518742**.
2	B. A. Forouzan, *Data Communications and Networking*, 5th ed. New York, NY, USA: McGraw-Hill Education, 2013, **ISBN: 978-1259064753**.

Reference Books: ***(As per IEEE format)***

1	W. Stallings, *Data and Computer Communications*, 10th ed. Boston, MA, USA: Pearson, 2014/2015, **ISBN: 978-0133506488**
2	J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach*, 8th ed. Boston, MA, USA: Pearson, 2020, **ISBN: 978-1292405469**.
3	W. Odom, *CCNA Routing and Switching 200-125 Official Cert Guide Library,* Indianapolis, IN, USA: Cisco Press, 2016, **ISBN-10: 1-58720-581-5; ISBN-13: 978-1-58720-581-1**.
4	R. A. Nastase, *Cisco CCNA Command Guide: An Introductory Guide for CCNA & Computer Networking Beginners*, Self-published/Independent, 2018, **ISBN-13: 978-1731124272**.

URL for Self-Study:

1	Computer Networks and Internet Protocol – IIT Kharagpur (NPTEL) https://nptel.ac.in/courses/106105183
2	Advanced Computer Networks – Deeper Concepts (for learners with basics) https://onlinecourses.nptel.ac.in/noc26_cs60/preview
3	Introduction to Networking (by NVIDIA) https://www.coursera.org/courses?query=introduction%20to%20networking
4	Computer Networks and Network Security (by IBM) https://www.coursera.org/courses?query=computer%20networks%20and%20network%20security

List of Practical's:

1. Design and configure a wired LAN using a Layer-2 switch, including UTP cable preparation and testing using a line tester, IP address configuration on end devices, network connectivity verification using the PING utility, and packet capture and analysis using the Wireshark packet analyzer.
2. Design and demonstrate various network topologies and transmission media using Cisco Packet Tracer.
3. Configure and verify Wireless LAN connectivity using access points, SSIDs, and security settings in Packet Tracer.
4. Demonstrate error detection and correction mechanisms using programming or simulation tools.
5. Implement and simulate Go-Back-N and Selective Repeat sliding window protocols in a peer-to-peer communication model.
6. Develop a program to perform IPv4 subnetting and determine appropriate subnet masks for given network requirements.
7. Configure classful and classless addressing (CIDR) for given network scenarios using Cisco Packet Tracer.
8. Implement either Distance Vector or Link State routing algorithm to determine the optimal path for data transmission.
9. Configure and verify a three-router network using Cisco Packet Tracer with one of the following routing protocols: RIP, OSPF, or BGP.
10. Develop TCP- and UDP-based chat applications to demonstrate reliable and unreliable communication.
11. Develop a UDP-based application to enable file transfer between two networked machines.
12. Capture and analyze TCP traffic for a generic HTTPS-enabled website using Wireshark and study protocol behavior.

List of Project areas:

1. Design and simulation of a small enterprise network
2. Routing protocol comparison using simulation tools
3. Network monitoring and traffic analysis system.
4. Secure Wireless LAN Configuration
5. Client–Server Chat and File Transfer Application
6. DHCP and DNS Server Implementation
7. IoT Network Design and Monitoring
8. Network Security and Firewall Configuration
9. MANET Routing Protocol Analysis
10. Cloud-Based Network Architecture Design

CO-PO Mapping

CO	**Program Outcomes (PO)**											**PSO**	
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	1	-	2	3	-
CO2	3	3	-	2	-	-	-	-	-	-	2	3	-
CO3	3	3	-	2	-	-	-	-	-	-	2	3	-
CO4	2	2	3	-	3	-	1	2	2	1	2	3	2
Average	2.75	2.5	3	2	3	-	1	2	1.5	1	2	3	2

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

SE2012: SOFTWARE ENGINEERING

Teaching Scheme	**Examination Scheme**
Credits: 03	CP: -- Marks
Lectures: 02 Hrs/week	GD/PPT/HA:30 Marks
Practical: -- Hrs/week	CVV :30 Marks
Tutorial: 01 Hrs/week	ESE (W): 40 Marks

Prerequisites:	
●	Basic Programming Skills, Object-Oriented Programming Concepts, Problem Solving and Logic Building
Course Objectives:	
●	To introduce the fundamental concepts of Software Engineering and various Software Development Life Cycle (SDLC) models used in real-world applications.
●	To enable students to perform effective requirements engineering, including elicitation, analysis, specification, and validation for software systems.
●	To understand and apply software design principles and architectures using a specific Model.
●	To provide knowledge of software testing, maintenance, configuration management, and project management practices for delivering high-quality software products.
Course Outcomes:	
	After completion of the course, student will be able to
1.	Explain the fundamentals of Software Engineering and various SDLC models.
2.	Elicit, analyze, and document software requirements using standard techniques and SRS.
3.	Apply software design principles and architectural concepts to design a System.
4.	Apply software testing, version control, and project management concepts to develop quality software.

Section-I	**(Topics/Contents)**

Introduction:

Introduction to Software Engineering, Software crisis, evolution of software engineering, characteristics of good software, attributes of software quality, software engineering layers, software process framework, software development life cycle (SDLC), generic process model, Waterfall model, Incremental model, Prototype model, Spiral model, V-model, Agile overview, Scrum roles,

Case Study: Online Shopping System.

Requirements Engineering and Analysis:

Software requirements, types of requirements (functional and non-functional), requirement elicitation techniques (interviews, questionnaires, observation, brainstorming, workshops), feasibility study (technical, operational, economic), requirement analysis, Software Requirement Specification (SRS) document, components of analysis model, user stories, requirement validation and verification,

Case Study: Hospital Management System.

Section-II	**(Topics/Contents)**

Software Design and Architecture:

Design Process, Software design principles, Design Concepts, The Design Model, Software Architecture, architectural Genres, user interface design principles,

Case Study: Library Management System.

Testing, Deployment and Maintenance:

Software testing objectives, testing principles, verification vs validation, types of testing: Unit, Integration, System, Acceptance testing, Alpha and Beta testing, White-box testing, Black-box testing, test case design techniques, debugging, software maintenance (corrective, adaptive, perfective, preventive), software configuration management, risk management.

Text Books:

1	Pressman, *R. S., Software Engineering: A Practitioner's Approach,* 8th Edition, McGraw-Hill, 2015
2	Rajib Mall, *Fundamentals of Software Engineering*, PHI Learning

Reference Books:

1	Ian Sommerville, *Software Engineering*, 10th Edition, Pearson, 2016
2	Pankaj Jalote, *An Integrated Approach to Software Engineering*, Wiley

URL for Self-Study:

1. Software Engineering – IIT Kharagpur (official NPTEL course)
   https://onlinecourses.nptel.ac.in/noc25_cs108/preview
2. NPTEL Software Engineering Course Materials & Videos (old archived/preview)
   http://nptel.ac.in/courses/106101061/
3. Introduction to Software Engineering (Beginner Friendly)
   https://www.coursera.org/learn/introduction-to-software-engineering

List of Tutorial's:

1. Analyze the causes and consequences of the software crisis and explain how software engineering principles address these issues.
2. Compare various SDLC models and justify the selection of an appropriate model for developing an Online Shopping System.
3. Identify and classify functional and non-functional requirements for a Hospital Management System based on given scenarios.
4. Develop a basic Software Requirement Specification (SRS) and user stories for a specified software application.
5. Design appropriate behavioural UML diagrams for a Library Management System using the provided requirements.
6. Prepare effective test cases using suitable black-box and white-box testing techniques for a given software module.
7. Analyze different types of software maintenance and identify the appropriate maintenance strategy for a real-world software failure.
8. Evaluate software risks in a project and propose suitable risk management and configuration management strategies.

CO-PO Mapping

CO	Program Outcomes (PO)											PSO	
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	2	-	-	-	-	-	-	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	3	-
CO4	3	2	3	3	-	-	-	3	2	2	-	3	1
Average	3	2.5	2.66	2.33	2	-	-	3	2	2	-	2.75	2

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

SE2011: BIG DATA ANALYTICS

Teaching Scheme	**Examination Scheme**
Credits: 3	CP:30 Marks
Lectures: 2 Hrs/week	GD/PPT/HA:20 Marks
Practical: 2Hrs/week	Lab:10 marks
Tutorial: 0 Hrs/week	ESE (O): 40 Marks

Prerequisites:	
●	Basic understanding of databases
●	Problem Solving and Programming
●	Data Analysis
●	Linear Algebra and Differential Equations
Course Objectives:	
●	Introduce foundational concepts of data integration, data warehousing, business intelligence systems, and analytics.
●	Develop skills in data transformation, modelling, visualization, and dashboard creation using BI tools.
●	Prepare students with data preprocessing techniques for handling real-world, imperfect datasets using Python and Pandas.
●	Prepare students with data preprocessing techniques for handling real-world, imperfect datasets using Python and Pandas.
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the fundamentals of data integration, data warehousing, OLAP, business intelligence architectures, and analytics concepts with real-world applications.
2.	Apply data transformation, modelling, and visualization techniques to create interactive dashboards and perform analytics calculations.
3.	Perform data preprocessing, including cleaning, normalization, handling missing values, and preparing datasets for analytics.
4.	Analyze business problems using predictive analytics, big data applications, and BI-driven solutions for informed decision-making in finance, marketing, and supply chain contexts.

Section1:	Data Warehouse and Business Intelligence

Data Warehouse and Business Intelligence

Data Integration and Data Warehouses: What is Data Integration? Need of Data Integration, ETL, What is Data Warehouse? Need of Data Warehouse, Facts and Dimensions , Star Schema and Snowflake Schema, Data Marts Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis. Business Intelligence Introduction to data, Information and Knowledge, Operational and Informational data, Introduction to Business Intelligence, BI architecture and its components Data Sources: Data Collection, Transactions Entry, Organizational Systems, Data Sources and Data Source Categories, Issues in Data and Need of Data Preparation Big Data, Metrics and Data classification, **Introduction to Analytics:** Overview of analytics, its need, and types—descriptive, predictive, and prescriptive. Applications in business, including text and web analytics. Case study: Zomato data analysis

Data Modelling and Visualization

Basics of data transformation including merging, appending, filtering, cleaning, error correction, and aggregation. Building data models by establishing relationships and structuring datasets. Data visualization covering KPIs, dashboards, reports, interactivity with slicers and filters, hierarchies, drill-downs, and formatting best practices. Analytics calculations including aggregations (SUM, MAX, AVG, MIN), calculated fields and measures, time-based functions, moving averages, running totals, what-if analysis, and conditional formatting for enhanced insights.

Section2:	

Data Preprocessing

Understanding the need and challenges of preprocessing, exploring processed and unprocessed data, data cleaning and normalization techniques, handling missing values and strategies to fill them, working with multiple file formats (CSV, text, Excel), using Python's Pandas library and dataframes to prepare real-world datasets for analytics

Recent Applications and Big Data Analytics Impact

Finance and Risk Analytics: Why Credit Risk-Using a market case study, Comparison of Credit Risk Models, Overview of Probability of Default (PD), Modelling PD Models , types of models, Steps to make a good model, Marketing analytics, ERP and Business Intelligence, Big data Applications in CRM, finance, Banking, Supply Chain and Logistics Analytics: Introduction to Supply Chain, Dealing with Demand uncertainty, Designing Optimal Strategy using Case Study, Inventory Control & Management.

Text Books:	
1	Rick Sherman, Business Intelligence Guidebook: From Data Integration To Analytics, *Elsevier Inc.*
2	Raghu Ramkrishnan, Johannes Gehrke, Database Management Systems, *Second Edition*
3	William Inmon, *Building the Data Warehouse*, Wiley publication 4th edition
Reference Books:	
1	Inmon, W.H., *Building the Data Warehouse*, Wiley.
2	Jiawei Han, *Data Mining: Concepts and Techniques*, Elsevier.
3	Carlo Vercellis, *Business Intelligence – Data Mining and Optimization for Decision Making*, Wiley Publications
URL for Self-Study:	
1	Data Analytics with Python (NPTEL) – Analytics fundamentals using Python: https://nptel.ac.in/courses/106107220
2	Data Mining (NPTEL) – Data mining and analytics concepts: https://onlinecourses.nptel.ac.in/noc21_cs06
3	https://learn.microsoft.com/power-bi/

List of Practical's:

1. Choose a set of business processes like Sales, Customer Services, Accounting, Production, Marketing processes etc. for any organization and design star, snow flake and fact constellation schema. Also using ETL tool, extract data from various sources and perform transform and load operations on data. (Use Power BI)
2. Perform Visual analytics using PowerBI/tableau. Plot various graph like table plot, histogram, boxplot for the suitable data and create a dashboard for the same (Consider Inventory control, Sales and Finance, Market risk,Stock exchange etc. and but not limited to this)
3. Create a dashboard using Power BI/Tableau for the dataset chosen in previous assignments and perform following operations Connecting to data source and visualizing and analysing data Connecting to data source and creating custom calculations, Deploying the dashboards and reports to Power BI Service
4. Create or use a dataset from kaggle like data set repository and fill in the missing values using approaches like mean/Median in case of numerical data and Maximum count in case of Categorical data.
5. Using SKLEARN libraries apply Machine Learning libraries for prediction (Use either of the approach: Supervised/Unsupervised)
6. Design a risk analysis model to predict market risk using stock case study

7. Perform a Course project for any Financial, Societal, Education problem Use methodologies, Models, algorithms.

List of Project areas:

1. Finance & Risk Analytics
2. Healthcare & Societal Analytics
3. Education Domain
4. Text & Web Analytics
5. Business Intelligence & Data Warehousing
6. Sustainability & Green Analytics

CO-PO Mapping

CO	Program Outcomes (PO)											PSO	
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	1	1	1	-	-	1	-	1	1	2	1
CO2	2	2	2	1	3	-	-	1	1	1	1	3	2
CO3	3	3	2	1	2	-	-	1	-	1	1	3	1
CO4	3	3	3	2	3	-	-	1	1	2	2	3	3
Average	2.75	2.5	2	1.75	2.25	-	-	1	1	1.25	1.25	2.75	1.75

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

MM0802: Probability and Statistics

Teaching Scheme	**Examination Scheme**
Credits: 3	Home Assignments: 30 Marks
Lectures: 2 Hrs/week	Test 1: 35 Marks
Practical: 0 Hrs/week	Test 2: 35 Marks
Tutorial: 1 Hrs/week	

Prerequisites:	
●	Basic knowledge of algebra and calculus
●	Familiarity with Python programming fundamentals
●	Understanding of Data Analytics
Course Objectives:	
●	Understand fundamental statistical concepts, data types, and probability rules.
●	Apply statistical methods to real-world datasets and interpret graphical summaries.
●	Analyse datasets using probability distributions and inferential statistics.
●	Evaluate statistical results and justify decisions based on hypothesis testing.
Course Outcomes:	
	After completion of the course, student will be able to
1.	Classify and summarize different types of data using appropriate descriptive statistical techniques.
2.	Apply probability concepts and probability distributions to solve real-world problems.
3.	Analyze sample data to perform estimation and hypothesis testing for proportions and means.
4.	Evaluate and justify statistical decisions involving categorical and numerical data using inferential tests.

Section1:	**Topics/Contents**

INTRODUCTION TO DATA AND STATISTICS

Data basics, collection principles, observational vs. experimental studies, sampling techniques, numerical and categorical data analysis, measures of central tendency and dispersion.

Case Study: Statistical Report on Students' Academic Performance – Collect sample data from a class, identify sampling bias, compute mean, variance & interpretation.

DISTRIBUTIONS OF RANDOM VARIABLES

Defining probability, conditional probability, sampling from a small population, random variables Normal Distribution, The Standard Normal (Z) Distribution, Evaluating the Normal approximation, Poisson Distribution, Binomial Distribution, Finding Binomial, Probabilities Using the Formula, Finding Probabilities Using the Binomial Table

Case Study: Quality Control in Manufacturing – Apply Binomial and Normal distribution to inspect defective product rates.

Section2:	**Topics/Contents**

FOUNDATION FOR INFERENCE

Sampling variability, Central limit Theorem, confidence intervals for proportion, Hypothesis formation, Z test, t-test, One-way ANOVA.

Case Study: COVID-19 Vaccination Effectiveness Survey – Estimate population vaccination proportion & test hypotheses across age groups.

INFERENCE FOR CATEGORICAL AND NUMERICAL DATA

Inference for a single proportion, difference of two proportions, one-sample and two-sample (paired & independent) t-tests, difference of two means.

Case Study: Marketing Strategy Evaluation – Compare online vs. offline sales effectiveness and customer satisfaction outcomes.

Text Books: ***(As per IEEE format)***

1	R. E. Walpole, R. H. Myers, S. L. Myers, and K. Ye, *Probability and Statistics for Engineers and Scientists*, 9th ed. Upper Saddle River, NJ, USA: Pearson/Prentice Hall, 2012, **ISBN-10: 0321629116**, **ISBN-13: 978-0321629111**
2	D. M. Diez and M. Çetinkaya-Rundel, *OpenIntro Statistics*, 3rd ed. OpenIntro Inc., 2015, **ISBN-10: 194345003X**, **ISBN-13: 978-1943450039**
3	S. D. H. Evergreen, *Effective Data Visualization: The Right Chart for the Right Data*, 3rd ed. SAGE Publications, 2019, **ISBN-10: 1506303056**, **ISBN-13: 978-1506303055**

Reference Books: ***(As per IEEE format)***

1	M. Gardener, *Beginning R: The Statistical Programming Language*. Wiley India Pvt. Ltd., 2013, **ISBN-13: 978-8126541201**.
2	D. Navarro, *Learning Statistics with R: A Tutorial for Psychology Students and Other Beginners*, Version 0.6. Lulu Press / independent publication, 2013, **ISBN-10: 1326189727**, **ISBN-13: 978-1326189723**
3	G. James, D. Witten, T. Hastie, and R. Tibshirani, *An Introduction to Statistical Learning with Applications in R*. New York, NY, USA: Springer, 2013, **ISBN-10: 1461471370**, **ISBN-13: 978-1461471370** (1st ed.)

4	T. Hastie, R. Tibshirani, and J. Friedman, *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, 2nd ed. New York, NY, USA: Springer, 2009, **ISBN-10: 0387848576**, **ISBN-13: 978-0387848570**.
5	B. Illowsky and S. Dean, *Introductory Statistics*. Houston, TX, USA: OpenStax, 2018, **ISBN-10: 1938168205**, **ISBN-13: 978-1-938168-20-8**
URL for Self-Study:	
1	https://statisticswithrk.blogspot.com/
2	https://nptel.ac.in/courses/111105090
3	https://www.coursera.org/learn/the-power-of-statistics.
4	https://www.coursera.org/projects/probability-distributions-real-world-problems-r

Home Assignments

Section 1

1. Collect real-world categorical and numerical dataset & visualize distributions.
2. Compare mean and median for skewed datasets and comment on which is better.
3. Prepare a mini-report identifying best sampling strategy for a campus survey.
4. Compute Binomial probabilities for product defect rate scenarios.
5. Solve Z-score problems and interpret outcomes for admission/eligibility criteria.
6. Perform Normal Approximation to Binomial & compare results

Section 2

1. Construct 95% CI for a survey proportion using given data.
2. Perform hypothesis testing for population mean & interpret p-value.
3. Conduct one-way ANOVA on three groups (sales/trials/samples) using Python.
4. Paired t-test on before & after training results of employees.
5. Independent two-sample t-test comparing two machinery performance.

List of Tutorial using Python

Students must use NumPy, Pandas, SciPy, and Matplotlib:

1. Load a dataset and classify each column as numerical/categorical.
2. Compute mean, median, mode, variance, standard deviation & plot boxplot.
3. Demonstrate random sampling & compare sample vs population mean.
4. Write a Python function to calculate Binomial probability manually.
5. Plot Normal Distribution curve for given μ and σ.
6. Compute area under Standard Normal curve using SciPy.
7. Perform conditional probability experiment using simulation.
8. Generate sampling distribution of sample means (Central Limit Theorem).
9. Construct confidence interval for population mean using Python.
10. Conduct hypothesis testing (z-test) on a dataset.
11. Perform independent and paired t-tests using SciPy.
12. Run ANOVA test on sample groups; interpret results.
13. End-to-End Case: Load a dataset → EDA → Select test → Perform inferential analysis → Report conclusion.

CO-PO Mapping

CO	Program Outcomes (PO)											PSO	
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2
CO1	2	2	1	1	-	-	-	2	2	-	-	2	2
CO2	2	3	2	2	1	-	-	2	2	-	-	3	2
CO3	2	3	3	3	2	-	-	3	3	-	-	3	2
CO4	2	3	3	3	2	-	-	3	3	-	-	3	3
Average	2	2.75	2.25	2.25	1.67	-	-	2.5	2.5	-	-	2.75	2.25

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

HS2003: From Campus To Corporate – 2

Teaching Scheme	**Examination Scheme**
Credits: 2	MSE(O): 50 Marks
Lectures: 2 Hrs/week	ESE(O): 50 Marks
Practical: 0 Hrs/week	
Tutorial: 0 Hrs/week	

Section1:	**Topics/Contents**
Introduction to the Corporate World Understanding organizational structure and hierarchy, Work culture differences: campus vs. corporate, Employer expectations from fresh graduates, Time management and ownership in corporate settings Professional Communication Skills: Verbal and non-verbal communication, Email and business writing etiquette, Presentation skills and use of visual aids, Listening skills and telephone etiquette, Soft Skills and Interpersonal Effectiveness: Body language, grooming, and first impressions, Conflict resolution and negotiation skills, Team dynamics and collaboration, Assertiveness vs. aggressiveness Resume Building and Job Preparation: Building an effective resume and cover letter, identifying strengths and achievements, Preparing for technical and HR interviews, Handling rejections and feedback	
Section2:	**Topics/Contents**
Group Discussions and Personal Interviews: Group discussion formats and evaluation criteria, Strategies for initiating, contributing, and summarizing, Mock interviews with feedback, STAR technique for answering behavioral questions, Corporate Etiquette and Workplace Ethics: Meeting and greeting protocol, Dining and social etiquette, Work ethics, punctuality, confidentiality, Respect for diversity and inclusion in the workplace Adaptability and Emotional Intelligence: Handling pressure, deadlines, and ambiguity, Selfawareness and emotional regulation, Empathy and workplace relationships, Managing feedback and continuous learning, Introduction to Project Management Basics: Understanding tasks, milestones, deadlines, Collaboration using tools like Trello, Slack, Teams, Basics of Agile/Scrum concepts, Reporting and escalation protocol	
Text Books: ***(As per IEEE format)***	
1	Dale Carnegie, How to Win Friends and Influence People
2	Stephen R. Covey, 7 Habits of Highly Effective People
Reference Books: ***(As per IEEE format)***	

1	Shital Kakkar Mehra, Business Etiquette: A Guide for the Indian Professional
2	Peggy Klaus, The Hard Truth About Soft Skills

Faculty are supposed to do conduct following in the class

- Resume and LinkedIn profile workshops
- Mock interviews and GD sessions
- Role plays: workplace scenarios, conflict handling
- Business email writing exercises
- Presentation and elevator pitch sessions

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

HS2004: Reasoning And Aptitude Development- 4

Teaching Scheme	**Examination Scheme**
Credits: 1	ESE(O): 100 Marks
Lectures: 1 Hrs/week	
Practical: 0 Hrs/week	
Tutorial: 0 Hrs/week	

Course Outcomes:	
	After completion of the course, student will be able to
1.	Improve the reading, writing and verbal skills, and enhance comprehension and articulation abilities
2.	Develop logical reasoning abilities, enabling them to make sound decisions in problem-solving scenarios
3.	Develop mathematical aptitude as well as data interpretation abilities and use them in test cases and real world problems
4.	Learn to apply approaches for optimum time-management, prioritization maximizing the accuracy
5.	Learn data interpretation, apply mathematical skills to draw accurate conclusions
6.	Apply their knowledge of English, reasoning and quantitative skills for planning, critical thinking and real world problems

Section1:	**Topics/Contents**

English Language

Familiarity with English Language, Ability to understand written text, spoken word and effective communication through written documents; Coverage of vocabulary to cope up with general and specific terminology, syntax and sentence structure, prevention of incorrect use leading to distortion in communication; synonyms, antonyms and contextual vocabulary, Grammar – Error identification, sentence improvement and construction, Reading Comprehension

Logical Ability

Objective interpretation of things, ability to perceive and interpret trends to make generalizations; ability to analyze assumptions behind an argument or statement; Deductive reasoning: Assessment of ability to synthesize information and derive conclusions - Coding deduction logic, Data Sufficiency, Directional Sense, Logical word sequence, Objective reasoning, Selection and decision tables, puzzles; Inductive reasoning: Assessment of ability to learn by example, imitation or by trial – Analogy pattern recognition, Classification pattern recognition, Coding pattern recognition, Number series pattern recognition; Abductive reasoning: Critical thinking ability of seeing through logical weak links or loopholes in an argument or a group of statements;

Critical reasoning: assessment of ability to think through and analyze logical arguments, assessment of ability to use logical constructs to offer reasoning in unfamiliar situations; Information Gathering and synthesis: Ability of locating information, information ordering, rule based selection and data interpretation, order and classify data, interpret graphs, charts, tables and make rule based deductions. Application of these approaches for using visual, numerical and textual data from single or multiple sources

Section2:	**Topics/Contents**

Quantitative Ability

Basic numbers – decimals and fractions, factorization, divisibility: HCF, LCM, Odd, even, prime and rational numbers. Application of algebra to real world, direct and inverse proportion, common applications – Speed-time -distance, Profit-loss, percentage, age relations, mixtures, other miscellaneous quantitative combination, exponentials and logarithms, permutations and combinations, probability. Spatial reasoning: Inductive – Missing portions, Sequence and series; Deductive analysis.

Text Books: ***(As per IEEE format)***

1	R. Murphy, *English Grammar in Use*. Cambridge, U.K.: Cambridge University Press.
2	N. Lewis, *Word Power Made Easy*. New Delhi, India: Goyal Publishers & Distributors.
3	S. P. Bakshi, *Objective General English*. New Delhi, India: Arihant Publications.
4	K. Sinha, *English for Competitive Examinations*. New Delhi, India: S. Chand Publishing.
5	P. Gucker, *Essential English Grammar*. Hoboken, NJ, USA: Wiley.
6	M. A. Yadav, *English Idioms and Phrasal Verbs*. New Delhi, India: Vikas Publishing House.
7	S. Greenbaum, *The Oxford English Grammar*. Oxford, U.K.: Oxford University Press.
8	R. S. Aggarwal, *A Modern Approach to Verbal & Non-Verbal Reasoning*. New Delhi, India: S. Chand Publishing.

Reference Books: ***(As per IEEE format)***

1	N. K. Sinha, *Logical Reasoning and Data Interpretation for the CAT*. New Delhi, India: Pearson India, ISBN: 978-8131709117.
2	A. Sharma, *Logical Reasoning and Data Interpretation for the CAT*. New Delhi, India: McGraw Hill Education, ISBN: 978-0070709642.
3	B. S. Sijwali and I. Sijwali, *A New Approach to Reasoning Verbal and Non-Verbal*. New Delhi, India: Arihant Publications, ISBN: 978-9311124692.
4	R. S. Aggarwal, *Quantitative Aptitude for Competitive Examinations*. New Delhi, India: S. Chand Publishing, ISBN: 978-8121900637.
5	A. Sharma, *How to Prepare for Quantitative Aptitude for the CAT*. New Delhi, India: McGraw Hill Education, ISBN: 978-0070709642.

6	Pearson, *The Pearson Guide to Quantitative Aptitude for Competitive Examination*. New Delhi, India: Pearson India, ISBN: 978-8131709117.
7	A. Guha, *Quantitative Aptitude for Competitive Examinations*. New Delhi, India: Tata McGraw Hill Education, ISBN: 978-0070666653.
8	R. S. Aggarwal, *Data Interpretation & Data Sufficiency*. New Delhi, India: S. Chand Publishing, ISBN: 978-8121903515.
9	S. Chand, *Quantitative Aptitude for Competitive Examinations*. New Delhi, India: S. Chand Publishing, ISBN: 978-8121903423.

CO-PO Mapping

CO	**Program Outcomes (PO)**										**PSO**		
CO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PS O1**	**PS O2**
CO1	2	2	2	2	-	-	-		3	2	2		3
CO2	2	2	3	2	2	-	-		3	2	2	3	3
CO3	2	2	3	2	3	-	-		3	2	2	3	3
CO4	2	2	3	2	3	3	-	2	3	2	2	3	3
CO5	2	2	3	2	3	2	-		3	2	2	3	3
CO6	2	2	3	3	2	-	-		3	2	2	3	3
Average	2	2	2.83	2.83	2.6	2.5	-	2	3	2	2	3	3

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

SE2013: Design Thinking - 2

Teaching Scheme	**Examination Scheme**
Credits: 1	ESE: 100 Marks
Lectures: 0 Hrs/week	
Practical: 0 Hrs/week	
Tutorial: 1 Hrs/week	

Prerequisites:	
●	Problem Based Learning, Project Centric Learning
Course Objectives:	
●	To provide ecosystem for students and faculty for paper publication and patent filing
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the importance of doing Research
2.	Interpret and distinguish different fundamental terms related to Research
3.	Apply the methodology of doing research and mode of its publication
4.	Write a Research Paper based on project work
5.	Understand Intellectual property rights
6.	Use the concepts of Ethics in Research
7.	Understand the Entrepreneurship and Business Planning

Section1:	**Topics/Contents**
What is research? Importance of Paper Publication and Patents Structure of Paper Journal Publication Publication in conference Literature Review Research Paper Writing Journal Ratings and Evaluation How to rate a Journal? Intellectual property (IP) Research Ethics Entrepreneurship	
Section2:	**Topics/Contents**
Structure of The paper	

Journal List (Top 50 Journals)
Selection of the journal
Use of various online journal selection tools
Plagiarism checking
Improving contents of the paper
Patent drafting
Patent search
Filing of patent
Writing answers to reviewer questions
Modification in manuscript
Checking of publication draft

CO-PO Mapping

CO	Program Outcomes (PO)											PSO	
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	1	1	1	1	1	--	--	--	--	--	1	2	3
CO2	1	1	1	1	1	--	--	--	--	--	1	1	3
CO3	2	2	3	3	2	2	2	2	3	--	1	3	3
CO4	3	3	3	3	3	2	2	2	3	1	1	2	3
CO5	1	1	1	1	1	--	--	--	--	--	1	1	2
CO6	2	2	2	2	2	2	3	2	3	--	1	2	3
CO7	1	1	1	1	1	--	--	--	--	--	1	1	1
Average	1.57	1.57	1.71	1.71	1.57	2.0	2.33	2.0	3.0	1.0	1.0	1.71	2.5

Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Department of Computer Engineering (Software Engineering)

SE2014: Engineering Design And Innovation - 2

Teaching Scheme	**Examination Scheme**
Credits: 2	MSE: 30 Marks
Lectures: 0 Hrs/week	ESE: 70 Marks
Practical: 8 Hrs/week	
Tutorial: 0 Hrs/week	

Prerequisites:	
●	Problem Based Learning
Course Objectives:	
●	To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problems.
●	To Evaluate alternative approaches, and justify the use of selected tools and methods,
●	To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
●	To engage students in rich and authentic learning experiences.
●	To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
●	To develop an ecosystem to promote entrepreneurship and research culture among the students
Course Outcomes:	
	After completion of the course, student will be able to
1.	Identify the real life problem from societal need point of view
2.	Choose and compare alternative approaches to select most feasible one
3.	Analyze and synthesize the identified problem from technological perspective
4.	Design the reliable and scalable solution to meet challenges
5	Evaluate the solution based on the criteria specified
6	Inculcate long life learning attitude towards the societal problems

Section1:	**Topics/Contents**

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course based projects, curriculum can be enriched with semester long Engineering Design and Development courses, in which students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and

Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. Modern world sustained and advanced through the successful completion of projects. In short, if students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. Project centric learning will also redefine the role of teacher as mentor in the learning process. The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

Preamble –

The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of "Engineering Design" are designed as a ladder to extend connectivity of software technologies to solve real word problem using interdisciplinary approach. The ladder in the form of gradual steps can be seen as below: Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Group Structure:

- There should be a team/group of 4-5 students.
- A supervisor/mentor teacher assigned to individual groups.
- It is useful to group students of different abilities and nationalities together.

Selection of Project/Problem:

- Students must focus to initiate the task/idea. The idea inception and consideration shall be from following areas as a real world problem:
- Health Care, Agriculture, Defense, Education, Smart City, Smart Energy, Swaccha Bharat Abhiyan, Environment, Women Safety.
- This is the sample list to start with. Faculty and students are free to include other areas which meet the society requirements at large.
- The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem/project within an articulated disciplinary subject frame/domain. • A problem can be theoretical, practical, social, technical, symbolic,

cultural, and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

- By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

Teacher's Role in PCL:

- Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
- To utilize the principles of problems solving, critical thinking and metacognitive skills of the students. • To aware the group about time management.
- Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

- Students must have ability to initiate the task/idea .they should not be mere imitators.
- They must learn to think.
- Students working in PCL must be responsible for their own learning.
- Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
- Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
- Students in PCL are expected to work in groups.
- They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Developing Inquiry Skills:

- Students in PCL are expected to develop critical thinking abilities by constantly relating: What they read to do? What they want to do with that information?
- They need to analyze information presented within the context of finding answers.
- Modeling is required so that the students can observe and build a conceptual model of the required processes.
- Use the following mechanism to maintain the track of moving towards the solution. How effective is …….? How strong is the evidence for ……? How clear is ……?
- What are the justifications for thinking? Why is the method chosen?
- What is the evidence given to justify the solution?

Literature Survey – To avoid reinvention of wheel:

- It is integral part of self- directed learning
- Identify the information needed to solve a given problem or issue
- Be able to locate the needed information
- Use the information to solve the given problem effectively.
- Skills required by students in information literacy include:
- How to prepare the search? How to carry out the research
- Sorting and assessing of information in general

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- • Reflection Skills

Section2:	**Topics/Contents**

EDD Sample Case Studies: -

With the adaptation of industry communication standards, Raspberry Pi and Sensors, following projects can be taken up: 1) Design a deployable product for soil moisture detection 2) Design a deployable product for temperature detection 3) Design a deployable product for pressure detection 3) Design a deployable product smoke detection 4) Design a deployable product for motion detection 5) Design a deployable product for collision detection 6) Design a deployable product for sound detection

...not limited to.....Faculty and students are free to include other areas which meet the society requirements at large.

Text Books: ***(As per IEEE format)***

1	*A new model of problem based learning.* By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017
2	*Problem Based Learning*. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.
3	*Stem Project based learning and integrated science, Technology, Engineering and mathematics approach.* By Robert Robart Capraro, Mary Margaret Capraro

Reference Books: ***(As per IEEE format)***

1	De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.
2	Project management core textbook, second edition, Indian Edition, by Gopalan.
3	The Art of Agile Development. By James Shore & Shane Warden
URL for Self-Study:	
1	https://worldwide.espacenet.com/
2	https://nptel.ac.in/

CO-PO Mapping

CO	**Program Outcomes (PO)**											**PSO**	
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO 11**	**PS O1**	**PS O2**
CO1	2	2	2	2	-	-	-	-	3	-	2	-	3
CO2	2	2	3	2	2	-	-	-	3	-	2	3	3
CO3	2	2	3	2	3	-	-	-	3	-	2	3	3
CO4	2	2	3	2	3	3	-	2	3	-	2	3	3
CO5	2	2	3	2	3	2	-	-	3	-	2	3	3
CO6	2	2	3	3	2	-	-	-	3	-	3	3	3
Average	2	2	2.83	2.83	2.6	2.5	-	2	3	-	2.13	3	3