

Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)



**Curriculum for  
Third Year B. Tech.  
(Computer Engineering)  
2020 Pattern**

**(AY 2023-24)**

**Department of  
Computer Engineering**



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

## **Vision and Mission of the Department**

- **Vision**

“Excellence in the field of Computer Engineering for rendering services to the industry and society”.

- **Mission**

- To empower our students for substantial contribution to economical, technological, entrepreneurial and social progress of the society.
- To strive for excellence at different levels and diverse dimensions in the field of computer engineering.
- To encourage students to pursue research and advanced studies for better adaptability towards globalization.

## **Program Specific Outcomes (PSOs)**

At the end of program, students should be able to

- **PSO a:** Use knowledge to write programs and integrate them with the hardware/software products in the domains of embedded systems, data Science, networking and web technology.
- **PSO b:** Participate in planning and implement solutions to cater to business – specific requirements, displaying team dynamics and professional ethics.

## **Program Outcomes (POs)**

At the end of program, students should 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, social 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 modeling 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.
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.



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

# Third Year B.Tech.

## Pattern 2020

## Syllabus Structure

### (AY 2023-24)



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
 (An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**Third Year B.Tech. Computer Engineering (TYBT) - Semester V**

**(Pattern 2020) AY 2023-24**

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/TW		
<b>CSUA31208</b>	Design and Analysis of Algorithms*	TH	3	0	2	20	30	20	30	25	125	4
<b>CSUA31202</b>	Data Science and Machine Learning*	TH	3	0	2	20	30	20	30	25	125	4
<b>CSUA31203</b>	Computer Networks – I	TH	3	0	2	20	30	20	30	25	125	4
<b>CSUA31204</b>	Software Engineering and Project Management	TH	3	-	-	20	30	20	30	-	100	3
<b>CSUA31205</b>	Professional Elective I*	TH	3	0	2	20	30	20	30	25	125	4
<b>CSUA31206</b>	Project - I	CE	-	-	4	-	-	-	-	25	25	2
<b>CSUA31207</b>	Intellectual Property Rights	CE	2	-	-	-	-	50	-	-	50	2
	Total		17	0	12	100	150	150	150	125	675	23

\*Indicates PR/OR

Professional Elective-I	
<b>CSUA31205A</b>	Computer Graphics
<b>CSUA31205B</b>	Business Intelligence and Data Analytics
<b>CSUA31205C</b>	Internet of Things
<b>CSUA31205D</b>	Artificial Intelligence

**Honors Course**

**HIT31201A:** Fundamentals of AR/VR (*Augmented and Virtual Reality (AR/VR)*)

**HIT31201B:** Essentials of Cyber Security (*Cyber Security*)

**HCS31201C:** Introduction to Quantum Computing (*Quantum Computing*)

**HCS31201D:** Blockchain Foundation (*Blockchain Technology*)

**BoS Chairman**

**Dean Academics**

**Director**



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
 (An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**Third Year B.Tech. Computer Engineering (TYBT) - Semester VI**

**(Pattern 2020) AY 2023-24**

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/TW		
<b>CSUA32207</b>	Language Processor and Compiler Construction*	TH	3	0	2	20	30	20	30	25	125	4
<b>CSUA32202</b>	Professional Elective-II*	TH	3	0	2	20	30	20	30	25	125	4
<b>CSITUA32203</b>	Cloud Computing	TH	3	0	2	20	30	20	30	25	125	4
<b>CSUA32204</b>	Professional Elective-III*	TH	3	0	2	20	30	20	30	25	125	4
<b>IOEUA32205</b>	Open Elective-I	TH	3	-	-	20	30	20	30	-	100	3
<b>CSUA32206</b>	Project - II	CE	1	-	2	-	-	-	-	25	25	2
<b>M3</b>	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total		16	0	10	100	150	100	150	125	625	21

\*Indicates PR/OR

Professional Elective-II		Professional Elective-III	
<b>CSUA32202A</b>	Augmented and Virtual Reality	<b>CSUA32204A</b>	Blockchain Technology
<b>CSUA32202B</b>	Advanced Machine Learning	<b>CSUA32204B</b>	Software Robotics
<b>CSUA32202C</b>	Digital Forensics	<b>CSUA32204C</b>	Edge Artificial Intelligence
<b>CSUA32202D</b>	Agile Methodology and DevOps	<b>CSUA32204D</b>	Software Design Architecture

**Open Elective -I**

**IOEUA32205A:** Social Science & Engineering Economics (*IT*)

**IOEUA32205B:** Engineering Economics and FinTech (*Comp*)

**IOEUA32205C:** Explainable Artificial Intelligence (XAI) for Engineering Applications (*AI&DS*)

**IOEUA32205D:** Management Information System (*E&TC*)

**IOEUA32205E:** Professional Practice, Law and Ethics (*Civil*)

**IOEUA32205F:** Industrial Engineering (*Mech*)

**IOEUA32205G:** Robotic Process Automation (*Industry*)

**Honors Course**

**HIT32202A:** App development using WebXR and Unity (*Augmented and Virtual Reality (AR/VR)*)

**HIT32202B:** Cryptography and Network Security (*Cyber Security*)

**HCS32202C:** Quantum Programs and Quantum Algorithms (*Quantum Computing*)

**HCS32202D:** Application Development on Public Blockchain Using Ethereum (*Blockchain Technology*)

**BoS Chairman**

**Dean Academics**

**Director**

Third Year B.Tech. (Pattern 2020)

Computer Engineering



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

# SEMESTER– V



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32108: Design and Analysis of Algorithms**

**Teaching Scheme**

Credits: 4  
Lectures: 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- Discrete Mathematics
- Data Structures
- Theory of Computation

**Course Objectives :**

- To study the analysis of algorithms
- To study the greedy and dynamic programming algorithmic strategies
- To study the backtracking and branch and bound algorithmic strategies
- To study the concept of hard problems through understanding of intractability and NP-Completeness
- To study some advance techniques to solve intractable problems
- To Study multithreaded and distributed algorithms

**Course Outcomes:**

- After completion of the course, student will be able to
1. Analyze algorithms for their time and space complexities in terms of asymptotic performance.
  2. Apply greedy and dynamic programming algorithmic strategies to solve a given problem
  3. Apply backtracking and branch and bound algorithmic strategies to solve a given problem
  4. Identify intractable problems using concept of NP-Completeness
  5. Use advance algorithms to solve intractable problems
  6. Solve problems in parallel and distributed scenarios

**Unit I : Introduction**

Analysis of Algorithms, Best, Average and Worst case running times of algorithms, Mathematical notations for running times  $O$ ,  $\Omega$ ,  $\Theta$ , Master's Theorem  
Problem solving principles: Classification of problem, problem solving strategies, classification of time complexities (linear, logarithmic etc.).  
Divide and Conquer strategy: General strategy, Quick Sort and Merge Sort w.r.t. Complexity

**Unit II : Greedy Method & Dynamic Programming**

Greedy Method: General strategy, the principle of optimality, Knapsack problem, Job Sequencing with Deadlines, Huffman coding. Dynamic Programming: General Strategy, 0/1 Knapsack, OBST, multistage graphs





Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**Unit III : Backtracking, Branch and Bound**

Backtracking: The General Method 8 Queen's problem, Graph Coloring Branch and Bound: 0/1 Knapsack, Traveling Salesperson Problem.

**Unit IV : Intractable Problems and NP-Completeness**

Time-Space trade off, Tractable and Non-tractable Problems, Polynomial and non-polynomial problems, deterministic and non-deterministic algorithms P-class problems, NP-class of problems, Polynomial problem reduction, NP complete problems- Vertex cover and 3-SAT and NP hard problem - Hamiltonian cycle

**Unit V : Approximation and Randomized Algorithms, Natural Algorithms**

Approximation algorithms, Solving TSP by approximation algorithm, approximating Max Clique Concept of randomized algorithms, randomized quicksort algorithms, Natural Algorithms–Evolutionary Computing and Evolutionary Algorithms, Introduction to Genetic Algorithm, Simulated Annealing

**Unit VI : Parallel and Concurrent Algorithms**

Parallel Algorithms: Sequential and parallel computing, RAM&PRAM models, Amdahl's Law, Brent's theorem, parallel algorithm analysis, multithreaded matrix multiplication, Concurrent Algorithms: Dining philosophers problem

**Text Books :**

1. Gilles Brassard, Paul Bratley, "Fundamentals of Algorithmics", PHI, ISBN 978-81-203-1131-2
2. Horowitz and Sahani, "Fundamentals of Computer Algorithms", University Press, ISBN: 978 81 7371 6126, 81 7371 61262

**Reference Books :**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press; ISBN 978-0-262-03384-8
2. Parag Himanshu Dave, Himanshu Bhalchandra Dave, "Design And Analysis of Algorithms", Pearson Education, ISBN 81-7758-595-9
3. Rajeev Motwani and Prabhakar Raghavan, "Randomized Algorithms", Cambridge University Press, ISBN: 978-0-521-61390-3
4. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", Wiley, ISBN 978-81-265-0986-7
5. Dan Gusfield, "Algorithms on Strings, Trees and Sequences", Cambridge University Press, ISBN: 0-521-7035-7

**List of Assignments:**

Note: Perform the following lab assignments using C++/Java/Python

1. Implement Quick Sort using divide and conquer strategy.
2. Implement 0/1 knapsack using Dynamic Programming.
3. Implement 8 queens problem using Backtracking
4. Implement Travelling Salesman problem using branch and bound technique.
5. Implement Travelling Salesman problem using Genetic Algorithm
6. Implement Concurrent Dining Philosopher Problem.
7. Implement multithreaded matrix multiplication.



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA31202 : Data Science and Machine Learning (DSML)**

**Teaching Scheme**

Credits : 4  
Lectures : 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation (CE): 20 Marks  
In-Semester Examination (ISE): 30 Marks  
Skills & Competency Exam.(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- Probability and Statistics

**Course Objectives :**

- Understand the data science life cycle
- Learn the statistical methods data pre-processing
- Learn and apply unsupervised approach for prediction.
- Learn and apply Supervised models for prediction
- Interpret classification outcome
- Learn effective data visualization

**Course Outcomes :**

After completion of the course, student will be able to

1. Describe the Data Science Process and explore components interaction.
2. Apply statistical methods for pre-processing and extracting meaning from data to the application dataset.
3. Apply specific unsupervised machine learning algorithm for a particular problem.
4. Apply specific supervised machine learning algorithm for a particular problem.
5. Analyse the outcome in terms of efficiency.
6. Analyse and organize data using visualization tools.

**Unit I : Introduction to Data Science**

Introduction: Big data overview, state of the practice in Analytics- BI Vs Data Science, Current Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach. Philosophy of Exploratory Data Analysis, The Data Science Process, A Data Scientist's Role Data Analytic Life Cycle: Overview, phase 1- Discovery, Phase 2- Data preparation, Phase 3- Model Planning, Phase 4- Model Building, Phase 5- Communicate Results, Phase 6-Operationalize. Case Study. Statistical description and inference of Data (Flipped Classroom)

**Unit II : Preprocessing and Extracting meaning from Data**

Identifying Missing values and approaches, Noisy Data Extraction, Data Cleaning as a process , Data reduction, Data Transformation and Discretization : Data Transformation by Normalization, Discretization by Binning Discretization by Histogram Analysis



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

Discretization by Cluster, Decision Tree, and Correlation and Regression analysis reasons to choose and cautions

**Unit III : Unsupervised Modelling**

Cluster Analysis: Basic Concepts and Methods, Partitioning Methods: k-Means: A Centroid-Based Technique, k-Medoids: A Representative Object-Based Technique, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering

**Unit IV : Supervised Models:**

Classification Decision trees- Overview, general algorithm, decision tree algorithm, evaluating a decision tree using Gini Index and Entropy ,Naïve Bayes – Bayes Theorem and Algorithm, Naïve Bayes Classifier, smoothing, diagnostics. Diagnostics of classifiers, additional classification methods.

**Unit V : Model Evaluation and Selection**

Metrics for Evaluating Classifier Performance Model Selection Using Statistical Tests of Significance Comparing Classifiers Based on Cost–Benefit and ROC Curves, Confusion Matrix, F-Measure, Precision, Recall

**Unit VI : Data Visualization (Case study)**

Basic principles, ideas, types and tools for data visualization, Visualization of Numerical Data, Visualization of Non-Numerical Data, The Visualization Dashboard

**Text Books :**

1. David Dietrich, Barry Hiller, “Data Science & Big Data Analytics”, EMC education services, Wiley publications, 2012, ISBN0-07-120413-X
2. Data Mining Concepts and Techniques, 3rd edition, Morgan Kaufman
3. Cathy O’Neil and Rachel Schutt. “Doing Data Science, Straight Talk From The Frontline”, O’Reilly.

**Reference Books :**

1. U Dinesh Kumar, “Business Analytics”, Wiley Tom Mitchell
2. “Machine Learning”, McGraw Hill Publication, ISBN : 0070428077 9780070428072

**Suggested List of Assignments: (Not limited to those mentioned below)**

1. Perform the following operations using R/Python on suitable data sets, read data from different formats(like csv, xls),indexing and selecting data, sort data, describe attributes of data, checking data types of each column, counting unique values of data, format of each column, converting variable data type (e.g. from long to short, vice versa), identifying missing values and fill in the missing values
2. Perform the following operations using R/Python on the data sets Compute and display summary statistics for each feature available in the dataset. (e.g. minimum value, maximum value, mean, range, standard deviation, variance and percentiles · Data Visualization-Create a histogram for each feature in the dataset to illustrate the feature distributions. · Data cleaning · Data integration · Data transformation · Data model building(e.g. Classification)
3. Write a program to do: A dataset collected in a cosmetics shop showing details of customers and whether or not they responded to a special offer to buy a new lip-stick is shown in table below.



Use this dataset to build a decision tree, with Buys as the target variable, to help in buying lipsticks in the future. Find the root node of decision tree. According to the decision tree you have made from previous training data set, what is the decision for the test data: [Age < 21, Income = Low, Gender = Female, Marital Status = Married]?

4. Write a program to do following: We have given a collection of 8 points.  $P1=[0.1,0.6]$   $P2=[0.15,0.71]$   $P3=[0.08,0.9]$   $P4=[0.16, 0.85]$   $P5=[0.2,0.3]$   $P6=[0.25,0.5]$   $P7=[0.24,0.1]$   $P8=[0.3,0.2]$ . Perform the k-mean clustering with initial centroids as  $m1=P1$  =Cluster#1=C1 and  $m2=P8$ =cluster#2=C2. Answer the following 1] Which cluster does P6 belongs to? 2] What is the population of cluster around  $m2$ ? 3] What is updated value of  $m1$  and  $m2$ ?
5. Visualize the data using R/Python by plotting the graphs for assignment no. 1 and 2. Use Scatter plot, bar plot, Box plot and Histogram OR Perform the data visualization operations using Tableau for the given dataset. Consider suitable data set.
6. Identify problem statement. Use Semi or unstructured data set. Define 3 to 4 objectives. Perform 1. Data Interpretation, 2. Data preprocessing, 3. Data Modeling (perform classification, Prescriptive Analysis (if required and fits for the data set)), and 4.data visualization. (Mini project is to be performed in a group of 3 to 4 students).



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA31203 : Computer Networks – I**

**Teaching Scheme**

Credits : 4  
Lectures : 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CIE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
TW: 25 Marks

**Prerequisites :**

- NA

**Course Objectives :**

- To study the fundamentals of networking.
- To understand functionalities of Physical layer.
- To understand the functionalities of Data Link Layer and Network Layer.
- To study various protocols at Transport and Application Layer.
- To learn Integrity checks and Authentication algorithms.
- To learn various types of Cryptographic algorithm.

**Course Outcomes :**

- After completion of the course, student will be able to
1. Explore network design issues.
  2. Recognize the functions of OSI layers & TCP/IP protocol stack.
  3. Describe and Demonstrate the functionality of Data Link Layer and Network Layer.
  4. Describe the functionality of Transport and Application Layer.
  5. Examine the protocols for integrity and authentication.
  6. Make use of various Cryptographic algorithm.

**Unit I : Introduction to Computer Network**

Network, Network Topologies.

**Transmission Media and Switching:** Guided Media: Twisted-Pair, Coaxial and Fiber-Optic Cable Unguided Media: Radio Waves, Microwaves, Infrared IEEE standard and connectors for media. (RJ45, RJ11, BNC, SC/ST etc.) Circuit-switched Networks: Three Phases, Efficiency, Delay, Packet switching: Datagram networks, Virtual circuit networks, Brief introduction of Digital Subscriber Line: ADSL, HDSL, SDSL, VDSL (DMT), Cable modem.

**Unit II : Physical Layer**

LANs, WANs, and the Internet, PAN, Ad-hoc and WLAN Network, Network Architectures: Client-Server; Peer To Peer; Network as a Platform, Network Topologies, OSI Model, TCP/IP protocol suite; Layer Details, Addressing: Physical &logical Addresses, Port Addresses, Specific Addresses. Connecting devices: Hubs (Passive, active, Intelligent),



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

Switches (Layer-2, Layer-3 and Managed), Bridges, Routers, Gateway.

**Unit III : Data Link Layer and Network Layer**

Data Link Layer Protocols, Media Access Control. Address Resolution Protocol. Types of Errors: Redundancy, Detection Versus Correction, Forward Error Correction Versus Retransmission. Network Layer Protocols, Routing, Routers, Configuring a Router. IP Addressing: IPv4 Network Addresses, IPv6 Network Addresses, Connectivity Verification. Subnetting IP Networks: Subnetting an IPv4 Network, Addressing Schemes, Address Schemes, Design consideration for IPv6.

**Unit IV : Transport Layer and Application Layer**

Transport Layer: Transport Layer Protocols, Role of transport layer, Responsibilities of Transport layer, Transport layer reliability. TCP and UDP: TCP communication Process, Reliability and flow control, UDP Communication, applications of TCP and UDP. Application Layer: Application Layer Protocols, Application layer protocols interaction with end-user applications, Presentation and Session layers. Well-Known Application Protocols and Services.

**Unit V : Integrity checks and Authentication algorithms**

MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications.

**Unit VI : Principles of Public Key Cryptosystems**

RSA algorithm - security of RSA - key management, Diffie–Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography –Elgamel encryption - Message Authentication and Hash Function: Authentication requirements -authentication functions - message authentication code - hash functions - birthday attacks –security of hash functions and MACS.

**Text Books :**

1. Fourouzan B., "Data Communications and Networking", 5th edition, McGraw-Hill Publications.
2. Stallings William., "Data and Computer Communications", Sixth Edition, Prentice Hall of India.
3. Andrew S. Tanenbaum , "Computer Networks", Pearson
4. Atul Kahate, "Cryptography and Network Security", McGraw Hill Publication, 2<sup>nd</sup> Edition, 2008, ISBN : 978-0-07-064823-4.
5. Dr. V.K. Pachgare, "Cryptography and Network Security", PHI, 2<sup>nd</sup> Edition, 2015.

**Reference Books :**

1. CCNA Basics and Fundamentals-Cisco
2. CCNA Routing and Switching 200-125 Official Cert. Guide Library
3. Cisco CCNA Command Guide- An Introductory Guide for Complete Beginners



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**Suggested List of Assignments:**

1. Configure Initial Switch and Router Settings using Packet Tracer.
2. Subnet an IPv4 Network.
3. Configure Secure Passwords and SSH using Packet Tracer.
4. Design and Build a Small Business Network using Packet Tracer.
5. Socket Programming using TCP/IP.
6. Write a python code to implement Diffie–Hellman and MD5.
7. Write a python code to implement RSA Encryption and Decryption.





Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA31204 : Software Engineering and Project Management**

**Teaching Scheme**

Credits : 3  
Lectures : 3 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks

**Prerequisites :**

- NA

**Course Objectives :**

- To learn and understand the principles of Software Engineering
- To know methods of capturing, specifying, visualizing and analyzing software requirements
- To understand the design process, model and architectural design
- To understand how to manage projects and manage the risks involved
- To learn to estimate cost and schedule of a software project
- To learn team management skills

**Course Outcomes :**

After completion of the course, student will be able to

1. Select a proper process model for a software project development
2. Prepare Software Requirements Specification (SRS) of a system
3. Design UI Interface and Web App Interface
4. Create project plan and RMMM plan
5. Estimate cost and schedule of the software project
6. Demonstrate team management skills

**Unit I : Introduction to Software Engineering**

Nature of Software, Software Process, Software Engineering Practice, software Myths, Generic Process model, Process Models: Waterfall Model, Incremental Models, Evolutionary Models, Concurrent, Specialized Process Models, Personal and Team Process Models,

**Unit II : Requirements Engineering**

Requirements Engineering, Initiating the process, Eliciting Requirements, Building the Requirements Model, Negotiating, validating requirements, Requirements Analysis, Scenario-Based Analysis, Requirements Modeling strategies, Flow-Oriented Modeling, Class based modeling, SRS.

**Unit III : Design Engineering**

Design Process, Design Concepts, The Design Model: Data Design, Architectural, interface Design Elements.

Architectural Design: Software Architecture, Architectural Styles, Architectural Design, User Interface Design: Rules, User Interface Analysis and Design, Applying Interface Design





Bansilal Ramnath Agarwal Charitable Trust's

## **Vishwakarma Institute of Information Technology, Pune-48**

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

### **Department of Computer Engineering**

Steps, Issues, Web App Interface Design Principles

#### **Unit IV : Project Management Framework**

Overview of project Management, Project Organization, Planning a s/w project , Project management life cycle, Risk management, Identification of Risks , Risk Analysis ,Risk Planning & Monitoring

#### **Unit V : S/w Project Estimation and Scheduling**

Project Estimation , Different methods of estimation (COCOMO model, Delphi cost estimation etc.) , Function point analysis, PERT & Gantt Charts , Introduction to Microsoft Project, CM planning, Change Management , Version and Release Management, Configuration Management Tools

#### **Unit VI : S/W Team Management**

Characteristics of Performance management, High performance Directive and collaborative styles, Team Structure, Team Communication, Managing customer expectations, Group Behavior, User role in project management, User role in various stages of S/W Development, User role in System implementation

#### **Text Books :**

1. Roger Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill
2. Ian Sommerville, " Software Engineering", Addison and Wesley

#### **Reference Books :**

1. Rajib Mall, "Fundamentals of Software Engineering, Prentice Hall India
2. Pankaj Jalote, "An Integrated Approach to Software Engineering, Springer
3. Carlo Ghezzi, "Fundamentals of Software Engineering", Prentice Hall India
4. Software Project management Edwin Bennatan
5. Software Engineering concepts Richard Fairley
6. Software Project Management S.A. Kelkar
7. System Analysis and Design Methods Whitten, Bentley and Dittman



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA31205A: Professional Elective – I**  
**Computer Graphics**

**Teaching Scheme**

Credits : 4  
Lectures : 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- Knowledge of Programming, Basic Data Structures and Mathematics

**Course Objectives :**

- To acquaint the learner with the basic concepts of Computer Graphics
- To learn the various algorithms for generating and rendering graphical figures
- To get familiar with mathematics behind the graphical transformations and projections.
- To understand and apply various methods and techniques related to illumination, shading and hidden surfaces.
- To understand the concepts related to Segmentation, Animation and Virtual Reality.
- To illustrate the concepts related to Curves, Fractals and Color Models.

**Course Outcomes:**

- After completion of the course, student will be able to
1. Apply mathematics and logic to develop computer programs for elementary graphic operations.
  2. Develop scientific and strategic approach to solve complex problems in the domain of Computer Graphics.
  3. Apply the basic principles of 2 and 3-Dimensional transformations and projections of computer graphics.
  4. Apply the logic to develop complex objects with Light sources, Shading and Hidden surfaces.
  5. Apply the logic to develop Animation and Gaming programs.
  6. Apply the logic to develop Curves, Fractals and Color Models.

**Unit I : Graphics Primitives and Scan Conversion**

Concepts, applications of computer graphics, pixel, frame buffer, resolution, aspect ratio.

Plotting Primitives: Scan conversions, lines, line segments, vectors, pixels and frame buffers, vector generation.

Display Files: display file structure, algorithms, and display file interpreter. Primitive



operations on display file.

Scan Conversion: Line and line segments, line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham's, Line styles: thick, dotted and dashed. Circle drawing algorithm: Bresenham. Character generating methods: stroke and bitmap method.

**Unit II : Polygons and Clipping Algorithms**

Introduction to Polygon, Types: Convex, Concave and Complex. Representation of polygon, Inside test, Polygon filling algorithms – Flood fill, Seed fill, Scan line fill.

Windowing and clipping: Viewing transformations, 2-D clipping: Cohen – Sutherland algorithm, Polygon clipping: Sutherland Hodgeman algorithm.

**Unit III : 2-D, 3-D Transformations and Projections**

2-D Transformations: Introduction, Matrices, Translation, Scaling, Rotation, Homogeneous coordinates and matrix representation, Rotation about an arbitrary point, inverse, and shear transformation.

3-D Transformations: Introduction, 3-D geometry, primitives, 3-D transformations and matrix representation, rotation about an arbitrary axis, 3-D viewing transformations.

Projections: Parallel Projection (Oblique: Cavalier, Cabinet and orthographic: isometric, diametric, trimetric) and Perspective Projection (Vanishing Points – 1 point, 2 point and 3 point)

**Unit IV : Illumination, Shading and Hidden Surfaces**

Illumination Models: Light Sources, Ambient Light, Diffuse reflection, Specular Reflection, and the Phong model, Combined diffuse and Specular reflections with multiple light sources.

Shading Algorithms: Gouraud and Phong Shading.

Hidden Surfaces: Introduction, Back face detection and removal, Algorithms: Depth buffer (z), Depth sorts (Painter), Area subdivision (Warnock), BSP tree.

**Unit V : Segment, Animation and Graphics Tools**

Segment: Introduction, Segment table, Segment creation, closing, deleting and renaming, Visibility. Animation: Introduction, Design of animation sequences, Animation languages, Key-frame, Morphing, Motion specification.

Graphics Tools: Introduction to graphics tool: OpenGL, WebGL & usage of at least one tool of computer graphics (3D studio, Maya, Blender, Unity, or Similar open-source tools).

**Unit VI : Curves, Fractals and Color Models**

Curves: Introduction, Interpolation and Approximation, Blending function, B-Spline curve, Bezier curve, Fractals: Introduction, Classification, Applications, Fractal generation: snowflake, Triadic curve, Hilbert curve.

Color models and applications: Properties of Light, CIE chromaticity Diagram, RGB, HSV, CMY, YIQ, color Selection and applications.

**Text Books :**

1. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 –100472 – 6.
2. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.
3. Donald D. Hearn, —Computer Graphics with Open GL, 4th Edition, ISBN-13: 9780136053583

**Reference Books :**



Bansilal Ramnath Agarwal Charitable Trust's

## **Vishwakarma Institute of Information Technology, Pune-48**

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

### **Department of Computer Engineering**

1. D. Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN 81 – 7808 – 794 – 4.
2. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8.
3. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.

#### **List of Assignments :**

1. Write C++/JavaScript/Java program to draw line using DDA and Bresenham's algorithm.
2. Write C++/JavaScript/Java program to draw circle using Bresenham's algorithm.
3. Write C++/JavaScript/Java program to draw 2-D object and perform following basic transformations,  
a) Scaling b) Translation c) Rotation.
4. Write C++/JavaScript/Java program to fill polygon using Scan Line Fill algorithm.
5. Write C++/JavaScript/Java program to draw a polygon and fill it with desired colour using Seed fill algorithm.
6. Design a Bouncing ball animation using Maya / Blender/Unity.
7. Write C++/JavaScript/Java program to simulate any one of the scenes using CG algorithms- (Mini Project)
  1. Vehicle Locomotion.
  2. Airplane Landing.
  3. Any Game with locomotion.
  4. Academic Animation (such as Stack Operation, Queue Operation, Tower of Hanoi, Graph Traversal etc.)



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA31205B: Professional Elective – I**  
**Business Intelligence and Data Analytics**

**Teaching Scheme**

Credits : 4  
Lectures : 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- Database Management System
- Data Structures

**Course Objectives :**

- To learn the basics of the Business intelligence Process
- To understand the Decision making support system.
- To learn the design of data warehouse
- To learn modelling a web based social business problem
- To design a dashboard using visualization technique.
- To understand different analytics techniques

**Course Outcomes:**

- After completion of the course, student will be able to
1. Understand the Business intelligence concept for projects.
  2. Apply Decision support system techniques for BI applications.
  3. Apply the data warehouse for business intelligence.
  4. Understand the knowledge of emerging and critical area in social media analytics.
  5. Apply contemporary visualization techniques and tool for real/distinguished time applications.
  6. Understand analytical techniques for different case studies.

**Unit I : Business Intelligence Concepts**

Introduction to data, Information and Knowledge, Operational and Informational data, Introduction to Business Intelligence, BI architecture and its components, BI opportunities, Benefits of BI, Factors Responsible for successful BI Project, Obstacle to Business Intelligence in an Organization.

**Unit II : Decision Making and Support System**

Concept of Decision Making system and its importance, Decision making process, Common strategies and approaches of decision makers, Decision support system(DSS) : Role of DSS, its main components, its various techniques, Types and classification, Applications of DSS, Role of Business intelligence in DSS.

**Unit III : Data Warehouse**

Introduction, Data Warehouse Modelling: Data Cube and OLAP Data Warehouse Design and



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

Usage, Distributed Data-warehouse and materialized view, Different types of OLAP and their applications, Difference between OLAP and OLTP, Big Data Lakes.

**Unit IV : Web and Social Media Analytics**

Introduction of unstructured data, Preprocessing of unstructured data, Challenges in processing of unstructured data, Applications, Introduction of Text Mining and Web Mining, Social Media Platforms, Performance and evaluation measures, Basic & Advanced Web Metrics Google Analytics, Campaign analytics IP .

**Unit V : Visualization**

Introduction to Tableau, Basic charts and Dashboards, Dashboard design and principal, Integrate Tableau with Google sheet.

**Unit VI : Recent application / Case studies**

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, BI 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. Raghu Ramkrishnan, Johannes Gehrke, Database Management Systems, Second Edition
2. William Inmon, "Building the Data Warehouse", Wiley publication 4th edition
3. Introduction to business Intelligence and data warehousing, IBM, PHI.
4. Introduction to Information Retrieval. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, Cambridge University Press, 2007

**Reference Books :**

1. Data Mining: Concepts and Techniques, Han, Elsevier ISBN:9789380931913
2. Business Intelligence – Data Mining and Optimization for Decision Making – Carlo Vercellis – Wiley Publications.

**List of Assignments:**

Note : Lab instructor can frame suitable assignment list referring to the following list.

1. Design Decision support system for any application such as banking application, where a bank loan officer verifying the credit of a loan applicant or an engineering firm that has proposal on several projects and wants to know if they can be competitive with their costs.
2. 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.
3. Perform text preprocessing with creation of inverted index for unstructured data (text). Consider suitable data set.
4. Study and implement opinion mining / sentiment analysis for sample online/offline application
5. Perform Visual analytics using Tableau /R/Python/Excel for the given use case in assignment 1 and 2.



Bansilal Ramnath Agarwal Charitable Trust's

## **Vishwakarma Institute of Information Technology, Pune-48**

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

### **Department of Computer Engineering**

6. Create a dashboard using device designer for assignment 1 and 2.
7. Integrate tableau with Google sheet and plot various graph like tableplot, histogram, boxplot for the suitable data
8. For the given use case perform sorting, using measure, Sorting using header and legends, grouping using data window and calculate static and dynamic grouping.
9. Design an inventory control management system using python/R for given case study.
10. Design a risk analysis model using Python/R to predict market risk using stock case study.



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA31205C: Professional Elective – I**  
**Internet of Things (IOT)**

**Teaching Scheme**

Credits : 4  
Lectures : 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CIE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- NA

**Course Objectives :**

- To understand fundamentals of IoT
- To gain knowledge of IoT protocols
- To implement small IoT systems using building blocks of IoT
- To comprehend fundamentals of security in IoT
- To learn how secure infrastructure for IoT is implemented
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies

**Course Outcomes :**

After completion of the course, student will be able to

1. Illustrate the fundamentals of IoT
2. Compare the distinguished IoT protocols
3. Design small IoT Systems using building blocks of IoT
4. Illustrate the security issues in IoT
5. Summarize the concepts of Cloud & Fog Computing
6. Develop cloud based IoT application

**Unit I : Introduction to IoT**

IoT: Definition and characteristics of IoT, Internet of Things: Vision, Emerging Trends, Economic Significance, Technical Building Blocks, Physical design of IoT, Things of IoT, IoT Protocols, Logical design of IoT, IoT functional blocks, IoT communication models, IoT Communication APIs, IoT enabling technologies, IoT levels and deployment templates, IoT Issues and Challenges, Applications.

**Unit II : Protocols for IoT**

IoT Protocols Organization, IoT Data Protocols: CoAP, MQTT, AMQP, DDS, IPv6, ZigBee, Bluetooth, Wifi, 6LowPAN, Comparison of Traditional Networking Protocols and IoT Protocols

**Unit III : IoT & M2M**

Machine to Machine, Difference between IoT and M2M, IoT Physical Devices and Endpoints: Basic building blocks of an IoT device, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Introduction to





Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python

**Unit IV : Security in IoT**

IoT Security: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modelling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for IoT

**Unit V : Cloud Computing and Fog Computing**

Introduction to Cloud Computing, Cloud of things, Cloud Middleware, Cloud Standards – Cloud Providers and Systems, Mobile Cloud Computing, The Cloud of Things Architecture. Challenges and issues in cloud Computing. Fog Computing, Need of Fog computing, Fog Computing Architecture. Edge Computing, Edge computing benefits and challenges.

**Unit VI : IoT Case Studies**

Case Studies: Home Automation, Weather Monitoring System, Air quality Monitoring, Smart Irrigation, Smart cities, Health Care, Manufacturing industry, Transportation

**Text Books :**

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
2. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012. ISBN : 9781439892992
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer, 2011. ISBN: 978-3-642-19156-5

**Reference Books :**

1. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012, ISBN:978-1-119-99435-0
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010.ISBN : 978-0-470-90356-8
4. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014, ISBN: 978-1-118-43063-7

**List of Assignments:**

1. Study of Arduino and Raspberry Pi.
2. Installation of Raspbian OS on Raspberry Pi
3. LED Blinking assignment using Arduino and Raspberry pi.
4. Interfacing Ultrasonic sensors with Arduino and Raspberry pi.
5. Interfacing LM35 sensor with Arduino
6. Interfacing BMP 380 with Raspberry Pi.
7. Interfacing of Camera Module with Raspberry Pi
8. Implement a cloud based miniproject in IoT - SCE



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA31205D: Professional Elective – I**  
**Artificial Intelligence**

**Teaching Scheme**

Credits: 4  
Lectures: 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- Data Structures
- Probability and Statistics

**Course Objectives :**

- To understand the various characteristics of Intelligent agents.
- To learn the different search strategies in AI.
- To learn how to represent knowledge in solving AI problems.
- To introduce the concepts of Expert Systems and Machine Learning.
- To know about the various applications of AI.
- 

**Course Outcomes:**

- After completion of the course, student will be able to
1. Understand different types of AI Agents and environment.
  2. Implement various AI search algorithms.
  3. Understand fundamentals of knowledge representation and working knowledge of reasoning in presence of incomplete and uncertain information.
  4. Apply knowledge representation, reasoning and machine learning techniques to real world problems.
  5. Apply AI techniques for real world application
  6. Understand AI cloud environments

**Unit I : Introduction**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Environment, Environment Types, Problem Solving Approach to Typical AI problems

**Unit II : Problem Solving Methods**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games



**Unit III : Knowledge Representation & Inference**

Logical Agents, Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic, First-Order Logic, Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic

Inferences: 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 IV: Learning**

Learning paradigms: **Supervised Learning:** Logistic Regression, K-Nearest Neighbour algorithm, Support Vector Machine, Perceptron Learning, Neural networks

**Ensemble learning:** Bagging, Boosting, stacking,

Learning with hidden variable, EM algorithm,

**Reinforcement learning,** Passive reinforcement learning, Active reinforcement learning, Generalization in reinforcement learning.

**Unit V: AI Applications**

Sequential and time series analysis, time series models: Auto regression (AR), Moving Average (MA), Autoregressive Moving Average (ARMA), Autoregressive Integrated Moving Average (ARIMA)

Natural Language Processing: NLP phases, sentiment analysis, interactive chatbots,

**Unit VI: Artificial Intelligence on Cloud**

**Amazon Web Services (AWS)** :Amazon SageMaker, Alexa, Lex, and Polly –Conversational gents, Amazon Comprehend – natural language processing, Amazon Rekognition – image and video, AmazonTranslate, Amazon Machine Learning, Amazon Transcribe – transcription Amazon Textract – document analysis

**Microsoft Azure** :Microsoft Azure Machine Learning Studio, Azure Machine Learning Service, Azure Cognitive Services

**Google Cloud Platform (GCP)** :AI Hub Google Cloud AI Building Blocks

**Explainable AI:** Introduction, Architecture, Principles, Techniques

**Text Books :**

1. Stuart Russell, Peter Norvig, Artificial intelligence : A Modern Approach, Prentice Hall, Fourth edition, 2020
2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan-Kaufmann, 1998.
3. [https://cse.iitkgp.ac.in/~pallab/artificial\\_intelligence\\_autumn\\_2020/index.html](https://cse.iitkgp.ac.in/~pallab/artificial_intelligence_autumn_2020/index.html)

**Reference Books :**

1. <https://london.ac.uk/sites/default/files/study-guides/introduction-tonatural-language-processing.pdf>
2. Artificial Intelligence with Python -Second Edition-Alberto Artasanchez Prateek Joshi-Packt Publishing Ltd.

**List of Assignments:**



Bansilal Ramnath Agarwal Charitable Trust's

**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

1. Implement DFS, BFS, A\* algorithm for 8-puzzle problem .
2. Solving a problem with constraints
3. Building a bot to play Tic-Tac-Toe
4. Perform parsing of family tree using knowledge- base
5. Build a reinforcement learning agent
6. Extract statistics from Time series data
7. Build a sentiment analyser for given data
8. Build a speech recognizer system
9. Create a Chabot application for any real world scenario



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA31206: Project-I**

**Teaching Scheme**

Credits : 2

Lectures : 1 Hrs/week

Practical : 2 Hrs/week

**Examination Scheme**

Summative Assessment(TW):25 Marks

**Prerequisites :**

- Java, Object Oriented Programming, Software Engineering

**Course Objectives :**

- To adapt the usage of modern tools and recent software.
- To evaluate problems and analyze data using current technologies
- To learn how to employ Integrated Development Environment(IDE) for implementing and testing of software solution
- To acquire contemporary skills to make the students employable in computer engineering domain

**Course Outcomes:**

1. After completion of the course, student will be able to Utilize current technologies in a wide variety of business and organizational contexts using modern tools
2. Identify Integrated Development Environment (IDE) for implementing and testing of software solution.
3. Apply best practices for building applications.
4. Make use of contemporary skills to make them employable.

**MODULE –I : JS, Angular, React JS**

**Unit 1 :** Javascript Development

- Fundamentals Of JavaScript
- JavaScript for Beginning Web Developers
- JavaScript for Absolute Beginners
- Fundamentals of jQuery
- Fundamentals of Ajax Development
- Create a node.js Real Time Chat Application
- Advanced JavaScript

**Unit 2 :** Angular

- What is a SPA? What is Angular?
- Preparing for TypeScript
- Angular-4 new features
- Building with A4 Components
- Bootstrap Scaffolding
- Angular 4 Binding and Events
- Dependency Injection and services



- Directives
- Pipes
- Forms
- HTTP, Promises, and Observables
- Testing

**Unit 3 :** React.js

- Welcome to Starting with React
- React Components
- React State and Props
- React Event Handling
- Routing in React React flux
- Styling React

**Module –II : Android Programming**

**Unit 1 : First Android App**

What is Android, First Android app, How to run and debug applications (Emulator vs. Real device), Android project structure, XML files, Enhancing the first app, Basic Android concepts, Activity, Menus, Intents, Context

**Unit 2 : Using more Android capabilities**

intelliJIDEA / Android Studio, Permissions, working with files, Working with the network, Debugging Android apps, Providing feedback to the user o Vibration o Sounds o Flash, Raw camera usage, Touch gestures, Location, Status bar notifications, Localization, Services

**Unit 3 : Graphics**

Animations, 2D graphics, 3D graphics and OpenGL

**Unit 4 : Web Services**

Soap and Rest overview, Working with SOAP, Working with Rest, Google's external libraries, Google Maps, Monetizing apps, Ads, Publishing and uploading app to Google Play

**Text Books:**

1. Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", Fifth Edition, Pearson Education, 2011.
2. Achyut S Godbole and Atul Kahate, "Web Technologies", Second Edition, Tata McGraw Hill, 2012.
3. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013.
4. David Flanagan, "JavaScript: The Definitive Guide, Sixth Edition", O'Reilly Media, 2011
5. Bear Bibeault and Yehuda Katz, "jQuery in Action", January 2008
6. Neil Smyth, "Android Studio 2 Development Essentials", Payload Media, ISBN: 1532853319
7. John Horton, "Android Programming for Beginners", ISBN 10:1785883267
8. Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, "ng-book, The Complete Book on Angular 4" September 2016

**Reference Books:**

1. Web link for Angular4.0: <https://angular.io/>



Bansilal Ramnath Agarwal Charitable Trust's

## **Vishwakarma Institute of Information Technology, Pune-48**

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

### **Department of Computer Engineering**

2. Ebook link for JavaScript - [https://github.com/jasonzhuang/tech\\_books/tree/master/js](https://github.com/jasonzhuang/tech_books/tree/master/js)
3. Reto Meier, "Professional Android 4 Application Development", Wrox, ISBN-10: 1118102274; ISBN-13: 978-1118102275
4. Greg Nudelman, "Android Design Patterns :Interaction Design Solutions for Developers", ISBN-10: 1118394151; ISBN-13: 978-1118394151

#### **List of Assignments:**

With intent to get some project development exposure, students must apply Technical, Behavioural, Process concepts learnt in the course by executing real-life project and working in teams. (Project team will ideally comprise of 3 to 4 members)



Bansilal Ramnath Agarwal Charitable Trust's

**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

# SEMESTER – VI





Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32207 : Language Processor and Compiler Construction**

**Teaching Scheme**

Credits : 4  
Lectures : 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- Computer Organization and Architecture.
- Processor Architecture and Interfacing.
- Data Structures
- Theory of Computation: DFA, NFA, Regular expressions, Grammars.

**Course Objectives :**

- To introduce language processing fundamentals and assemblers.
- To explain design of macro processors.
- To introduce compiler design process
- To explain working of syntax analyser.
- To explain importance of semantic analysis and intermediate code representation
- To introduce different code optimization methods

**Course Outcomes :**

After completion of the course, student will be able to

1. Develop hypothetical assembler.
2. Illustrate macro processors, linkers and loaders.
3. Implement lexical analyser using LEX tool.
4. Build parser using YACC tool.
5. Construct the intermediate code representations.
6. Demonstrate code optimization and code generation concept.

**Unit I : Introduction To Systems Programming And Assemblers**

Introduction: Need of System Software, Components of System Software, Language Processing Activities, Fundamentals of Language Processing, Interpreter  
Assemblers: Elements of Assembly Language Programming, A simple Assembly Scheme, Pass structure of Assemblers, Design of Two Pass Assembler.

**Unit II : Macroprocessors, Loaders And Linkers**

Macro Processor: Macro Definition and call, Macro Expansion, Nested Macro Calls and definition, Advanced Macro Facilities, Design of two-pass Macro Processor.

Loaders: Loader Schemes, Compile and Go, General Loader Scheme, Absolute Loader Scheme, Subroutine Linkages, Relocation and linking concepts, Self-relocating programs, Relocating Loaders, Direct Linking Loaders, Overlay Structure. Linkers.

**Unit III : Introduction To Compilers**

Phase structure of Compiler and entire compilation process. Lexical Analyzer: The Role of the Lexical Analyzer, Input Buffering. Specification of Tokens, Recognition Tokens, Design



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

of Lexical Analyzer using Uniform Symbol Table, Lexical Errors.  
LEX: LEX Specification, Generation of Lexical Analyzer by LEX.

**Unit IV : Parsers**

Role of parsers, Classification of Parsers: Top down parsers- recursive descent parser and predictive parser (LL parser), Bottom up Parsers – Shift Reduce parser, LR parser.  
YACC specification and Automatic construction of Parser (YACC).

**Unit V : Semantic Analysis And Intermediate Code Generation**

Need, Syntax Directed Translation, Syntax Directed Definitions, Translation of assignment Statements, iterative statements, Boolean expressions, conditional statements, Type Checking and Type conversion.

Intermediate Code Formats: Postfix notation, Parse and syntax trees, Three address code, Quadruples and triples.

**Unit VI : Code Generation And Optimization**

Code Generation: Code generation Issues. Basic blocks and flow graphs, A Simple Code Generator.

Code Optimization: Machine Independent: Peephole optimizations: Common Sub-expression elimination, Removing of loop invariants, Induction variables and Reduction in strengths, Use of machine idioms, Dynamic Programming Code Generation.

Machine dependent Issues: Assignment and use of registers

**Text Books :**

1. D. M. Dhamdhare, Systems Programming and Operating Systems, Tata McGraw-Hill, ISBN 13:978-0-07-463579-7, Second Revised Edition
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques and Tools, Addison Wesley, ISBN:981-235-885 - 4, Low Price Edition
3. John R. Levine, Tony Mason & Doug Brown, "Lex & Yacc", O'Reilly

**Reference Books :**

1. J. J. Donovan, Systems Programming, McGraw-Hill, ISBN 13:978-0-07-460482-3, Indian Edition

**List of Assignments :**

Note: Students can implement following assignments using LEX/YACC, C/C++, JAVA, Python.  
Lab instructor can frame suitable assignment list from the following list.

1. Generate Symbol table, Literal table, Pool table & Intermediate code along with error table for first pass of a two-pass Assembler for the given source code.
2. Implement second pass of a two-pass Assembler and generate machine language code for the given intermediate code.
3. Design suitable data structures & implement first pass of a two-pass Macro processor
4. Design suitable data structures & implement second pass of a two-pass Macro processor
5. Write a program to implement a lexical analyzer for parts of speech.
6. Write a program to evaluate arithmetic expression, built-in functions and variables using Yacc specification.
7. Write a program to generate three address code for simple expression.
8. Write a program to apply various code optimization techniques for given three address code.
9. Write a program to generate assembly language code for given three address code.



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32202A:Professional Elective -II**  
**Augmented and Virtual Reality**

**Teaching Scheme**

Credits: 4  
Lectures: 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites:**

- Discrete Mathematics, Data Structures, Theory of Computation, Computer Graphics

**Course Objectives:**

- To learn the basic concept and framework of virtual reality.
- To learn fundamental of computer graphics and Visual Computation in Virtual Reality.
- To make students aware of the technology for managing large scale VR environment in real time.
- To learn the concepts of Haptic & Force Interaction in Virtual Reality systems.
- To provide students with an introduction to the VR system framework and development tools.
- To learn the basic concept and framework of Augmented Reality.

**Course Outcomes:**

After completion of the course, student will be able to

1. To understand the basic concept and framework of virtual reality
2. To understand the concept of computer graphics and its implication on perception and rendering.
3. To understand the technology for multimodal user interaction and perception in VR  
Decide and apply algorithmic strategies to solve a given problem
4. Explain the concepts of Haptic & Force Interaction in Virtual Reality systems.
5. To apply VR Development Tools in real time environment.
6. To understand concepts of Augmented Reality.

**Unit I: Introduction**

Introduction to Virtual Reality Fundamental Concept and Components of Virtual Reality, Primary Features and Present Development on Virtual Reality.

Multiple Modals of Input and Output Interface in Virtual Reality, Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based 3D Menus & 3D Scanner etc; Output -- Visual / Auditory / Haptic Devices.

**Unit II: Visual Computation in Virtual Reality**

Fundamentals of Computer Graphics; Real time rendering technology; Principles of Stereoscopic Display; Software and Hardware Technology on Stereoscopic Display



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**Unit III: Environment Modeling in Virtual Reality**

Geometric Modelling; Behaviour Simulation; Physically Based Simulation

**Unit IV: Haptic & Force Interaction in Virtual Reality**

Concept of haptic interaction; Principles of touch feedback and force feedback; Typical structure and principles of touch/force feedback facilities in applications

**Unit V: VR Development Tools**

Frameworks of Software Development Tools in VR; Modelling Tools for VR; X3D Standard; Vega, MultiGen, Virtoolsetc

**Unit VI: Augmented Reality**

System Structure of Augmented Reality; Key Technology in AR; General solution for calculating geometric & illumination consistency in the augmented environment.

**Text Books:**

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.
2. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009.
3. Gerard Jounghyun Kim, Designing Virtual Systems: The Structured Approach, 2005

**Reference Books :**

1. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, 3D User Interfaces, Theory and Practice, Addison Wesley, USA, 2005.
2. Oliver Bimber and Ramesh Raskar, Spatial Augmented Reality: Merging Real and Virtual Worlds, 2005.
3. Burdea, Grigore C and Philippe Coiffet, Virtual Reality Technology, Wiley Interscience, India, 2003.
4. John Vince, Virtual Reality Systems, Addison Wesley, 1995
5. Howard Rheingold, Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society, Simon and Schuster, 1991.
6. William R Sherman and Alan B Craig, Understanding Virtual Reality: Interface, Application and Design (The Morgan Kaufmann Series in Computer Graphics). Morgan Kaufmann Publishers, San Francisco, CA, 2002
7. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013

**List of Assignments:**

1. Design a Cube Runner game which shows motion of cube in forward direction and can move left and right and show the haptic force feedback when it gets hit to any of the surface.
2. Create one Cube and show all three properties like material Texture and shaders. Create a material and provide physics property like gravity torque etc. to it.
3. Create a terrain and run a spherical object on the terrain.
4. Design & Animate a Game Character using unity.



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32202B: Professional Elective-II**  
**Advanced Machine Learning**

**Teaching Scheme**

Credits: 4  
Lectures: 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- Machine Learning, Probability and Statistics

**Course Objectives :**

- To understand human learning aspect and relate it with machine learning concepts.
- To understand nature of the problem and apply machine learning algorithm.
- To find optimized solution for given problem.
- Learn to implement train, and validate neural network, and improve understanding of the on-going research in computer vision and multimedia field.

**Course Outcomes:**

1. Apply specific feature engineering techniques for a particular problem.
2. Summarize the basic concepts of Deep Learning
3. Understand data, training parameters, network structure, and other strategies to increase performance and capability.
4. Describe architecture of Convolutional Neural Network
5. Compare different architectures of Convolutional Neural Networks.
6. Describe and Analyze the working of Recurrent Neural Networks

**Unit I: Introduction and Feature Engineering**

**Introduction**-Classic and adaptive machines, Relationship between Artificial Intelligence, Machine Learning, and Data Science, Definition and Features of Machine Learning, Machine Learning Approaches, Machine Learning Techniques, Applications of Machine Learning.

**Feature Engineering** – Creating training and test sets, managing categorical data, Managing missing features, Data scaling and normalization, Feature selection and Filtering, Principle Component Analysis(PCA).

**Unit II: Introduction to Deep Learning**

History of Deep Learning McCulloch Pitts Neuron, Thresholding Logic, Activation functions, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

Power of MLPs, Sigmoid Neurons, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks.

**Unit III: Gradient Descent and Regularization**

**Gradient Descent** – Gradient Descent (GD), **Regularization** –Bias Variance Tradeoff, L2 regularization, Early stopping, Data set augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout

**Unit IV : Basics of Convolutional Neural Networks**

**Convolutional Neural Networks-** Convolutional Neural Networks, Architectures, Convolution /pooling layers, Transfer Learning, Case Study

**Unit V : Convolutional Neural Networks**

**Convolutional Neural Networks-** LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Deep Dream, Deep Art

**Unit VI : Recurrent Neural Networks**

**Recurrent Neural Networks -** Architecture of Recurrent Neural Networks, Backpropagation through time (BPTT), Case Study

**Text Books :**

1. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited, ISBN-10:1785889621, ISBN-13:978-1785889622
3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioners Approach", O'REILLY, SPD, ISBN: 978-93-5213-604-9, 2017

**Reference Books :**

1. Tom Mitchell "Machine Learning", McGraw Hill Publication, ISBN: 00704280779780070428072
2. Nikhil Buduma, "Fundamentals of Deep Learning", O'REILLY publication, second edition 2017, ISBN: 1491925612

**List of Assignments:**

1. Write a program to do: Download the appropriate dataset and preprocess it using feature engineering techniques.
2. Write a program to implement Principal Component Analysis.
3. Write a program to implement Gradient Descent.
4. Implement Convolutional Neural Network for Image Classification.
5. Implement Recurrent Neural Network for Sentiment Analysis.



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32202C: Professional Elective-II**  
**Digital Forensics**

**Teaching Scheme**

Credits: 4  
Lectures: 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- Computer Networks-I

**Course Objectives :**

- To acquaint with the digital forensic investigation process
- To learn the process of data acquisition in a digital crime scene
- To understand the various file system analysis
- To understand the various evidence on the network
- To identify the various evidence on the Internet
- To understand and apply the digital forensic concepts

**Course Outcomes:**

At the end of the course students will be able to

1. Outline the digital forensic investigation process(Remember)
2. Understand the process of data acquisition in a digital crime scene(Understand)
3. Analyse the evidence from the file system(Analyze)
4. Interpret the various evidence on the network (Understand)
5. Identify the various evidence on the Internet (Understand)
6. Use the digital forensic concepts (Apply)

**Unit I: Introduction To Computer Forensics**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Incident and Incident Response(IR) methodology – Forensic duplication and investigation. Preparation for IR

**Unit II: Data Acquisition**

Understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools and other forensics acquisitions tools

**Unit III: File System Analysis**

Windows System Forensics, Linux System Forensics

**Unit IV : Network Forensics Investigation**

Email analysis, Network analysis

**Unit V : Digital Evidence On Internet**





Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

Digital Evidence on Physical and Data-Link Layers, Digital Evidence on Network and Transport Layers

**Unit VI : Case Study And Forensic Tools**

Study of Forensic Tools (Wireshark, nmap, etc.)

Case study on Cyber Forensics

**Text Books :**

1. Eoghan Casey, "Digital Evidence and Computer Crime", Third Edition Elsevier Academic publication

**Reference Books :**

1. Nina Godbole, Sunit Belapur, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Publications, April, 2011.

**List of Assignments:**

1. Understanding Hard Disks and File Systems
2. Analysis of Windows / Linux log files.
3. Network Forensics
4. Evidence on Physical layer
5. Investigating Web Attacks
6. Email Analysis
7. Case study on any digital crime investigation





Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32202D: Professional Elective-II**  
**Agile Methodology and DevOps**

**Teaching Scheme**

Credits: 4

Lectures: 3 Hrs/week

Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks

In-Semester Examination(ISE): 30 Marks

Skills & Competency Exam(SCE): 20 Marks

End Semester Examination(ESE): 30 Marks

PR/OR: 25 Marks

**Prerequisites :**

- Software Engineering, Software Design and Architecture

**Course Objectives :**

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To understand the benefits and pitfalls of working in an Agile team.
- To gain in-depth knowledge on Continuous Development, Continuous Integration, and Continuous Testing by performing hands-on on GIT, Jenkins
- To get comprehensive knowledge on Configuration Management, and Continuous Deployment using Puppet
- To able automate all aspects of a modern code delivery and deployment pipeline using: Source code management tools

**Course Outcomes:**

1. To realize the importance of interacting with business stakeholders in determining the requirements for a software system
2. To perform iterative software development processes: how to plan them, how to execute them.
3. To show how agile approaches can be scaled up to the enterprise level.
4. To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your business requirements
5. To have a detailed overview of continuous integration and container ecosystem by learning tools such as Jenkins and Docker
6. To be able to deliver change requests from customers rapidly and effectively by adding new (and updating existing) features

**Unit I: Agile Methodology**

Theories for Agile Management – Agile Software Development – Traditional Model vs.



Agile Model – Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams – Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

**Unit II: Agile Processes**

Lean Production – SCRUM, Crystal, Feature Driven Development- Adaptive Software Development – Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

**Unit III: Agility And Requirements Engineering**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

**Unit IV : DevOps Essentials**

Why DevOps? What is DevOps? DevOps Market Trends, DevOps Engineer Skills, DevOps Delivery Pipeline, DevOps Ecosystem

**Unit V : Build Tools – GIT and Jenkins**

Introduction to VCS and GIT, GIT File workflow, Important GIT Commands, Plugin Management in Jenkins, Introduction to Continuous Integration and Jenkins, Various scenarios of Building Delivery Pipeline, Build Setup in Jenkins, Test Automation, Security in Jenkins, Notification System

**Unit VI : Puppet**

Puppet Introduction, Puppet Architecture, Basic Puppet Terminologies, Puppet Language Constructs, Puppet Modules, Puppet Environment, Node Classification, Puppet Classes, Puppet Template

**Text Books :**

1. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.
3. Gene Kim, Patrick Debois, John Willis, Jez Humble, John Allspaw, “The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations”, October 6, 2016

**Reference Books :**

1. Craig Larman, —Agile and Iterative Development: A Manager's Guide, Addison-Wesley, 2004.
2. Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.
3. Jennifer Davis, Ryn Daniels, “Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale”, 1st Edition.



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**List of Assignments:**

1. Students should form and operate as Scrum teams to build a real open-source software product together. The project starts at the start of semester and continues through the end of the semester.

In this project, students will:

Form a Scrum team: Form a team, name your team, volunteer for Scrum roles, create a Slack channel, create a public git repository.

Create a product vision: Articulate your far vision and your near vision, identify your stakeholders.

Create your initial product backlog: Create initial product backlog items as user stories, order your product backlog.

Get your product backlog ready: Estimate the size of your backlog items and do everything you think you need to do to be ready for sprint planning.

Read the rubric carefully for a description of what to do.

Submit your team's GitHub repo URL as the solution to the assignment.

Be prepared to share your team roster, product vision, and initial product backlog in class.

2. Installing Git, First-Time Git Setup, Getting a Git Repository, Working Cth various git commands, Working Cth Local repository vs remote repository, Managing remote repository, Stashing operations and various local repository operations, Branching and merging operations, Resolving conflicts during merges, Managing access on repository managements

3. Installing Jenkins, Post-installation setup wizard, Unlocking Jenkins, Customizing Jenkins with plugins, User management — Authentication and Authorization, Deploying an application to a container using Jenkins



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSITUA32203: Cloud Computing**

**Teaching Scheme**

Credits : 4  
Lectures : 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
PR/OR: 25 Marks

**Prerequisites :**

- Operating System, Computer Networks, Database Management Systems

**Course Objectives :**

- To revise the basics of Linux commands, scripting, computer network
- To study the cloud fundamentals and AWS fundamentals
- To study the Infrastructure as Code (Terraform)
- To study configuration management tool(Ansible)
- To study containerization technologies in cloud computing
- To study DevOps fundamentals and Git

**Course Outcomes :**

After completion of the course, student will be able to

1. Explain Linux commands, networking concepts and database concepts
2. Demonstrate how to use public cloud to solve deploy applications
3. To develop terraform code to create infrastructure on any cloud provider
4. To write Configuration management playbooks to automate the server configurations
5. Demonstrate how the containerization technology is used to deploy applications
6. To differentiate the between different software development life cycles methods

**Unit I : Fundamentals**

**Network Fundamentals:** The OSI Model, TCP vs UDP, IP addressing &Subneting, Routing & Firewall, **Storage Fundamentals:** Block Storage, Object Storage, File storage, SAN, NAS

**Databases fundamentals:**Basics, Relational database, Non-Relational database, SQL

**Linux Introduction and Essential Commands:** Introduction, History, Usage, Flavours, Linux Commands Shell Scripting: Basics, Arithmetic & Logical Operations, Cron, Loops

**Unit II : AWS**

**Cloud Fundamentals:** What is Cloud? Properties of cloud, Benefits of using cloud, service models, deployment models **Course Fundamentals and AWS Accounts:**AWS Accounts - The Basics, Creating an AWS Account, Securing An AWS Account, Creating a Budget, IAM, Creating Access keys and setting up AWS CLI v2 tools

Simple Storage Service (S3), VIRTUAL PRIVATE CLOUD (VPC) BASICS, ELASTIC COMPUTE CLOUD (EC2) BASICS, Infrastructure as Code (CloudFormation), Load Balancing, Systems Manager, AWS Lambda.

**Unit III : Terraform**

**Cloud file systems:** GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores:



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

Datastore and Simple DB Cloud Storage-Overview, Cloud Storage Providers. Case study: Firebase. **Securing the Cloud-** General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats. Case study: Discuss research problems of cloud security

**Unit IV : Ansible**

**YAML:** YAML Fundamentals. **Ansible Introduction:** What Is Ansible, Provisioning, Automation. **Architecture:** Why Use Ansible, Architecture and Process Flow, Architecture Introduction, Components Overview, Process of Execution and Flow, Execution Types. **Playbook Concepts:** Installing Ansible, Playbooks Introduction, Packages: apt, become, with\_items, Services: service, **Ansible Inventory and Configuration:** Inventory Fundamentals, **Ansible Modules:** Ansible Modules Fundamentals, **Roles:** Role Basics

**Unit V : Docker and Kubernetes**

**Virtuallization Fundamentals:** Virtualization, Hypervisor, Docker containers, Containers vs VMs. **Docker Introduction :** Docker Engine Architecture, Docker Engine Setup on Linux or windows, Basic Container Operations, Interacting with a Running Container, Stopping and Removing a Container, **Docker Image Management:** Docker Image Registry, Removing a Docker Image, Save and Load Images, **Docker Engine - Storage:** Docker Storage, Docker Volume. **Docker Compose :** Docker Compose.

**Kubernetes**

Kubernetes Architecture, Scheduling, Application Lifecycle Management, Security, **Helm Introduction.**

**Unit VI : DevOps**

Explain what is DevOps Culture, Continuous Delivery/Continuous Integration, Various tool used in Devops phases, Git and Github introduction, Automation Testing introduction, Monitoring, Maven, Jenkins Introduction

**Reference :**

1. Computer Networks, 5<sup>th</sup> Edition, Book by Andrew S. Tanenbaum, Database Management System, Avi Silberschatz · Henry F. Korth · S. Sudarshan, UNIX, concepts and applications by Sumitabha Das
2. AWS Documentation (<https://docs.aws.amazon.com/>)
3. Terraform documentation (<https://www.terraform.io/docs>)
4. ansible documentation (<https://docs.ansible.com/>) (youtube: DevOps | Introduction to YAML, Ansible Complete Tutorial | Learn Complete Ansible From Basic To Advanced Level | Nehra Classes)
5. Kubernetes Documentation (<https://kubernetes.io/docs/home/>)
6. <https://online-pmo.com/wp-content/Education/Learning%20DevOps.pdf>, <https://git-scm.com/book/en/v2>, <https://www.techmagic.co/blog/best-application-deployment-strategies/>, <https://www.jenkins.io/doc/>

**List of Assignments :**

Practical hands on is the absolute necessity. Lab sessions and assignments are intended to enhance the competency in this course.

1. Linux commands practice
2. Shell scripting programs



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

3. Deploy web application on AWS cloud (use VPC, ec2, load balancer, route-53 service)
4. Deploy static website using s3 bucket
5. Write IaC using terraform to create EC2 machine on aws (use modules, input and output)
6. Write a ansible playbook to deploy Apache Web server. (use roles)
7. Deploy a Node.js/Python Flask or any web application using Docker.
8. Deploy anweb app on kubernets cluster
9. Create a CI/CD pipeline using Jenkins/Github Actions



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32204A: Professional Elective -III**  
**Blockchain Technology**

**Teaching Scheme**

Credits : 4  
Lectures : 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
TW: 25 Marks

**Prerequisites :**

- NA

**Course Objectives :**

- To introduce fundamentals of Blockchain
- To explain Bitcoin Blockchain
- To explain Ethereum Architecture & Components
- To explain Hyperledger Frameworks and Fabric Concepts
- To explain Web 3 technology
- To discuss Emerging Trends in Blockchain and Use cases

**Course Outcomes:**

After completion of the course, student will be able to

1. Explain fundamental knowledge of Blockchain (Understand)
2. Illustrate Bitcoin Blockchain (Understand)
3. Summarise Ethereum Architecture & Components (Understand)
4. Introduce Hyperledger Frameworks and Fabric Concepts (Understand)
5. Introduce Web 3 Technology (Understand)
6. Explore emerging trends in Blockchain and Use cases (Understand)

**Unit I : Overview of Blockchain**

What is Blockchain?, History of Blockchain, Network and protocols, Smart Contract and Consensus Algorithms, Blockchain users and adoption, Blockchain challenges

**Unit II : Bitcoin Blockchain**

Cryptocurrency, Bitcoin Blockchain fundamentals, Keys as Identity, Digital Signatures, Hashes, Hashes as Addresses, Hash Pointers and Data Structures, Blockchain transactions, Blockchain block structure, Bitcoin Mining, Proof-of-Work

**Unit III : Ethereum Architecture & Components**

Evolution of Ethereum, Ethereum Components, Ethereum Virtual Machine, Types of Transactions, Solidity language, Ethereum Smart Contracts, Tokenization, Ethereum Clients, The Ethereum network, The Ethereum Mining Process, Ethereum Genesis Block Creation, Dapps.

**Unit IV : Hyperledger Frameworks & Fabric Concepts**

Overview of Hyperledger, Hyperledger Projects, Hyperledger Architecture, Consensus model





for permissioned Blockchains, Fabric Elements, Transaction Execution in Fabric, Fabric Network Setup, Fabric Chaincode Development & Deployment

**Unit V : Web3**

Web3 applications, cryptocurrency, Token creation, Web infrastructure protocols, web3 spaces, Payment process

**Unit VI : Emerging Trends in Blockchain and Use cases**

Introduction to Corda, Ripple, Multichain, etc.

Blockchain and cloud computing, Blockchain and Artificial Intelligence, Blockchain and IOT, Blockchain and Machine Learning.

Blockchain use cases in Health Care, Banking, Government Sector, Supply Chain Management, Identity Management, etc.

**Text Books :**

1. Mastering Bitcoin: Unlocking Digital Crypto currencies, by Andreas Antonopoulos
2. Blockchain by Melanie Swa, O'Reilly
3. Mastering Ethereum Building Smart Contracts and DApps, Andreas M. Antonopoulos, Gavin Wood, O'Reilly
4. Hyperledger Fabric - <https://www.hyperledger.org/projects/fabric>

**Reference Books :**

1. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits
2. Ethereum Yellow Paper : "Ethereum: A Secure Decentralised Generalised Transaction Ledger Petersburg", Dr. Gavin Wood

**Suggested list of Assignments :**

1. Study of various websites related Blockchain like
2. Case Study on various use cases of Blockchain.
3. Study of SOLIDITY programming.
4. Write Smart Contract for various use cases of Blockchain.
5. Implementations in Public Blockchain network such as – Bitcoin, Ethereum
6. Research & writing on topics such as Forking, Wallets, Consensus Mechanisms, Performance enhancement.
7. Comparative study of various Blockchain Platforms (Bitcoin, Ethereum, Hyperledger, Ripple, Corda, R3...).





Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32204B: Professional Elective -III**  
**Software Robotics**

**Teaching Scheme**

Credits: 4  
Lectures: 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
TW: 25 Marks

**Prerequisites :**

- Software Engineering, Software Testing

**Course Objectives :**

- To learn concepts of Robotic Process Automation techniques in businesses
- To learn Robotic Process Automation using different tools for configuration and management
- To Automate data messaging operations
- Elaborates on the features of PDF files for automated extraction
- To integrate security features for creating more secured applications
- To learn enterprise business application

**Course Outcomes:**

After completion of the course, student will be able to

1. Gain insights into Robotic Process Automation Technology
2. Explore Automation using various tools and its configuration
3. Use several types of data massaging operations
4. Gain insight of business application on reports generated in PDF formats
5. Apply security features using lockers and credentials for real life application
6. Demonstrate real-world workflow automation for business use case

**Unit I : Basics of RPA**

Basics of RPA, RPA VS Test automation, RPA history and drivers. Difference in RPA and automation, Architecture, Introduction to Product Architecture , Benefits and challenges of RPA, Business use case in RPA using process flow diagram

**Unit II : Configuration and Management in RPA**

Architecture: Blue prism Technology overview, installing blue prism, Automation Anywhere architecture, installing Automation Anywhere , Configuring control room in Blur prism/Automation Anywhere Configuring Automation Anywhere and Blue prism tool .Overview of Task Bots and its usages, Meta Bots and its usages. IQ Bots and its usage. Dashboard in Automation Anywhere and Blue prism.

**Unit III : Basic data massing commands and Actions**

Basic Input output commands/Action. Data types, Files and folder actions. the task of copying the files from a source folder to the destination folder with various options. Use of FTP/SFTP in automation FTP /SFTP working. Commands use in FTP servers. Uploading and downloading files



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

using SFTP Transferring audio and video files from local machine to FTP server. Usage of If/else/loop command, Database and RPA tool. Handling Exceptions.

**Unit IV : Integration of PDF files**

Converts a PDF document into a specified file type. , Extracts all form field data and selected text, and stores the data in variables. Merges selected PDF documents into a single PDF file.

**Unit V : Credentials and Lockers**

Why credentials and Lockers are needed How to create credential and Lockers Edit ,View and delete lockers, Related use cases, E mail automation using Lockers and credentials

**Unit VI : Implementing RPA in Enterprise**

Case study Building a business case, Determining which process to automate, Case study of invoice automation, Email automation, ERP automation of an institute for various students processing data .

**Web links**

1. <https://docs.automationanywhere.com>
2. <https://community.blueprism.com>

**List of Assignments (Sample) :**

1. Using variables and data types perform Window Action  
Sample P.S. : To automate the action of getting the title of an active window.
2. To perform various String operations such as comparing two strings, replacing a string, finding a length of the string, reversing a string, splitting a string , and so on.  
Sample P. S: Extract Domain name from an email id , extract country code from the list of mobile numbers
3. To automate the task of copying the files from a source folder to the destination folder.  
Sample P.S. : Transfer Student Attendance generated files from Google drive folder/ Mobile App to specific folder .( Process may automate after end of the month)
4. To automate the task of extracting a table from a webpage.  
Sample P. S. : Extract student information from a web page
5. To automate the task of Extracting, writing and displaying text from a CSV/Excel file and store it into a notepad file.
6. To automate the task of extracting the data from multiple PDF documents and storing the data into a CSV file.  
Sample use case: Generate an invoice
7. Create a cognitive Bot for any specific application.



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32204C: Professional Elective-III**  
**Edge Artificial Intelligence**

**Teaching Scheme**

Credits: 4  
Lectures: 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
TW: 25 Marks

**Prerequisites :**

- Artificial Intelligence, Machine Learning, Internet of Things

**Course Objectives :**

- To learn the existing techniques and component areas of Artificial Intelligence
- To apply knowledge of AI to develop Edge Artificial Intelligent Systems
- To find optimized solution for given problem.

**Course Outcomes:**

After completion of the course, student will be able to

1. Understand basics of Embedded Systems, Internet of Things and Edge Computing.
2. Understand need of Edge AI
3. Understand the hardware requirements for Edge AI
4. Understand and apply the algorithms of Edge AI
5. Apply knowledge of AI for optimizing Edge applications
6. Design and Develop edge applications

**Unit I: Foundations**

Basics of: Embedded systems, parallelism, Internet of Things, Cloud Computing, Fog Computing, Edge Computing.

**Unit II: Introduction to Edge AI**

Artificial intelligence, Machine learning, Embedded ML and Tiny ML, need of edge AI, benefits of edge AI, differences between edge AI and regular AI.

**Unit III: The Hardware of Edge AI**

Sensors, signals, and sources of data: Types of sensors and signals: Acoustic and vibration Visual and scene, Motion and position, Force and tactile, Optical, electromagnetic, and radiation, Environmental, biological, and chemical

Processors for edge AI: Microcontrollers and digital signal processors, System on Chip, Deep learning accelerators, FPGAs and ASICs, Edge servers, Multi-device architectures, Edge Computing Frameworks

**Unit IV : Algorithms and Tools for Edge AI**



Bansilal Ramnath Agarwal Charitable Trust's

## **Vishwakarma Institute of Information Technology, Pune-48**

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

### **Department of Computer Engineering**

Feature Engineering, Filtering, image feature detection, Machine learning and deep learning algorithms.

Tool: Edge Impulse

#### **Unit V : Training and Deployment at Edge**

Build Dataset, Design Edge AI application, Model Training, Model Deployment, Handling delay sensitive applications, Integration and heterogeneity, hardware and software support required to implement edge computing on devices.

#### **Unit VI : Edge AI Applications**

Types of applications: Keeping track of objects, Understanding and controlling systems, Understanding people and living things, Generating and transforming signals.

Case studies: Wild life monitoring, Food quality Assurance AI solution for people counting sensor, Consumer products.

#### **Text Books :**

1. Daniel Situnayake, Jenny Plunkett, "AI at the Edge", December 2022, Publisher(s): O'Reilly Media, Inc. ISBN: 9781098120146
2. Wang, X., Han, Y., Leung, V. C., Niyato, D., Yan, X., & Chen, X. , "Edge AI: Convergence of edge computing and artificial intelligence", Singapore: Springer, 2020, ISBN 978-981-15-6185-6

#### **Reference Books :**

1. <https://www.udacity.com/course/intel-edge-ai-for-iot-developers-nanodegree--nd131>

**List of Assignments:** Suitable assignments to be framed based on the six units



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32204D: Professional Elective -III**  
**Software Design and Architecture**

**Teaching Scheme**

Credits : 4  
Lectures : 3 Hrs/week  
Practical : 2 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks  
TW: 25 Marks

**Prerequisites :**

- Software Engineering

**Course Objectives :**

- To understand software design methods and UML notations.
- To learn architectural design for real time software architecture.
- To select and use appropriate design pattern applicable to software system.
- To use the Siemens four-views approach for developing.
- To use the documentation and Architecture Analysis & Design Language.
- To select and use appropriate software architecture evaluation method.

**Course Outcomes:**

After completion of the course, student will be able to

1. Remember various software design methods and UML notations.
2. Understand importance of different views in architectural views.
3. Apply appropriate design pattern in software design.
4. Analyze need of Siemens four-views approach for developing.
5. Understand importance of the documentation and Architecture Analysis & Design Language.
6. Develop and use appropriate software architecture evaluation method.

**Unit I : Introduction to Software Design**

Design Methods: Procedural and Structural Design methods, Object Oriented design method, Unified modelling Language overview, Static and Dynamic Modelling Advance Use case, Class, State, Sequence Diagrams

**Unit II : Architectural Design**

Need of Architectural Design, importance and architecture views, client-server, service oriented, component based concurrent and real time software architecture with case studies.

**Unit III : Design Pattern**

Introduction, creational, Structural and behavioural patterns, singleton, proxy, adapter, factory, abstract factory, iterator, observer pattern with application. Case study of any one pattern

**Unit IV : Aspect-Oriented Architecture**

Introduction to Aspect-Oriented Programming (basic concepts), Aspect oriented architecture,



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

Aspect oriented Modelling using UML, Aspect Oriented Modelling tools, Model-Driven Architecture (MDA), Why MDA? State of the Art Practices and Tools.

**Unit V : Documenting Architecture**

Documenting Interfaces, documenting Behaviour, documenting architectural through views, reviewing architecture documents. Introduction to Architecture Analysis Languages (ADLs).

**Unit VI : Evaluation of Software Architecture**

What is architecture evaluation, Evaluation approaches, Benefits and limits of architecture evaluation, ATAM as evaluation method, Architecture Tradeoff Analysis Method, Example Evaluation; Tactics, Reverse Engineering of software architecture & Software Visualization

**Text Books :**

1. "Software Design", 2nd edition, Pearson Education, David Budgen.
2. Software Architecture in Practice, 3rd Edition by Len Bass, Paul Clements, Rick Kazman, Addison-Wesley Professional

**Reference Books :**

1. The UML Users Guide, Pearson Publication, Grady Booch, James Rumbaugh, Ivar Jacobson
2. Software Design: From Programming to Architecture, Eric J.
3. Applied Software Architecture, Christine Hofmeister, Robert Nord, Deli Soni, Addison-Wesley Professional
4. Enterprise Patterns and MDA: Building Better Software with Archetype Patterns and UML Addison-Wesley Professional, Jim Arlow, IlaNeustadt
5. Documenting Software Architectures: Views and Beyond, 2<sup>nd</sup> Edition, Addison-Wesley, Clements, P., et al.
6. The Architecture Analysis & Design Language (AADL): An Introduction, CMU/SEI-2006-TN-011, Carnegie Mellon University, Gluch, D., Feiler. P., and Hudak. J.

**List of Assignments:**

1. Design and draw diagram in UML for software system of Realtime use using any free UML tool. Environment/Tool/Language: Linux/Unix base free tool. (StartUML).
2. Perform architectural design and implement singleton pattern for software system using java/c++/python/any advanced programming language. Environment/Tool/Language: Linux/Unix base java/c++/python/any advanced programming language.
3. Perform architectural design and implement observer pattern for software system using java/c++/python/any advanced programming language. Environment/Tool/Language: Linux/Unix base java/c++/python/any advanced programming language.
4. Design and draw UML diagram using any one aspect-oriented approach for any software system with the help of JBoss AOP. Environment/Tool/Language: Linux/Unix base JBoss AOP
5. Perform detailed documentation of assignment no 4 using Doxygen/Swagger/any web-based tool etc. Environment/Tool/Language: Doxygen/Swagger/web based tool etc
6. Assignment based on unit 6



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**IOEUA32205A: Open Elective-I**  
**Social Science and Engineering Economics**

**Teaching Scheme**

Credits : 3  
Lectures : 3 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks

**Prerequisites:** NIL

**Course Objectives:**

- Human and social development.
- Contemporary national and international affairs.
- Emergence of Indian society and Economics.
- Sectoral development and Economic development and related issues (such as international economics, WTO, RBI, etc).

**Course Outcomes:**

After completion of the course, student will be able to

1. Understand various issues concerning human and society.
2. Realize social, cultural, economic and human issues, involved in social changes
3. Understand the nature of the individual and the relationship between the self and the community
4. Express their opinion about national health and education policies.
5. Understand major ideas, values, beliefs, and experiences that have shaped human history and cultures.
6. Understand the fundamental concepts in engineering economics

**Unit I - Indian Society**

Structure of Indian Society, Indian Social Demography– Social and Cultural, Differentiations: caste, class, gender and tribe; Institutions of marriage, family and kinship- Secularization – Social Movements and Regionalism- Panchayatraj Institutions; Affirmative Action Programme of the Government-various reservations and commissions.

**Unit II - Social Development**

Scientific approach to the study of human beings. Evolution of human kind, social change and evolution. Industrial revolution. National policy on education, health and health care and human development.

**Unit III – Sectoral Development**





Bansilal Ramnath Agarwal Charitable Trust's

## **Vishwakarma Institute of Information Technology, Pune-48**

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

### **Department of Computer Engineering**

Agriculture: Technology changes, Green revolutions, Employment Rural and Urban, Government Schemes.

Industrial Development: Strategies, Public and Private Sectors, Categories, infrastructure, transport and communication, Consumer Awareness.

#### **Unit IV - Economic Development**

Need for planned economic development – Law of demand and supply. Planning objective, five years plan, priorities and problems. Population and development.

Indian Economics – basic features, natural resources population size and composition, national income concepts, micro economics of India, inflation, GDP.

#### **Unit V - Banking and Trades**

Financial Analysis, Ratios, Cost Analysis, financial Institutions, Finance Commissions, Budget Analysis. Indian Banking, Role of Reserve bank of India International Economy, WTO, International aid for economic growth.

#### **Unit VI - Understanding Cash Flow and Taxes**

Accounting for Depreciation and Income Taxes, Project Cash-Flow Analysis, Understanding Financial Statements, Case Studies - cash flow analysis done in start-up companies.

#### **Textbooks:**

1. Krugman, International Economics, Pearson Education.
2. Prakash, The Indian Economy, Pearson Education.
3. Thursen Gerald, Engineering Economics, Prentice Hall.
4. C.S. Rao, Environmental Pollution Control Engineering, New Age International Pvt. Ltd.

#### **Reference Books:**

1. Rangarajan, Environmental Issues in India, Pearson Education.
2. University of Delhi, The Individual & Society, Pearson Education.
3. Wikipedia.org / wiki /social studies.
4. M. N. Srinivas, Social change in modern India, 1991, Orient Longman.
5. David Mandelbaum, Society in India, 1990, Popular





Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**IOEUA32205B: Open Elective-I**  
**Engineering Economics and FinTech**

**Teaching Scheme**

Credits : 3  
Lectures : 3 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks

**Prerequisites :**

- NA

**Course Objectives :**

- To learn about the economic development and related issues
- To explain the Indian banking structure and terms like GDP, inflation
- To introduce Cash Flow analysis and Taxes
- To introduce FinTech and it's sub sectors
- To explain the classification of various models of FinTech.
- To describe the innovation in FinTech

**Course Outcomes :**

After completion of the course, student will be able to

1. Understand the fundamental concepts in engineering economics
2. Illustrate the terms like GDP, inflation, and Indian banking structure
3. Analyze and Calculate cash flow analysis and taxes
4. Understand what FinTech is and the sub sectors that comprise it
5. Classify various models of the Fintech
6. Illustrate various innovations done using latest technology trends in FinTech

**Unit I : Introduction to Economics**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost.

**Unit II : Banking and Trades**

Indian Economics – basic features, natural resources, population size and composition, national income concepts, microeconomics of India, Indian Banking, Role of Reserve bank of India, International Economy, inflation, GDP, Financial Analysis, Ratios, financial Institutions, Finance Commissions.

**Unit III : Understanding Cash Flow analysis**



Budget Analysis, Break-even analysis, Elementary economic Analysis – Material selection for product, Accounting for Depreciation, Project Cash-Flow Analysis, Understanding Financial Statements.

**Unit IV: Introduction to FinTech**

Introduction, Financial Services and Fintech: Introduction, Changing Environment, Customer Centricity, Digital Transformation, Definition of Fintech, History of Fintech, Fintech stages, An Overview of Fintech Initiatives Around the World, Ecosystems, Downsides of Disruptive Fintech

**Unit V: Model and Classifications**

Introduction, Classification, Five Ws and one H : 1. Why a fintech initiative was born? 2. For whom was it born? 3. Which are the services it aims to provide? 4. Where does it aim to perform its business? 5. When does it aim to operate, within the framework of the financial cycle? 6. How is fintech working? The organization and its elements, The V4 business model framework, A Business Model, A Business Model for Fintech. Business Model Canvas (BMC) for FinTech.

**Unit VI : FinTech Innovation**

Innovation and Fintech, Digital Transformation and Fintech, A model for an integrated innovation strategy, Types of Innovation: Product (or services), Process, Organization, Examples of Innovation, Process Innovation : Big Data Analytics, Value Creation from Big Data Analytics, Kreditech's self-learning algorithm, Internet of Things, Blockchain Technology, Organizational Innovation: Social Networks.

**Text Books :**

1. B. Nicoletti, The Future of FinTech, 1st ed. Palgrave Macmillan, 2017
2. Krugman, International Economics, Pearson Education.
3. Thursen Gerald, Engineering Economics, Prentice Hall.

**Reference Books**

1. Accenture. (2015). The future of FinTech and banking: Digitally disrupted or reimagined? Accenture Research, 1–12
2. Dietz M., Khanna S., Olanrewaju T., and Rajgopal K. (2015). Cutting through the fintech noise: Markers of success, imperatives for banks. Practice, G. B. (Ed.), 1–18. McKinsey and Company. Retrieved from <http://www.mckinsey.com/industries/financial-services/our-insights/cutting-through-the-noise-round-financial-technology>.
3. "What is FinTech and why does it matter to all entrepreneurs?". *Hot Topics*. July 2014. retrieved December 9, 2014.
4. Accenture. (2015). The future of Fintech and banking: Digitally disrupted or reimagined? Accenture Research, 1–12



**IOEUA32205C: Open Elective-I**  
**Explainable Artificial Intelligence (XAI) for Engineering Applications**

**Teaching Scheme**

Credits : 3  
Lectures : 3 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks

**Prerequisites :**

- Fundamentals of Probability & Statistics, Machine Learning and Deep Learning basics, Python for Data Science

**Course Objectives :**

- Making students familiarize with the need of XAI for engineering applications and its central concepts
- Making students understand with the mathematical concepts like ensemble models and non- linear models to analyse the problems
- Providing tools and techniques of XAI for design and building solutions

**Course Outcomes :**

After completion of the course, student will be able to

1. Learn the fundamental concepts of XAI and its use to build various use cases in engineering domain
2. Compare merits and demerits of linear and non-linear model in problem analysis
3. Provide knowledge about using ensemble learning and contrastive explanations and LRP for machine learning
4. Performs parametric evaluation of AI-based and XAI-based solutions
5. Apply the knowledge for drafting clear requirements to build end-to-end XAI solution
6. Learn and apply knowledge of XAI and tools for application and protocol development in engineering applications

**Unit I : Introduction to Explainable Artificial Intelligence**

Artificial Intelligence, Need for XAI, Explainability vs. Interpretability

Explainability Types: Intrinsic explanation, Post-hoc explanation, Model specific, Model agnostic, Local interpretation, Global interpretation, Sublocal interpretation, Textual explanations, Visual explanations

Tools for Model Explainability: SHAP, LIME, ELI5, Skater, Skope\_rules

Evolution of XAI, Biasness, and Reliability, Challenges to achieve explainable AI and design issues



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

Case Studies: Fraud Detection, Online Recommendations, Credit and Loan Decision Making

**Unit II : Explainability for Linear Models**

Linear Models, Linear Regression

VIF and the Problems It Can Generate : Final Model, Model Explainability

Trust in ML Model: SHAP - Local Explanation and Individual Predictions in a ML Model, Global Explanation and Overall Predictions in ML Model, LIME Explanation and ML Model, Skater Explanation and ML Model, ELI5 Explanation and ML Model, Logistic Regression: Interpretation, LIME Inference

Case Studies: Linear Regression

**Unit III : Explainability for Non Linear Models**

Non-Linear Models      Decision Tree Explanation, Data Preparation for the Decision Tree Model  
Creating the Model , Decision Tree — SHAP, Partial Dependency Plot, PDP Using Scikit-Learn,  
Non- Linear Model Explanation — LIME, Non-Linear Explanation — Skope-Rules

Case Studies: Comparison of Husky Dog and Wolf

**Unit IV: Explainability for Ensemble Models**

Ensemble Models: Types of Ensemble Models

Why Ensemble Models?, Using SHAP for Ensemble Models, Using the Interpret Explaining,  
Boosting Model, Ensemble Classification Model: SHAP, Using SHAP to Explain Categorical  
Boosting Models, Using SHAP Multiclass Categorical Boosting Model, Using SHAP for Light  
GBM Model Explanation

Case Studies: Model Interpretability

**Unit V: Counterfactual Explanations for XAI Models**

AI Model Fairness Using a What-If Scenario: What Is the WIT (Google Tool)?, Evaluation Metric.  
Counterfactual Explanations for XAI Models: What Are CFEs?, Implementation of CFEs, CFEs  
Using Alibi, Counterfactual for Regression Tasks.

Case Studies: Causability Algorithms and Applications

**Unit VI : Contrastive Explanations and LRP for Machine Learning**

What Is CE for ML?, CEM Using Alibi, Comparison of an Original Image vs. an Autoencoder.  
Generated Image, CEM for Tabular Data Explanations. Layer wise relevance propagation (LRP):  
Introduction, Working Principle, Mathematical Modeling. Case Studies: Pertinent Negatives,  
Explanation based on missing

**Text Books : -**

**Reference Books**

1. Hands-On Explainable AI (XAI) with Python: Interpret, visualize, explain, and integrate reliable AI for fair, secure, and trustworthy AI apps by Denis Rothman



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**IOEUA32205D: Open Elective-I**  
**Management Information System**

**Teaching Scheme**

Credits : 3  
Lectures : 3 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks

**Prerequisite:**

- Basics terminology of Information Technology/Internet/MSExcel

**Course Objectives:**

- To understand types of MIS applications in organizations
- To understand information system and its components, its association in big picture
- To analyze the requirement of users and draft specifications of system
- To study databases and its importance in system and business process
- To develop broad understanding of ethics and code of conduct
- To study process of decision making and its phases

**Course Outcomes:**

After completion of this course student should be able to

1. Appreciate what a supply chain is and what it does
2. Understand the role of IT in Engineering and business process
3. Describe a business process and link it to information system
4. Apply MIS concepts to reach to decision in the tasks he/she undertake
5. Apply ethical practices in day-to-day life

**Unit-I: Information Technology and its Impact**

Information Technology-Definition, Data, Information, Knowledge, Dataflow, system, Apps. IT Capabilities and their impact on Industrial, Educational, Business and Profession.

Telecommunication and Networks – Need, Basics of networking and internet, Concept of cloud and datacenters, Video Conferencing and virtual meetings

IT enabled services such as Call Centres, Geographical Information Systems, E Commerce, etc.

**Unit-II: Information System Analysis and Design**

User requirement analysis, Feasibility study, Software Development/Product development life cycle, systems study and systems design, Resource utilization, implementation, audit, operation, maintenance and modification.



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**Unit–III: Database Management System**

Introduction, Types, Advantages using data base models, Basics of data models, Queries, generating a report, Excel as a database for trend analysis.

**Unit-IV Functional MIS:**

MIS within functional are as such as Human Resources, Marketing & Sales, Production, Accounting & Finance, Customer Relationships Management(CRM), Product Supply Chain Management systems, Logistic Management, Learning Management System

**Unit-V: Decision Support System and strategic management:**

Decisions support systems, expert systems, office automation systems and knowledge-based systems, Structured decision making, unstructured decision making and semi structured decision making, Setting up Strategy for the organization/situation

**Unit-VI: Ethical and Social Issues in Information Systems:**

Moral dimensions of Information Age, Concept of responsibility, accountability and liability, Professional Code of conduct, Information rights: Privacy and freedom, Ethical Dilemma

**Text Books:**

1. Kenneth C. Laudon & Jane P.Laudon, Essentials of Management Information Systems, 16<sup>th</sup> Edition, Pearson Prentice-Hall,2012.ISBN978-0132668552
2. Analysis and Design of Information Systems, Rajaraman, Prentice Hall

**Reference Books:**

1. Management Information Systems, Laudon and Laudon,7<sup>th</sup> Edition, Pearson Education
2. Management Information Systems, Davis and Olson, Tata McGraw Hill
3. Decision Support Systems and Intelligent Systems, Turban and Aronson, Pearson Education Asia



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**Open Elective-I**  
**IOEUA32205E : Professional Practice, Law and Ethics**

**Teaching Scheme**

Credits : 3  
Lectures : 3 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks

**Prerequisite:** NIL

**Course Objectives:**

- To make the students aware of types of roles they would play in the society as professionals/ practitioners of the Civil Engineering profession.
- To introduce some legal and practical aspects of Civil Engineering profession

**Course Outcomes:** Upon completion of the course, students will be able to:

1. Explain the terms related to civil engineering profession and various professional bodies including their roles and responsibilities
2. Summarize necessity and all aspects related to professional ethics
3. Identify all details of Civil Engineering contracts and tenders
4. Use Arbitration for disputes in Civil Engineering projects
5. Explain the legal provisions with reference to labor in construction works
6. Understand concepts of Copyright, Trademark, Intellectual Property Right , Patents

**Unit I – Introduction to Professional Practice**

Concepts of Profession, Professionalism, and Professional Responsibility. Roles of various stakeholders:

Government (Statutory/ regulatory bodies and organizations),  
Standardization Bodies such as BIS, IRC (formulating standards of practice);  
Professional bodies such as Institution of Engineers (India),  
Local Bodies/ Planning Authorities (certifying professionals); Clients/ owners (role governed by contracts)  
Developers (role governed by regulations such as RERA);  
Consultants (role governed by bodies such as CEAI)  
Contractors (role governed by contracts and regulatory Acts and Standards);  
Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)





Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**Unit II– Introduction to Professional Ethics**

Definition/ meaning of Ethics and its necessity/ importance.

Types of ethics – Personal, Engineering, Professional, Business, and Corporate.

Code of Ethics as defined by Institution of Engineers (India). Conflict of Interests, Gift Vs Bribery,

Environmental breaches, Negligence, Deficiencies in state-of- the-art; Vigil Mechanism, Whistle blowing protected disclosures.

**Unit III – Legal Aspects Part-I**

General Principles of Contracts & Management: Indian Contract Act 1972 and amendments covering general principles of contracting,

Contract Formation & Law,

Privacy of contract. Various types of contract and their features.

Valid & Voidable Contracts. Prime and sub-contracts.

Joint Ventures & Consortium. Tenders, its types & tender Notice, Bids & Proposals.

Bid Evaluation. Contract Conditions & Specifications.

Variations & Changes in Contracts, Differing site conditions, Cost escalation, Delays, Suspensions & Termination. Liquidated damages & Penalties.

**Unit IV – Legal Aspects Part-II**

Definition/ meaning of Arbitration & Arbitrator, necessity, scope, and types.

Conciliation and ADR (Alternative Dispute Resolution) system.

Extent of judicial intervention; International commercial arbitration.

Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision.

Enforcement of foreign awards – New York and Geneva Convention Awards.

Distinction between conciliation, negotiation, mediation, and arbitration.

**Unit V– Legal Aspects Part-III**

Labour& other construction-related Acts/ Laws. Role of Labour in Civil Engineering.

Methods of engaging labour: on-roll (Muster), labour sub-contract, piece rate work.

Industrial Disputes Act, 1947. Industrial Employment (Standing Orders) Act, 1946;

Workmen's Compensation Act, 1923;

Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998);

Real Estate Regulatory Authority(RERA) Act 2017, National Building Code (NBC) 2017.

**Unit VI – Introduction to Copyright, IPR and related aspects.**





Bansilal Ramnath Agarwal Charitable Trust's

## **Vishwakarma Institute of Information Technology, Pune-48**

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

### **Department of Computer Engineering**

Law relating to Intellectual Property: Introduction – meaning of Intellectual Property and IPR, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Meaning of copyright – computer programs, etc. Ownership of copyrights and assignment. Piracy & Remedies. Meaning and process for Patents. Law relating to Patents under Patents Act, 1970.

#### **Textbooks:**

1. B.S. Patil, “Legal Aspects of Building and Engineering Contracts”, 1974.
2. National Building Code, Latest
3. RERA Act, 2017
4. Meena Rao (2006), “Fundamental concepts in Law of Contract”, 3rd Edn. Professional Offset
5. Avtarsingh (2002), “Law of Contract”, Eastern Book Co.
6. Dutt (1994), “Indian Contract Act”, Eastern Law House
7. Kwatra G.K. (2005), “The Arbitration & Conciliation of Law in India with case law on UNCITRAL MODEL LAW on Arbitration”, Indian Council of Arbitration
8. T. Ramappa (2010), “Intellectual Property Rights Law in India”, Asia Law House
9. O.P. Malhotra, “Law of Industrial Disputes”, N.M. Tripathi Publishers
10. Rustamji R.F., “Introduction to the Law of Industrial Disputes”, Asia Publishing House
11. ASCE Code of Ethics (2011) – Principles Study and Application
12. [www.ieindia.org](http://www.ieindia.org)



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**Open Elective-I**

**IOEUA32205F: Industrial Engineering**

**Teaching Scheme**

Credits : 3  
Lectures : 3 Hrs/week

**Examination Scheme**

Continuous Evaluation(CE): 20 Marks  
In-Semester Examination(ISE): 30 Marks  
Skills & Competency Exam(SCE): 20 Marks  
End Semester Examination(ESE): 30 Marks

**Prerequisite(s):** Manufacturing Processes, Engineering Mathematics, Computer Fundamentals

**Course Objectives:**

- To introduce the concepts, principles and framework of contents of Industrial Engineering.
- To acquaint the students with various productivity enhancement techniques.
- To acquaint the students with different aspects of Production Planning and Control and Facility Design.
- To introduce the concepts of various cost accounting practices as applied in industries
- To acquaint students with different aspect of simulation modeling for various industrial engineering applications.

**Course Outcomes:** After successful completion of the course, student will be able to

1. Compute the partial productivity and total productivity indexes considering different influencing factors
2. Analyse each operation with a view to eliminate unnecessary operations, avoidable delays and other forms of waste.
3. Compute the standard time for a qualified worker to carry out a specified job at a defined level of performance.
4. Design a physical arrangement of facilities most economically at optimum plant location.
5. Design the production system considering an estimate of future event through past data.
6. Calculate optimum inventory level by establishing the relationship among the factors affecting profit.

**Unit I: Introduction to Industrial Engineering and Productivity**

Definition, Industrial engineering approach, Objectives of Industrial Engineering Role of Industrial Engineer, Techniques of industrial Engineering, Industrial engineering in service sector, Measurement of productivity: Factors affecting the productivity, Productivity Models and Index, Productivity improvement techniques. Some case studies on applications of industrial engineering to different service sectors

**Unit II: Method Study**



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

Work Study: Definition, Objectives, Procedure, Concept of work content, Method Study: Definition, Objectives, Scope and Steps involved in method study, Recording techniques, Micro-motion study, Cycle graph and chrono cycle graph, Critical examination, Principles of motion economy, Concepts of value engineering and value analysis. Some case studies on method study referring to research papers.

### **Unit III: Work Measurements**

Work Measurements: Definition, Objectives and techniques of work measurement, Steps in making time study, Types of elements, Time study equipment's, Performance rating, Allowances, Computation of standard time, Comparison of various techniques, Introduction to PMTS, MTM and MOST. Some case studies on work measurements referring to research papers.

### **Unit IV: Plant Location and Plant Layout**

Need for selecting a suitable plant location, Factors influencing plant location, Comparison between urban and rural locations, Quantitative method for evaluation of plant location, Plant Layout: Objectives, Principles, Types, Factors affecting plant layout, Types of manufacturing systems, Tools and techniques of plant layout, Computer packages for layout analysis. Some case studies on plant layout based on actual industry visit and referring to research papers.

### **Unit V: Production Planning and Control – I (PPC - I)**

Production Planning and Control (PPC): Need, Objectives, Functions, Production procedure, Measures of capacity, Capacity planning, Factors influencing effective capacity, Aggregate planning: Methods, advantages and limitations, Demand forecasting: Need and classification (Least square method, moving average, weighted moving average, exponential smoothing method and Casual forecasting method. Some case studies on production planning and control referring to research papers and visit to industry.

### **Unit VI: Production Planning and Control – II (PPC - II)**

Inventory types, Inventory control: Objectives and benefits, Inventory cost relationships, Inventory models: Basic inventory models, (with and without shortage and discount), Selective control of inventory: ABC and VED analysis, Production cost concepts and break-even analysis, Cost-volume-profit analysis. Some case studies on production planning and control referring to research papers and visit to industry.

### **Textbooks:**

1. M Mahajan, Industrial Engineering and Production Management, Dhanpat Rai and Co.
2. O. P. Khanna, Industrial engineering and management, Dhanpat Rai publication
3. MartendTelsang, Industrial Engineering, S. Chand Publication.
4. Banga and Sharma, Industrial Organization & Engineering Economics, Khanna publication

### **Reference Books:**

1. Askin, Design and Analysis of Lean Production System, Wiley, India



Bansilal Ramnath Agarwal Charitable Trust's

**Vishwakarma Institute of Information Technology, Pune-48**

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

**Department of Computer Engineering**

2. Barnes, Motion and time Study design and Measurement of Work, Wiley India
3. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBH Publishing Company, New Delhi, Second Indian Adaptation, 2008.
4. H. B. Maynard, K. Jell, Maynard 's Industrial Engineering Hand Book, McGraw Hill Education



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

**CSUA32206: Project - II**

**Teaching Scheme**

Credits : 2

Lectures : 1 Hrs/week

Practical : 2 Hrs/week

**Examination Scheme**

Summative Assessment (TW) : 25 Marks

**Prerequisites :**

- Programming knowledge, Software Engineering

**Course Objectives :**

- To adapt the usage of modern tools and recent software.
- To evaluate problems and analyze data using current technologies
- To learn how to employ Integrated Development Environment(IDE) for implementing and testing of software solution
- To acquire contemporary skills to make the students employable in computer engineering domain

**Course Outcomes:**

After completion of the course, student will be able to

1. Utilize current technologies in a wide variety of business and organizational contexts using modern tools
2. Identify Integrated Development Environment (IDE) for implementing and testing of software solution.
3. Apply best practices for building applications.
4. Make use of contemporary skills to make them employable.

**MODULE-I (Node.Js, MongoDB)**

**Unit I : Node.Js**

- Introduction and Foundation
- Node Projects
- Working with shrink-wrap to lock the node modules versions
- Working with asynchronous programming
- Building a HTTP Server with Node.JS using HTTP APIs
- File System
- Buffers, Streams, and Events
- Multi-Processing in NodeJS
- ExpressJS
- Express JS with MongoDB and Sqlite
- io, The Front-end, and A Chat App
- Introduction to Task Managers with unit testing

**Unit II : MongoDB**

- Introduction to NoSQL databases
- MongoDB A Database for the Modern Web
- CRUD Operations in MongoDB



Bansilal Ramnath Agarwal Charitable Trust's  
**Vishwakarma Institute of Information Technology, Pune-48**  
(An Autonomous Institute affiliated to Savitribai Phule Pune University)  
**Department of Computer Engineering**

- Indexing and Aggregation
- Replication and Sharding
- Developing Java and Node JS Application with MongoDB
- Administration of MongoDB Cluster Operations

**Module – II: iOS Programming**

**Unit 1 : Fundamentals**

Overview of iOS and X-CODE: Installation, Create and manage project using XCode, Introduction to iPhone Architecture, Introduction to SWIFT, Developer Technology Overview: The Apple Developer Tool, Swift, Cocoa Touch, Model-View-Controller, Interface Builder, Overview of latest iOS features.

**Unit 2 : Swift Basics**

Object oriented programming with swift, File structure in Swift, Swift Programming Basics: Data types, Constants, Variables, Operators, Decision making and Branching, Arrays, Functions, Enumerations. Introduction to iOS Playground

**Unit 3 : iPhone Application Development**

Exploring the iOS Framework with XCode, Cocoa Fundamentals, Tracking the iOS Application Life cycle, Understanding Interface Builder, Creating User Interface, Customizing the Interface Appearance using Layout, Views, Outlets and Actions, View Controllers and UI Controllers like Labels, Buttons, Sliders, Different Views, Gestures, etc. Connecting the code with Accelerometer, Location service, 3D touch, Push notifications Understand the MVC Design pattern, MVC in XCode, Using Application Templates, User Input and Output: Handling Keyboard Input, Implementing Alert, Sounds and Vibrations, Using XCode debugger

**Unit 4 : Database Management and Web Services**

Parsing JSON data, Parsing XML data, SQLite databases, Web Service APIs calls

**Unit 5 : Submit App to Apple Store**

Create Apple developer account, Submit App to Apple Store.

**Textbooks:**

1. Krasimir Tsonev, “Node.js by Example Paperback”, May 2015
2. Matt Neuberg, “ iOS 15 Programming Fundamentals with Swift: Swift, Xcode, and Cocoa Basics”, October 2021

**Reference Books:**

1. Web link for Node.js : <https://nodejs.org/en/>
2. iOS 13 Programming for Beginners: Get started with building iOS apps with Swift 5 and Xcode 11, 4th Edition

**List of assignments:**

With intent to get some project development exposure, students must apply Technical, Behavioural, Process concepts learnt in the course by executing real-life project and working in teams. (Project team will ideally comprise of 3 to 4 members)