Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Curriculum for

Final Year B.Tech.

(Information Technology)

(Pattern 2017)

Department of Information Technology

Vision and Mission of the Department

- **Vision**

  "To create professionally competent and globally acceptable IT engineers with social awareness".

- **Mission**

  - Educating budding engineers for, **industry, academia, research** and **entrepreneurial** pursuit through rigorous implementation of IT curriculum
  - Inculcating IT skills to develop **innovative solutions** relevant to **global issues**
  - **Imparting values** to practice social and **professional ethics.**

Program Specific Outcomes (PSOs)

At the end of program, students should be able to

- **PSO a:** An ability to understand, analyze and develop computer programs in the areas related to algorithms, web development and database management
- **PSO b:** An ability to apply knowledge of software engineering principles and practices for multidisciplinary applications to meet the needs of the industry and society

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 Information Technology

Final Year B.Tech.

2017 Pattern

Syllabus Structure

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of Information Technology

FINAL YEAR B. TECH (INFORMATION TECHNOLOGY), SEMESTER VII (PATTERN 2017)

MODULE-I

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
ITUA40171	Data Science and Analytics*	TH	3	-	2	20	30	20	30	25	125	4
ITUA40172	Cloud Computing	TH	3	-	2	20	30	20	30	25	125	4
ITUA40173	Object Oriented Modelling and Design*	TH	3	-	2	20	30	20	30	25	125	4
ITUA40174 / CSUA40174	Elective-III	TH	3	-	2	20	30	20	30	25	125	4
ITUA40175	Intellectual Property Rights	CE	2	-	-	-	-	50	-	-	50	2
ITUA40176	Project Work	CE-PR/OR	-	-	10	100	-	-	-	50	150	5
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
Total		-	14	-	18	180	120	130	120	150	700	23

Elective – III:

1. CSUA40174A : Advanced Computer Networks-II
2. CSUA40174B : Advance Machine Learning
3. CSUA40174C : Information and Cyber Security
4. ITUA40174 : Business Intelligence

BoS Chairman Dean Academics Director

MODULE-II

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
ITUA40177	Semester Internship	CE-PR/OR	-	-	24	100	-	-	-	50	150	12
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
Total		-	-	-	24	100	-	-	-	50	150	12

Semester Internship: For detailed syllabus see the Annexure A

List of Audit Courses: Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extra-curricular activities.

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 Information Technology

FINAL YEAR B. TECH (INFORMATION TECHNOLOGY), SEMESTER VIII (PATTERN 2017)

MODULE-III

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/TW		
ITUA42171 / CSUA42171	Elective-IV*	TH	3	-	2	20	30	20	30	25	125	4
IOEUA42172	Open Elective-I	TH	2	-	2	20	30	20	30	25	125	3
IOEUA42173	Open Elective-II	TH	3	-	-	20	30	20	30	-	100	3
CSUA42174	Introduction to Research	CE-PR/OR	1	-	2	-	-	-	-	25	25	2
M4	Mandatory course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	9	-	6	60	90	60	90	75	375	12

Note: *above indicates that the theory subject has PR/OR component

Elective-IV		Open Elective-I		Open Elective-II	
CSUA42171A	Software Defined Network	IOEUA42172A	Gamification	IOEUA42173A	Financial Technology
CSUA42171B	Robotic Process Automation	IOEUA42172B	Inferential Statistics for Data Science	IOEUA42173B	Electronics for Agriculture
		IOEUA42172C	Solar and wind Energy	IOEUA42173C	Operation Research
CSUA42171C	Augmented/Virtual Reality	IOEUA42172D	Numerical Methods in Engineering	IOEUA42173D	Total Quality Management
ITUA42171	Ubiquitous computing	IOEUA42172E	Social Media Analytics	IOEUA42173E	Block chain Technology

List of Audit Courses: Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extra-curricular activities.

BoS Chairman **Dean Academics** **Director**

MODULE-IV

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/ TW		
ITUA40177	Semester Internship	CE-PR/OR	-	-	24	-	-	100	-	50	150	12
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	24	-	-	100	-	50	150	12

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 Information Technology

FINAL YEAR B. TECH (INFORMATION TECHNOLOGY) SEMESTER VII(PATTERN 2017)

MODULE-V

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
ITUA40171	Data Science and Analytics*	TH	3	-	2	20	30	20	30	25	125	4
ITUA40172	Cloud Computing	TH	3	-	2	20	30	20	30	25	125	4
ITUA40173	Object Oriented Modelling and Design*	TH	3	-	2	20	30	20	30	25	125	4
ITUA40174 / CSUA40174	Elective-III	TH	3	-	2	20	30	20	30	25	125	4
ITUA40175	Intellectual Property Rights	CE	2	-	-	-	-	50	-	-	50	2
ITUA40176	Project Work	CE-PR/OR	-	-	10	100	-	-	-	50	150	5
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
Total		-	14	-	18	180	120	130	120	150	700	23

Note: * above indicates that the theory subject has PR/OR component

Elective – III:

1. CSUA40174A : Advanced Computer Networks-II
2. CSUA40174B : Advance Machine Learning
3. CSUA40174C : Information and Cyber Security
4. ITUA40174 : Business Intelligence

List of Audit Courses: Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extracurricular activities.

NOTE:

- **Students who will register for Module-I in Semester VII have to register either of Module-III or Module IV in Semester VIII.**
- **Students who will register for Module-II in Semester VII have to register for Module-V in Semester VIII.**

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 Information Technology

Final Year B.Tech

2017 Pattern

Syllabus Curriculum

SEMESTER – VII

Data Science and Analytics (ITUA40171)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisites: Linear Algebra and Calculus, Probability Basics

Course Objectives:

- To develop problem solving abilities using Mathematics
- To apply algorithmic strategies while solving problems
- To develop time and space efficient algorithms
- To study algorithmic examples in distributed, concurrent and parallel environments

Course Outcomes :

After studying this course, students will be able to:

1. Write case studies in Business Analytic and Intelligence using mathematical models
2. Present a survey on applications for Business Analytic and Intelligence
3. Provide problem solutions for multi-core or distributed, concurrent/Parallel environments

Unit I : Introduction and Life

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.

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: GINA

Unit II : Basic Data Analytic Methods

Statistical Methods for Evaluation- Hypothesis testing, difference of means, wilcoxon rank–sum test, type 1 type 2 errors, power and sample size, ANNOVA.

Advanced Analytical Theory and Methods: Clustering- Overview, K means- Use cases, Overview of methods, determining number of clusters, diagnostics, reasons to choose and cautions.

Unit III : Association Rules and Regression

Advanced Analytical Theory and Methods: Association Rules- Overview, a-priori algorithm, evaluation of candidate rules, case study-transactions in grocery store, validation and testing, diagnostics.

Regression- linear, logistics, reasons to choose and cautions, additional regression models.

Unit IV : Classification

Decision trees- Overview, general algorithm, decision tree algorithm, evaluating a decision tree. Naïve Bayes – Bayes‟ Algorithm, Naïve Bayes‟ Classifier, smoothing, diagnostics. Diagnostics of classifiers, additional classification methods.

Unit V : Big Data Visualization

Introduction to Data visualization, Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Analytical techniques used in Big data visualization.

Unit VI : Advanced Analytics-Technology and Tools

Analytics for unstructured data- Use cases, Map Reduce, Apache Hadoop. The Hadoop Ecosystem- Pig, HIVE, HBase, Mahout, NoSQL. An Analytics Project-Communicating, operationalizing, creating final deliverables.

Text books :

1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012, ISBN0-07-120413-X
2. Ashutosh Nandeshwar , "Tableau Data Visualization Codebook", Packt Publishing, ISBN 978-1-84968-978-6

Reference Books :

1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.
2. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication, ISBN: 978-1-118-16430-3
3. Luís Torgo, "Data Mining with R, Learning with Case Studies", CRC Press, Talay and Francis Group, ISBN9781482234893
4. Carlo Vercellis, "Business Intelligence - Data Mining and Optimization for Decision Making", Wiley Publications, ISBN: 9780470753866.

Prerequisites: Knowledge of Programming language such as Java, R, Python, Weka

List of Practical Assignments:

1	Download the Iris flower dataset or any other dataset into a DataFrame. (eg https://archive.ics.uci.edu/ml/datasets/Iris) Use Python/R and Perform following – • How many features are there and what are their types (e.g., numeric, nominal)? • Compute and display summary statistics for each feature available in the dataset. eg. 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. Plot each histogram.

	• Create a boxplot for each feature in the dataset. All of the boxplots should be combined into a single plot. Compare distributions and identify outliers.
2	Download Pima Indians Diabetes dataset. Use Naive Bayes" Algorithm for classification • Load the data from CSV file and split it into training and test datasets. • summarize the properties in the training dataset so that we can calculate probabilities and make predictions. • Classify samples from a test dataset and a summarized training dataset.
3	Write a program that interacts with the weather database. Find the day and the station with the maximum snowfall in 2013
4	Use Movies Dataset. Write the map and reduce methods to determine the average ratings of movies. The input consists of a series of lines, each containing a movie number, user number, rating, and a timestamp: The map should emit movie number and list of rating, and reduce should return for each movie number a list of average rating.
5	Trip History Analysis: Use trip history dataset that is from a bike sharing service in the United States. The data is provided quarter-wise from 2010 (Q4) onwards. Each file has 7 columns. Predict the class of user. Sample Test data set available here https://www.capitalbikeshare.com/trip-history-data
6	Bigmart Sales Analysis: For data comprising of transaction records of a sales store. The data has 8523 rows of 12 variables. Predict the sales of a store. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problem-big-mart-sales-iii/
7	Twitter Data Analysis: Use Twitter data for sentiment analysis. The dataset is 3MB in size and has 31,962 tweets. Identify the tweets which are hate tweets and which are not. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problemtwitter-sentiment-analysis/
8	Time Series Analysis: Use time series and forecast traffic on a mode of transportation. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problemtime-series-2/

Cloud Computing (ITUA40172)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisites: Computer Networks

Course Objectives

- To understand cloud computing concepts
- To study supporting technologies of cloud
- To study open research problems of cloud computing
- To study various platforms for cloud computing
- To explore the applications based on cloud computing
- To study and evaluate the contemporary technologies in cloud computing

Course Outcomes

After completion of the course, student will be able to

1. Summarize the basic concepts of cloud computing **(Remember**)
2. Explore the supporting technologies of cloud computing **(Understand)**
3. Analyze the challenges and opportunities in the cloud computing **(Analyze)**
4. Use the cloud services for deployment of his own applications **(Create)**
5. How technologies are interrelated and use with each other **(Apply)**
6. To explore future trends of cloud computing **(Evaluate)**

Unit I: Basics of Cloud Computing

Overview, Applications, Intranets and the Cloud. Your Organization and Cloud Computing- Benefits, Limitations, Security Concerns. Software as a Service (SaaS)- Understanding the Multitenant Nature of SaaS Solutions, Understanding SOA. Platform as a Service (PaaS)-IT Evolution Leading to the Cloud, Benefits of Paas Solutions, Disadvantages of PaaS Solutions. Infrastructure as a Service (IaaS)-Understanding IaaS, Improving Performance through Load Balancing, System and Storage Redundancy. Case Study: Google Cloud Platform.

Unit II: Virtualization

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

Common Standards: The Open Cloud Consortium, Open Virtualization Format. Standards for Security. Case study : VirtualBox, vmware

Unit III: Data Storage and Security in Cloud

Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: 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: Approximation and Randomized Algorithms, Natural Algorithms

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

Unit V: Ubiquitous Clouds and the Internet of Things

Introduction to Ubiquitous computing, Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management)

Unit VI: Future of Cloud Computing

Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, TheDocker Workflow. Docker compose file, Docker volume, Docker storage.

Kubernetes : introduction to Kubernetes, Features of Kubernetes, Kubernetes API, Basic Architecture, Minikube.

Text books :

1. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.
2. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more" , Wiley Publications, ISBN: 978-0-470-97389-9.
3.Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, *ISBN*: 9780511778476.
4. Docker Documentation (https://docs.docker.com/get-started/)
5. Kubernetes Documentation (https://kubernetes.io/docs/home/)

6-8 assignments will be based on above syllabus.

Object Oriented Modeling and Design (ITUA40173)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisites: Software Engineering, Object Oriented Programming, proficiency in Java

Course Objectives:

- To understand the object-oriented concepts for designing object-oriented models.
- To understand the use of UML (Unified Modeling Language) for object oriented analysis and design.
- To describe the step by step object oriented methodology of software development from problem statement through analysis, system design, and class design.
- To understand the issues for implementing object oriented designs or models.
- To study different types of design patterns.
- To study various architectural designs.

Course Outcomes:

After studying this course, students will be able to:

1. To differentiate between traditional approach of software development and object oriented unified approach.
2. Design and implement object oriented analysis phase with use case modeling.
3. Apply domain /class modeling for the OO design phase.
4. Implement behavioral modeling using various interaction diagrams.
5. Demonstrate the ability to apply the concepts of design patterns for cleaner software development.
6. Study and differentiate various architectural designs.

Unit I : Object oriented analysis, modeling and design

Views of Software Developments: Traditional System Development Methodology and Object Oriented Analysis and DesignUnified Approach: Object Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modeling Based on UML, Layered Approach,

Unified Modeling Language: Introduction to Modeling & UML.

Unit II : Behavioral/Functional modeling

Object Oriented Analysis Process, Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use case scenarios, Use Case realizations.

Unit III : Structural modeling

Domain / Class Modeling: Approaches For Identifying Classes (Noun-Phase Approach, Common Class Pattern Approach, Class Responsibilities Collaboration Approach, Naming Classes, Class Associations and Identification of Associations, Generalization/Specialization Relationship, Aggregation and Composition Relationships, Attributes and Methods Identification.

Unit IV : Interaction And Behavior Modeling

Activity Diagram: Activity and Actions, Initial and Final Activity, Activity Edge, Decision and Merge Points, Fork and Join, Input and Output Pins, Activity Group, Activity Partitions, Constraints on Action, Swim Lanes.Sequence Diagram: Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions.

State Diagram: State Machine, Triggers and Ports, Transitions, Initial and Final State, Composite States, Submachine States. Introduction to Communication, Component, Deployment diagram

Unit V: **Design Patterns**

Introduction to Design Patterns, need, applications. Gang of Four (GoF): Introduction, Categories of Patterns (Creational, Structural and Behavioral Patterns), Singleton, Adapter, State, and Strategy.

Unit VI: Architectural Design

Overview of software Architecture, Designing Client / Server Software Architectures, Designing Service Oriented Software Architectures, Designing Component Based Software Architectures

Text books :

1. Michael. Blaha, James. Rumbaugh **"Object-Oriented Modeling and Design with UML"**, 2nd Edition, Pearson Education, 2005.
2. Craig Larman, Applying UML and Patterns, Pearson Education, Second Edition,ISBN:978-0130925695.
3. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First Edition,ISBN:9789332555402, 9332555400.

Reference Books :

1. **Ali. Bahrami, "Object Oriented Systems Development",** McGraw-Hill, 2008.
2. Grady. Booch **"Object-Oriented Analysis and Design with Applications",** 3rd Edition, Pearson, 2007.
3. Mark. Priestley, **"Practical Object-Oriented Design with UML"**, 2nd Edition,Tata McGraw-Hill, 2003.

List of practical assignments:

1	**Write Problem Statement for System / Project.** Identify Project of enough complexity, which has at least 4-5 major functionalities. Identify stakeholders, actors and write detail problem statement for your system.
2	**Prepare Use Case Model:** Identify Major Use Cases, Identify actors. Write Use Case specification for all major Use Cases. Draw detail Use Case Diagram using UML2.0 notations.
3	**Prepare Activity Model** Draw Activity diagram with Swim lanes using UML2.0 Notations for major Use Cases.
4	**Prepare Analysis Model-Class Model and implement it.** Identify Analysis Classes and assign responsibilities. Draw Analysis class Model using UML2.0 Notations.
5	**Prepare a Design Model from Analysis Model and implement it.** Study in detail working of system/Project. Identify Design classes/ Evolve Analysis Model. Use advanced relationships. Draw Design class Model using OCL and UML2.0 Notations. Implement the design model with a suitable object-oriented language.
6	**Prepare Sequence Model.** Identify at least 5 major scenarios (sequence flow) for your system. Draw Sequence Diagram for every scenario by using advanced notations using UML2.0
7	**Prepare a State Model and implement it.** Identify States and events for your system. Study state transitions and identify Guard conditions. Draw State chart diagram with advanced UML 2 notations. Implement the state model with a suitable object-oriented language.
8	Design and implement Strategy pattern for suitable application.
9	Design and implement State pattern for suitable application.

Text books :

1. UML2 Bible by Tom Pender, Wiley India Pvt. Limited 2011
2. Applying UML and Patterns Second Edition by Craig Larman, Pearson Education
3. UML 2 and the Unified Process, Second Edition, JIM Arlow, Ila Neustadt, Pearson

Reference Books :

1. Mark. Priestley, **"Practical Object-Oriented Design with UML"**, 2nd Edition,
Tata McGraw-Hill, 2003.
2. Design Patterns: Elements of Reusable Object Oriented Software, Erich Gamma, Pearson
3. Design Patterns in Java Second Edition by Steven John Metsker, Pearson

Elective-III Advanced Computer Network- II (CSUA40174A)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisites: Fundamentals of Computer Networks, Computer Networks-I, Computer Networks-II

Course Objectives

- To understand the WAN concepts
- To identify the requirements for point to point and branch connections
- To illustrate the concept of security using access control lists
- To identify network security and monitoring requirements
- To understand QoS and parameters
- To perform network troubleshooting

Course Outcomes

After completion of the course, student will be able to

1. Explore the WAN concepts- REMEMBER.
2. Analyze the connection types- ANALYSE
3. Describe and Demonstrate the Access Control Lists– UNDERSTAND & APPLY
4. Analyzing the network security requirements ANALYSE
5. Analyze QoS parameters- ANALYSE
6. Planning and implementing network troubleshooting- CREATE

Unit I: WAN Concepts

Introduction to WAN, WAN Topologies and Types of Networks, WAN Operations: Circuit Switching and Packet Switching, Selecting A WAN, Public WAN Infrastructure, Selecting WAN Services

Unit II: Point to Point and Branch Connections

Serial Communication, HDLC Encapsulation, PPP, PPP implementation, PPP Troubleshooting, Remote Access Connection, PPPoE, PPPoE implementation, VPN. GRE, GRE implementation, eBGP.

Unit III: Access Control Lists

Introduction to ACL, ACL Operation, Types of IPv4 ACLs, Configuration and implementation of Standard and Extended IPv4 ACLs, IPv6 ACL Creation, Configuring IPv6 ACL, Troubleshooting ACLs.

Unit IV: Network Security and Monitoring

LAN Security: LAN Security Attacks, Best Practices, SNMP: Operation, Configuration, Cisco Switch Port Analyzer (SPAN): Overview, Configuration, SPAN as a troubleshooting tool
Unit V: Quality of Service
QoS overview, Traffic characteristics, Queuing algorithms QoS Models, QoS implementation techniques.
Unit VI: Network Evolution and Network Troubleshooting
Internet of Things: IoT Elements, IoT Pillars, Cloud and Virtualization: Cloud Computing, Virtualization, Virtual Network Infrastructure, Network Programming: Software Defined Networking, Controllers, Network Troubleshooting: Troubleshooting methodology, Troubleshooting process, isolating issues using layered models. Troubleshooting scenarios: Using IP SLA, Tools, Symptoms and causes of troubleshooting, Troubleshooting IP Connectivity.
Text books :
1.Fourauzan 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
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

List of practical assignments:

1	(Packet Tracer Index-2.1.2.5)Troubleshooting serial interfaces
2	(Packet Tracer Index-2.3.2.6)Configuring PAP and CHAP authentication
3	(Packet Tracer Index-2.4.1.4)Troubleshooting PPP with authentication
4	(Packet Tracer Index-3.4.2.4 and 3.4.2.5)Configuring and troubleshooting GRE
5	(Packet Tracer Index-3.5.3.4)Configuring and verify eBGP
6	(Packet Tracer Index-4.3.1.5 and 4.3.2.6)Configure standard IPv4 and IPv6 ACL
7	(Packet Tracer Index-)4.4.2.9 and 4.4.2.10Troubleshooting IPv4 and IPv6 ACLs
8	(Packet Tracer Index-8.2.4)Troubleshooting IP connectivity

Elective-III Advance Machine Learning (CSU40174B)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisites: Knowledge of Programming, Engineering Mathematics III

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.
- To learn- to implement train, and validate neural network, and improve understanding of the on-going research in computer vision and multimedia field.

Course Outcomes

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

1. Differentiate between supervised, unsupervised machine learning approaches.
2. Apply specific supervised or unsupervised machine learning algorithm for a particular problem.
3. Analyse and suggest the appropriate machine learning approach for the various types of problem.
4. Design and make modifications to existing machine learning algorithms to suit an individual application.
5. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.

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)-non negative matrix factorization, Sparse PCA, Kernel PCA

Unit II: Supervised Learning

Linear regression- Linear models, A bi-dimensional example, Linear Regression and higher dimensionality, Ridge, Lasso and ElasticNet, Polynomial regression, Isotonic regression,
Logistic regression-Linear classification, Logistic regression, Implementation and Optimizations,
Bayes Theorom, Naïve Bayes Classifiers.
Support Vector Machine(SVM)- Linear Support Vector Machines, Kernel based classification, Non- linear Examples. Controlled Support Vector Machines, Support Vector Regression.

Unit III: Unsupervised Learning

Clustering Fundamentals- Basics, K-means: Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth- Homogeneity, Completeness, Adjusted Rand Index, Hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering- Dendrograms.

Unit IV: Introduction to Deep Learning

History of Deep Learning McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks.

Unit V: Gradient Descent and Regularization

Gradient Descent -Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp

Regularization- Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout

Unit VI: Convolutional Neural Networks and Recurrent Neural Networks

Convolutional Neural Networks- Convolutional Neural Networks , Architectures, convolution / pooling layers, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks.

Recurrent Neural Networks- Recurrent Neural Networks , Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs

Deep Learning research: Object recognition, Sparse coding, Computer Vision, Natural Language Processing

Text books :

1. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited**,** ISBN-10: 1785889621, ISBN-13: 978-1785889622
2. Ethem Alpaydin, " Introduction to Machine Learning", PHI 2nd Edition-2013, ISBN 978-0-262-01243-0
3. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

Reference Books :

1. Tom Mitchell "Machine Learning" McGraw Hill Publication, ISBN : 0070428077 9780070428072
2. Nikhil Buduma, "Fundamentals of Deep Learning", O"REILLY publication, second edition 2017, ISBN: 1491925612
3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioners Approach", O"REILLY, SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.

List of Assignments: - 6-8 assignments will be based on above syllabus.

Elective-III Information and Cyber Security (CSUAA40174C)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisites: Fundamentals of Computer Networks

Course Objectives

- To know the need and basic of security
- To learn various types of Cryptographic algorithm
- To learn various authentication techniques
- To acquire knowledge of protocols employed to provide
- Confidentiality and integrity
- To understand various threats
- To acquaint with current security scenario

Course Outcomes

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

1. Identify the need and basic of security (Knowledge)
2. Summarize various Cryptographic algorithm (Understand)
3. Infer various authentication techniques (Understand)
4. Summarize protocols for confidentiality and integrity (Understand)
5. Identify various threats (Knowledge)
6. Relate with current industry trends (Understand)

Unit I: Security Basics and Introduction to cryptography

Introduction, Elements of Information Security, Understanding concepts: threat, exploit, privacy, vulnerability and policy, Types of Attacks, Operational Model of Network Security, Cryptography, Substitution Ciphers, Transposition Ciphers, Stenography applications and limitations.

Unit II: Symmetric Key Cryptography

Introduction, Encryption Methods: Symmetric, Asymmetric, Block Ciphers and methods of Operations, Data Encryption Standard (DES), Advance Encryption Standard (AES).

Unit III: Asymmetric Key Cryptography

Public Key Cryptography, RSA Algorithm: Working, Key length, Security, Key Distribution, Deffie-Hellman Key Exchange, Authentication methods, Message Digest, Kerberos, X.509 Authentication

service,Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.

Unit IV: Network Layer Security

IP Security: IPSec protocols, and Operations, AH Protocol, ESP Protocol, ISAKMP Protocol, Oakkey determination Protocol, VPN. WEB Security: Introduction, Secure Socket Layer (SSL), SSL Session and Connection, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol. Electronic Mail Security: Introduction, Pretty Good Privacy, MIME, S/MIME, Comparison. Secure Electronic Transaction(SET)

Unit V: Firewall And Intrusion

Introduction, Computer Intrusions. Firewall Introduction, Characteristics and types, Benefits and limitations. Firewall architecture, Trusted Systems, Access Control. Intrusion detection, IDS:Need, Methods, Types of IDS, Password Management, Limitations and Challenges.

Unit VI: Introduction to OWASP

Introduction, Top 10 Vulnerabilities, understanding Top 10 Vulnerabilities.

Text books :

1. Atul Kahate, "Cryptography and Network Security", Mc Graw Hill Publication, 2nd Edition, 2008, ISBN : 978-0-07-064823-4.
2. Dr. V.K.Pachgare, "Cryptography and Network Security", PHI, 2nd Edition, 2015.

Reference Books :

1. William Stallings, "Cryptography and network security principles and practices", Pearson, 6th Edition, ISBN : 978-93-325-1877-3.

2. Forouzan, "Cryptography and Network Security (SIE)", Mc Graw Hill, ISBN, 007070208X, 9780070702080 .

Web Resource: www.owasp.org

List of practical assignments:

1	Implement Symmetric key algorithm DES
2	Implement Symmetric key algorithm AES
3	Implement ASymmetric key algorithm RSA
4	Implement Asymmetric key algorithm Diffie-Helman Key exchange

5	Study and implement SSL
6	Study and implement IDS
7	Study and implement any 3 Vulnerabilities of OWASP

Elective-III Business Intelligence (ITUA40174)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisites: Database Management System

Course Objectives

- To study and understand the importance of Business Intelligence and need of data preparation for Business Intelligence
- To study and understand the different components of analytics landscape and project cycle aligned with these components
- To study and understand different data transformations, data modelling steps and visualize the data on the data models
- To study and understand the ways of adding custom calculations needed and understanding the applications of different statistical concepts
- To study and understand the BI deployments, administration cycle of BI implementations using Power BI
- To study and understand various topics and concepts in the areas of analytics and their industrial applications through study of different use cases.

Course Outcomes

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

1. Describe the importance of Business Intelligence and need of data preparation for Business Intelligence
2. Identify, describe, relate to the concepts of different components of analytics landscape and project cycle aligned with these components
3. Design and develop different data transformations, data models, analyse and visualize the data.
4. Design and develop custom calculations based on business and technical needs and demonstrate and implement different statistical concepts.
5. Author BI deployments, BI environments
6. Describe and compare industrial BI implementations, use cases and current and future trends

Unit I: Need Of Analytics And Data Preparation

Introduction to Analytics: What is Analytics?, Need of Analytics, Why Microsoft Power BI?, Types of Business Analytics

Data Sources: Data Collection, Transactions Entry, Organizational Systems, Data Sources and Data Source Categories, Issues in Data and Need of Data Preparation

Need of Data Preparations: What is Data Preparation?, Joining data, Appending Data, New Calculations, Removing Inconsistencies, Transposing

Setting up Power BI: Installation and configuration of Power BI Desktop, Setup of required connector

Unit II: Data Landscape And Project Cycle

Understanding Data and Databases: What is a database?, What is a DBMS?, What is SQL?, What are tables?, Organization of tables in databases, Types of Data, Database Keys, Relationships between tables, Joins and Unions, Cross-database Joins, Type of Data: Structured, Unstructured and Semi-structured data

Data Architecture: BI Architecture, Data Security and Governance, Administration

Analytics Project Lifecycle: Requirements Understanding, Data Understanding, Wireframes, Data Preparation, Data Visualization, Deployment, Documenting, Project Team and Roles, Challenges in Projects

Unit III: Data Modelling And Visualization

Data Integration and Data Warehouses: What is Data Integration?, Need of Data Integration, ETL, What is Data Warehouse?, Need of Data Warehouse, Facts and Dimensions , Star Schema and Snowflake Schema, Data Marts

Data Transformation [Basics]: Merging and Appending Data, Filtering, Cleaning Data, Fixing Errors, Transforming Data, Aggregating Data

Data Modelling: Setting Relationships, Creating Data Models

Data Visualization: What are KPIs?, Dashboards, Reports and Scorecards, Types of Dashboards, Slicers and Filters, Setting interactivity, Creating Hierarchies, Groups, Drilldowns and Drill-through, Formatting your visualizations, Best practices of visualizations, Aggregations: SUM, MAX, AVG, MIN

Unit IV: Custom Calculations And Analytics

Data Transformations [Advanced]: Tabular Model at database level, Cross-database joins

Calculations: Calculated Fields, Calculated Measures, Time-intelligent Functions, Moving Averages and Running Total, What-if Analysis, Conditional formatting

Statistical Analytics: Mean, Mode, Median, Variance and Standard Deviation,Simple Regression, Multiple Regression

Unit V: Power BI Deployment, Administration And Mobility

Power BI Deployment: Overview of Power BI Service, Publishing to Power BI Service. Understanding the Power BI Service Workspaces, Apps, Creating Dashboards in Power BI Service,

Subscriptions, Comments and Data Driven Alerts, Authoring reports within Power BI Service, Sharing dashboards across your organization, Configuring Gateways, Scheduling automated refresh of your reports using Data Gateway

Power BI Advanced Features: Using NLP to creating dashboards, Influencers, Delivering Insights, Explain Analysis

Mobile Analytics: Creating Dashboards for Mobiles, Using dashboards and reports using Mobile App

Unit VI: Industry Analytics Landscape

Working with Tableau: Introduction to Tableau, Installation and Setup of Tableau Desktop, Visualizing with Tableau

Advanced Concepts: Web Analytics, Sentiment Analysis, Big Data, Data Lakes, IoT

Applications of Business Analytics: Manufacturing Use Cases, EPC Use Cases, Retail Use Cases, Future Trends of Analytics

Text books :

1. "Business Intelligence Guidebook: From Data Integration To Analytics" by Rick Sherman, Elsevier Inc
2. "Successful Business Intelligence, Second Edition: Unlock The Value Of BI & Big Data" by Cindi Howson, McGraw Hill Edition
3. Data Analytics For Beginners: Your Ultimate Guide To Learn And Master Data Analysis. Get Your Business Intelligence Right – Accelerate Growth And Close More Sales" by Victor Finc
4. Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things" by Bernard Marr, Koganpage Publicaitons, Auva Press

Reference Books :

1. "Performance Dashboards – Measuring, Monitoring, And Managing Your Business" by Wayne Eckerson, John Wiley & Sons, Inc
2. Business Intelligence Roadmap: The Complete Project Lifecycle For Decision-Support Applications" by Larissa T. Moss & Shaku Atre, Addison-Wesley information Technology Series
3. Artificial Intelligence: Building Intelligent Systems" by Dr. Parag Kulkarni, Dr. Prachi Joshi, PHI publication (for understanding of concepts)

List of practical assignments:

1	Create multiple sample tables and join them in Power BI.
2	Connect to data source and transform data in Power BI.

3	Connect to data source and create data models by establishing relationships
4	Connect to data source and visualize and analyse data
5	Connect to data source and create custom calculations
6	Deploy the dashboards and reports to Power BI Service
7	Administrate and use advanced features of Power BI Service.
8	Create Mobile layouts in Power BI Desktop.
9	Mini Project 1- Transform and Model Data
10	Mini Project 2- Develop Interactive Dashboards

Intellectual Property Rights (ITUA40175)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	-	-	50	-	-	-	50

Prerequisites: NA

Course Objectives :

- Explain the importance of ideas, concept and creativity.
- Transfer the knowledge about the IPR required for Engineer's
- Describe the how IPR creates National wealth
- Teach National and International IP System

Course Outcomes :

Upon completion of the course, students will be able to

1. Infer that tomorrow's world will be ruled by ideas, concept, and creativity.
2. Gather knowledge about Intellectual Property Rights which is important for students of engineering as they are tomorrow's technocrats and creator of new technology.
3. Discover how IPR are regarded as a source of national wealth and mark of an economic leadership in context of global market scenario.
4. Study the national & International IP system.

Unit I: Introduction

Introduction to the concepts Property and Intellectual Property, Nature and Importance of Intellectual Property Rights, Objectives of understanding Intellectual Property Rights , IPR and IITs.

Unit II: Types of IPRs

Understanding the types of Intellectual Property Rights: - Patents, Designs, Trademarks (Registered and unregistered trademarks), Copyright, Traditional Knowledge, Geographical Indications, Trade Secrets, Idea Patenting, (Case Studies)

Unit III: IPR Development Cycle

New Developments in IPR , Process of Patenting and Development: technological research, innovation, patenting, development, International Scenario: WIPO, TRIPs, Indian Patent Office and its Administration .

Unit IV: Patent System

Administration of Patent System – Patenting under Indian Patent Act , Patenting under PCT , Patent

Rights and its Scope, Licensing and transfer of technology, Patent information and database. Provisional and Non Provisional Patent Application and Specification
Text books :
1. Resisting Intellectual Property by Halbert, Taylor & Francis Ltd ,2007 . 2. Industrial Design by Mayall, Mc Graw Hill. 3. Intellectual Property in New Technological Age by Robert P. Merges, Peter S. Menell, Mark A. Lemley.
Reference Books :
1. Intellectual Property Rights under WTO by T. Ramappa, S. Chand. 2. Introduction to Design by Asimov, Prentice Hall

Project Work (ITUA40176)

Teaching Scheme	Examination Scheme						
Credits: Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): 10 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	100	-	50	-	-	50	150

Course Objectives:

- To apply SDLC and meet the objectives of proposed development or research work
- To test rigorously before deployment of work in objective 1
- To validate the work undertaken during objective 1 and 2
- To consolidate the development or research work as project report.

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

1. Produce evidence of independent investigation
2. Analyze the results and their interpretation intensively and critically.
3. Report and present the original results in an orderly way and placing the open questions in the right perspective.
4. Link techniques and results from literature as well as actual research and future research lines with the research.
5. Appreciate practical implications and constraints of the specialist subject

Guidelines

The student shall complete the work of the Project which will consist of problem statement, literature review, SRS, Model and Design, Selection of Technology and Tools, Installations, UML implementations, testing, Results, performance discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems and comparative analysis and validation of results and conclusions. The candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic. The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report. The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is the duly certified by the concerned guide and head of the Department/Institute.

MODULE-II

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
			L	T	P	ISE		CE	ESE	PR/ OR		
						T1	T2					
ITUA40177	Semester Internship	CE-PR/ OR	-	-	24	-	-	100	-	50	150	12
A4	Audit Course	AU	-	-	-	-	-	-	-	-	-	-
Total		-	-	-	24	-	-	100	-	50	150	12

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of Information Technology

T.Y.B.Tech

2017 Pattern

Syllabus Curriculum

SEMESTER – VIII

Elective-IV Software Defined Network (CSUA42171A)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisites: Computer Networks

Course Objectives

- To understand the challenges of the traditional networks and evolution of next generation networks.
- To gain conceptual understanding of Software Defined Networking (SDN) and its role in Data Center.
- To understand role of Open Flow protocol and SDN Controllers..
- To study industrial deployment use-cases of SDN
- To Understand the Network Functions Virtualization and SDN.

Course Outcomes

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

1. Interpret the need of Software Defined Networking solutions.
2. Analyze different methodologies for sustainable Software Defined Networking solutions.
3. Select best practices for design, deploy and troubleshoot of next generation networks.
4. Develop programmability of network elements.
5. Demonstrate virtualization and SDN Controllers using OpenFlow protocol .

Unit I: Introduction to Software Defined Networking (SDN)

Challenges of traditional networks, Traditional Switch Architecture - Control, Data and management Planes, Introduction to SDN, Need of SDN, History of SDN, Fundamental characteristics of SDN (Plane Separation, Simplified Device and Centralized control, Network Automation and Virtualization, and Openness), SDN Operation/Architecture, SDN API"s (Northbound API"s, Southbound API"s, East/West API"s), ONF, SDN Devices and SDN Applications.

Unit II: Open Flow

OpenFlow Overview, The OpenFlow Switch, The OpenFlow Controller, OpenFlow Ports, Message Types, Pipeline Processing, Flow Tables, Matching, Instructions, Action Set and List, OpenFlow Protocol, Proactive and Reactive Flow, Timers, OpenFlow Limitations, OpenFlow Advantages and Disadvantages, Open v Switch Features

Unit III: SDN Controllers

SDN OpenFlow Controllers: Open Source Controllers - NOX, POX, Beacon, Maestro, Floodlight, Ryu and Open Daylight, Applicability of OpenFlow protocol in SDN Controllers, Mininet, and

implementing software-defined network (SDN) based firewall.	
Unit IV: SDN in Data Centre	
Data Center Definition, Data Center Demands (Adding, Moving, Deleting Resources, Failure Recovery, Multitenancy, Traffic Engineering and Path Efficiency), Tunneling Technologies for the Data Center, SDN Use Cases in the Data Center, Comparison of Open SDN, Overlays, and APIs, Real-World Data Center Implementations.	
Unit V: Network Functions Virtualization (NFV)	
Definition of NFV, SDN Vs NFV, In-line network functions, Benefits of Network Functions Virtualization, Challenges for Network Functions Virtualization, Leading NFV Vendors, Comparison of NFV and NV.	
Unit VI: SDN Use Cases	
Wide Area Networks, Service Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile Networks, Optical Networks, SDN vs P2P/Overlay Networks.	
Text books :	1.Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann, 2014, ISBN: 9780124166752, 9780124166844. 2.Siamak Azodolmolky, "Software Defined Networking with Open Flow, Packt Publishing, 2013, ISBN: 9781849698726 3.Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", 2013, ISBN : 10:1-4493-4230-2, 978-1-4493-4230-2
Reference Books :	1. Vivek Tiwari, "SDN and OpenFlow for Beginners", Digital Services, 2013, ISBN: 10: 1-940686-00-8, 13: 978-1-940686-00-4 2. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", CRC Press, 2014, ISBN: 10: 1466572094 3. Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015

Elective-IV Robotic Process Automation (CSUA42171B)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisites: Software Engineering, Software Testing, java programming concept

Course Objectives

- To learn concepts of Robotic Process Automation.
- To learn Robotic Process Automation for performing repetitive, less complex tasks.
- automate manually performed workflow tasks that are rule-based, repeatable, time-consuming
- elaborates on the features and benefits of using Robotic Process Automation techniques in businesses

Course Outcomes

Upon completion of the course, student will be able to

1. Gain insights into Robotic Process Automation Technology
2. Learn basic concepts of UI Automation using UiPath
3. Learn to use several types of data inside a workflow
4. Learn to organize a real-world workflow automation project
5. Develop skills in debugging a workflow
6. Understand reusing of automation by implementing templates

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**

Unit II: Dashboard in Automation Anywhere

Task Bots,.Recording the task. ,Create Task, .Task Editor and its usages .Features in Task Editor

Unit III: Types of BOTS

Task Bots and its usages ,Meta Bots and its usages, .Learn IQ Bots, Implement web services: MetaBot and its Usages,.Overview, Creation of Metabot , Understand Designer in MetaBot

Unit IV: Integrate PDF

Usage of If/else command ,Datanse and AA, Email Automation in AA, .Handling Exceptions , Commons in PGP	
Unit V: ADDING METABOT and folders to METABOT	
Recording Record set ,Various configurations in MetaBot Screens ,Calibrations in MetaBotScreens, adding folders to METABOT: How to record in MetaBot, Logic Editor,.Import and export MetaBot	
Unit VI: Implementing RPA in Enterprise : Case study	
Building a business case, Determining which process to automate, Case study of invoice automation	
Web Links	1. https://www.cb-india.com/books/artificial-intelligence-en/robotics/robotic-process-automation-and-risk-mitigation-the-definitive-guide/?currency=INR 2. https://www.amazon.com/Robotic-Process-Automation-Repetitive-Consultant-ebook/dp/B07DFNGWCH/ref=pd_sbsd_14_1/147-4549802-0204421?_encoding=UTF8&pd_rd_i=B07DFNGWCH&pd_rd_r=d79d69ba-d6e6-4662-9927-54ebbfb5273a&pd_rd_w=srv7k&pd_rd_wg=PPSKp&pf_rd_p=2c2d0d3b-b3c5-4110-93fa-2c1270309ac1&pf_rd_r=06VJFMFHZNR8MWA2QEPF&psc=1&refRID=06VJFMFHZNR8MWA2QEPF 3. https://www.simplilearn.com/introduction-to-robotic-process-automation-course#course-description 4. https://www.tutorialspoint.com/blue_prism/blue_prism_introduction_to_rpa.htm 5. https://www.multisoftvirtualacademy.com/robotics/robotics-process-automation-online-training 6. https://www.edureka.co/lms_courses/download_curriculum?filename=robotic-process-automation-training-3.pdf **7.** https://www.yet5.com/institutes/courses/244/1263/1/875/rpa-robotic-process-automation-training-at-pondicherry-city.html

Elective-IV Augmented/Virtual Reality (CSUA42171C)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisites: Discrete Mathematics, Data Structures and Theory of Computation

Course Objectives

- To make students know the basic concept and framework of virtual reality.
- To introduce students the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behavior.
- To aware students the technology for managing large scale VR environment in real time.
- To provide students with an introduction to the VR system framework and development tools.
- To learn **VR Development Tools**
- To know vAugmented Reality System Structure

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 technology for multimodal user interaction and perception in VR Decide and apply algorithmic strategies to solve a given problem
3. To apply VR Tools in real time environment.
4. To understand Augmented reality
5. To understand Augmented Reality System Structure

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-based3D Menus & 3DScanner 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

Unit III: Environment Modeling in Virtual Reality

Geometric Modeling; Behavior 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; Modeling Tools for VR; X3D Standard; Vega, MultiGen, Virtools etc
Unit VI: Augmented Reality
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.
Reference Books :

1. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009.
2. Gerard Jounghyun Kim, Designing Virtual Systems: The Structured Approach, 2005.
3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, 3D User Interfaces, Theory and Practice, Addison Wesley, USA, 2005.
4. Oliver Bimber and Ramesh Raskar, Spatial Augmented Reality: Meging Real and Virtual Worlds, 2005.
5. Burdea, Grigore C and Philippe Coiffet, Virtual Reality Technology, Wiley Interscience, India, 2003.
6. John Vince, Virtual Reality Systems, Addison Wesley, 1995.
7. Howard Rheingold, Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society, Simon and Schuster, 1991.
8. 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
9. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

Elective-IV Ubiquitous Computing (ITUA42171)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisites: Human Computer Interaction, Computer Network Technology.

Course Objectives:

- To describe ubiquitous computing, its properties applications and architectural design.
- To explain various smart devices and services used in ubiquitous computing.
- To teach the role of sensors and actuators in designing real time applications using Ubicomp.
- To explore the concept of human computer interaction in the context of Ubicomp.
- To explain Ubicomp privacy and challenges to privacy.
- To describe Ubicomp network with design issues and Ubicomp management.

Course Outcomes:

After studying this course, students will be able to:

1. Describe the characteristics of pervasive computing applications including the basic computing application problems, performance objectives and quality of services, major system components and architectures of the systems.
2. Analyze the strengths, problems and limitations of the current tools, devices and communications for pervasive computing systems.
3. Recognize the different ways that humans will interact with systems in a ubiquitous environment and account for these accordingly
4. List and exemplify the key technologies involved in the development Ubicomp systems
5. Develop an attitude to identify and propose solutions for security and privacy issues.
6. Explore the trends and problems of current pervasive computing systems using examples.

Unit I : Introduction to Ubiquitous Computing

Concept of Distributed Computing, Mobile Computing, Pervasive Computing, Wearable Computing, Modeling the Key Ubiquitous/Pervasive Computing Properties, Mobile Adaptive Computing , Mobility Management and Caching.

Unit II : Pervasive Computing Devices

Smart Environment: CPI and CCI Smart Devices: Application and Requirements, Device Technology and Connectivity, Human Computer Interaction.

Unit III : Human-Computer Interaction	
Explicit HCI, Implicit HCI, User Interface and Interaction for four hand-held widely used devices, Hidden UI via basic smart devices, Hidden UI via wearable and Implanted devices, Human centered design, user models.	
Unit IV : Middleware for Pervasive Computing	
Adaptive middleware, Context aware middleware, Mobile middleware, Service Discovery, Mobile Agents. User Models: Direct and indirect user input and modeling, modelling users' planned tasks and multiple tasks-based computing.	
Unit V : Security in Pervasive Computing	
Security and Privacy in Pervasive Networks, Experimental Comparison of Collaborative Defense Strategies for Network Security.	
Unit VI : Challenges and Outlook	
Overview of challenges, smart devices, Smart Interaction, Smart physical environment device interaction, Smart human-device interaction, Human Intelligence versus machine intelligence, social issues. Case Study- Wearable Computing/ Cyber Physical System.	
Text books:	
1. Stefan Poslad, Ubiquitous Computing, Wiley, Student Edition, ISBN:9788126527335 John Krumm, Ubiquitous Computing Fundamentals. 2. Frank Adelstein, Sandeep Gupta, Golden Richard III, Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing," Tata McGraw Hills.	
Reference Books:	
1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtor, Thomas Schaeck, "Pervasive Computing," Pearson, Eighteenth Impression, 2014.	
Prerequisites: Human Computer Interaction, Computer Network Technology.	
1	**Setting-up the environment:** Android development environment. Installing and setting up the environment. Hello world application. Running the emulator. Inserting debug messages.
2	**UI Design:** Design a User Interface using pre-built UI components such as structured layout objects, UI controls and special interfaces such as dialogs, notifications, and menus. Also make this UI attractive using Android graphics platform OpenGL.
3	**Database Connectivity:** Create a SQLite Database for an Android Application and perform CRUD (Create, Read, Update and Delete) database operations.
4	**Sensors for building Smart Applications:** Use any sensors on the device to add rich location and motion capabilities to your app, from GPS or network location to accelerometer, gyroscope, temperature, barometer, and more.
5	**Design and Development of Smart Application/System :** List of Project Areas: Context-aware

	computing, Proactive computing, Mobile and real-time data/media management, Multimedia data and sensing dissemination, Mobility management, Location-dependent query processing, and positioning and Healthcare application.
6	**Android API:** Implement an application that uses Android APIs like Google Map, recording and playing audio and video, using the built-in camera as an input device.
7	**Machine Learning :** Mobile multimodal sensing- Draw inferences over the data coming from phone's sensing hardware (e.g. accelerometer, GPS, microphone), and processing these samples with the help of machine learning. (Any Application: Healthcare, Smart City, Agriculture, etc).
8	**Wireless Network and Security :** The inputs are supplied by the mobile phone/ by another computer connected through wireless networks and Authentication of two devices.

WebLink : Links for Laboratory Assignments

1. https://developer.android.com/
2. https://www.androidhive.info/2011/11/android-sqlite-database-tutorial/
3. https://developers.google.com/android/guides/api-client
4. https://developer.android.com/guide/topics/sensors/sensors_overview

Open Elective-I Introduction to Gaming (IOEUA42172A)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisites: NA

Course Objectives:

- To learn about the video game art principles, Video Game production, Design Process and the Industry
- To understand and distinguish Video game elements, genres, types ad hardware
- To Study various video game production practices, terminology, Industry roles and responsibilities
- To know the application and use of a game engine across various verticals and develop and learn how to work with the game engine as a tool for production
- To examine and game engine interface, coding, game objects, asset Store, services, etc

Course Outcomes:

Upon completion of the course, student will be able to –

1. Use terminology related to Games and Interactive Media Industry
2. Relate to Industry demands and structure project as per required specifications
3. Define Specifications for the execution of the project
4. Demonstrate game engine tools usage across art, animation, asset management, Interface, Audio, Lighting, Materials, Physics and Programming systems.
5. List and select gaming services related to project structure
6. Develop basic interactive games

Unit I- Introduction to Games Industry

Video game production techniques, hardware, production roles and responsibilities, Video game design elements, game genres, game types, examples of gaming platforms, gaming services, video game controls, video game industry terms, model asset optimization, asset store, video game art principles, video game industry practices, video game industry terminology.

Unit II-Game Engine Fundamentals

Gaming engine user interface, hierarchy, editor, game Window, navigation, inspector, scene, project, game object, prefab, models, tags, sounds, assets, project management, materials, textures, effects, lights, modelling practices and optimization practices, import system, managing materials, managing textures.

Unit III- World Building and Animation

Environment, Static Meshes, Rigid Body, Colliders, Preparing for lighting, Light tools, light types, User

Interface, Art principles, Sprite editor, Lighting process, Baking process, Animated objects, Importing animation, Setting up animation states, Animation controllers, Transition, Animation refinement.

Unit IV- Scripting a Game Development

Script types, Variables, Methods, C# fundamentals, Game mechanics, Ray casting, Program Debugging, Various Error states, Navigation, Nav Mesh, Building NPC, Simple AI, Enemy System, Particle system, Adding Game audio, Audio types, Audio formats, Audio clips and properties, Camera System, Building camera system, Player Behaviors, User Interface system, User Interface Implementation, Properties of UI, Build tools, Cloud Services, Console, Build Settings, Platforms, Publishing tools, Mobile Publishing

Text books :

1. Tom Meigs, Ultimate Game Design: Building Game Worlds 1st Edition, McGraw-Hill Education, 2003

2. Sam R. Kennedy, How to Become a Video Game Artist: The Insider's Guide to Landing a Job in the Gaming World, Watson-Guptill, 2013

Reference Books :

1. Penny de Byl, Holistic Game Development with Unity: An All-in-One Guide to Implementing Game Mechanics, Art, Design and Programming, 2nd Edition, A K Peters/CRC Press, 2017

2. Mike Geig, Unity 2018 Game Development in 24 Hours, Sams Teach Yourself, 3rd Edition, Sams Publishing, 2018

List of Practical Assignments:

Develop a game "Roller Madness" in Unity environment as following assignments

1	Implement the Setting Up the Scene, Camera Setup
2	Implement the Physics system
3	Configure the Player Control and Appearance
4	Health and Damage, Pickups
5	UI Basics and Game Manager
6	Create the Enemies
7	Implement the Particle System
8	Implement Animations to the game avatar
9	Spawners to create multiple objects of same type

Note: Do any 6 assignments based on syllabus

Open Elective-I Inferential Statistics to Data science (IOEUA42172B)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Basics of Probability

Course Objectives:

- To equip students with the basic understanding of the fundamental concept of data and the nature of data sets
- To understand the fundamentals of probability distributions and their application for data analysis
- To derive the conclusions from the data sets with Bayesian and Inferential statistics

Course Outcomes:

1. Comprehend and correlate the nature and central tendency of given data sets using appropriate probability distribution for the given data set.
2. Implement the fundamentals of Bayesian statistics to find out probability of unknown parameters of statistical model
3. Analyze and conclude the hypothesis using inferential statistical tests
4. Evaluate the prominent characteristics of data sets with exploratory data analysis methods

Unit I : Understanding Data and probability distributions

Understanding Data, Frequency Tables, Distributional Shapes, Central Tendency Describing Spread: Range, Interquartile Ranges and Standard Deviation , Measuring Data ,Measurements of Central Tendency, Measurements of Dispersion, Bi-variate Data and Covariance ,Pearson Correlation Coefficient, Uniform Distribution, Binomial Distribution, Poisson Distribution, Normal Distribution, Normal Distribution - Formulas and Z Scores

Unit-II : Bayesian Statistics

Likelihood function and maximum likelihood, The minimaxity, Computing the MLE, Computing the MLE: examples ,Continuous version of Bayes' theorem, Priors and prior predictive distributions Prior predictive: binomial example, Posterior predictive distribution, Bernoulli/binomial likelihood with uniform prior, Conjugate priors

Unit III: Inferential analysis

Central limit theorem and Hypothesis Testing , t-tests, Sensitivity Analysis ,chi square test, Correlation-values and confidence intervals, Use Analysis of Variance (ANOVA) or Analysis of Covariance (ANCOVA),Regression analysis

Unit IV: Exploratory Data Analysis

Univar ate data: measures of center and spread, transformations, visualization. – Bivariate data: Simple regression, curve fitting, – Trivariate/Hypervariate data: Multiple regression, model selection, principal components. – Binary responses: Logistic regression, residuals. – Categorical data:

Contingency tables, correspondence analysis. – Distance data: Multi-dimensional scaling, non-linear dimensionality reduction. – Graph data: Descriptive statistics, spectral methods, visualization.

Text Books :

1. Sahu, Pradip Kumar, **Pal**, Santi Ranjan, **Das**, Ajit Kumar, "Estimation and Inferential Statistics", Springer
2. S.C. Gupta and V. K. Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 88, Daryaganj, New Delhi,
2. Manoj Kumar Srivastava, Abdul Hamid Khan, Namrata Srivastava, "Statistical Inference, Theory of estimation", PHI

Reference Books :

1.George Casella, Roger Berger," Statistical Inference ",CENGAGE Learning, Second Edition
2.Malcom O, Asadoorian, Demetri Kantarelis, "Essentials of Inferential Statistics", University Press of America

List of Practical Assignments:

1	Study of Hypothesis testing(One sample t test, z test)
2	Analysis of variance (ANOVA)
3	To study Linear regression to predict the outcome of a variable.
4	Study of outlier in Predictive analysis.
5	Finding the most important predictor variable in a dataset for feature Selection
6	Model selection and analysis for a real world dataset
7	Study of Logistic Regression
8	To build an application: Time series forecasting

Assignments can be implemented using Python/R

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of Information Technology

Open Elective-I Solar and Wind Energy (IOEUA42172C)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Basic Mechanical Engineering, Basic Electrical and Electronics Engineering

Course Objectives:

- To understand fundamentals of solar and wind energies.
- To understand constructions, working principle and design procedure of solar and wind power plants.
- To apply basic engineering principle to design a simple solar and wind power system.

Course Outcomes:

After successful completion of the course, student will be able to

1. Understand solar radiation and geometry principles.
2. Apply aspects of solar thermal system and its practical applications.
3. To aware design process of solar food drier/solar cooker/solar pv system for domestic purpose.
4. Design miniature wind mill for domestic purpose referring existing system.

Unit I- Solar Energy Principles

Present solar energy scenario, world energy futures, governing bodies (self-study), solar radiations and its measurements, solar constant, solar radiation geometry, solar radiation data, estimation of average solar radiation, solar radiation on tilted surface.

Unit II- Solar Thermal Systems and Applications

Types of Solar thermal collector, flat plate collector analysis, Evacuated tube collectors (ETC) analysis, its design and application, solar air heaters and its types, solar distillation.
Solar Concentrating collectors: types- line and point concentrator, theory of Concentrating collectors, parabolic trough collector, parabolic dish collector, solar tower, concentrated Fresnel linear receiver (CFLR).

Unit III- Solar Photovoltaic and Applications

Forming the PN junction solar cells & its applications, Structure of a solar cell, types of modules, PV array, solar cell equation, Fill factor and maximum power, Grid aspects of solar power, equipment used in solar photovoltaic plants, Power Conditioning Equipment-inverters, Regulators, Other Devices; System Analysis-Design Procedure, Design Constraints, Other Considerations.

Unit IV- Wind Energy

Principle of wind energy conversion; Basic components of wind energy conversion systems; various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations, wind energy potential and installation in India.

Text Books:	
1. G. D. Rai, 'Non-Conventional Energy Sources', Khanna Publisher 2. S. P. Sukhatme, 'Solar Energy: Principles of thermal collections and storage', McGraw Hill 3. Tiwari G N. 'Solar Energy: Fundamentals, design, modeling and Applications', Narosa, 2002	
Reference Books :	
1. Mukund R. Patel, 'Wind And Solar Power Systems: Design, Analysis and Operation, Second Edition', CRC Press 2. Kreith And Kreider, Solar Energy Handbook, McGraw Hill 3. Ray Hunter, 'Wind Energy Conversion: From Theory to Practice', John Wiley and Son Ltd 4. Gary L Johnson, 'Wind Energy Systems', Prentice-Hall Inc., New Jersey 5. Martin O L Hansen, 'Aerodynamics of Wind Turbines', James & James/Earthscan. 6. Goswami D Y, Kreith F, Kreider J F, 'Principles of Solar Engineering', Taylor & Francis 7. Robert Gasch, 'Wind Power Plant Fundamentals, Design, Construction And Operations', Springer 8. C S Solanki, 'Solar Photovoltaic: Fundamentals, Technology And Applications', PHI Learning	
List of Practical Assignments:	
1	Design of solar food drier for domestic purpose referring existing system.
2	Design of parabolic dish solar cooker for domestic purpose.
3	Design and analysis of liquid flat plate type heater used in domestic purpose.
4	Design of solar photovoltaic system for domestic/ commercial building purpose.
5	Case study on designing miniature wind mill for domestic purpose referring existing system.
6	Visit to solar PV system used in commercial building.
7	Visit to wind power system used in commercial building.

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of Information Technology

Open Elective-I Statistical and Numerical Methods (IOEUA42172D)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: Engineering Mathematics

Course Objectives:

• To prepare the students to apply numerical methods to solve differential equations, integrations and simultaneous equations and perform regression analysis.

Course Outcomes:

Upon the completion of the course, students will be able to

1 Apply curve fitting techniques, carry out regression and interpolation analysis of any engineering problem.

2 Solve simultaneous equations using numerical technique.

3 Perform numerical integration for any engineering problem.

4 Solve differential equation of any engineering problem using numerical technique.

Unit I: Curve Fitting, Regression and Interpolation

Curve fitting with Linear Equation, Criteria for a Best Fit, Linear Least Square Regression, Linear Regression Analysis, Coefficient of Determination, Polynomial Regression, Multiple Linear Regression, Lagrange's Interpolation, Newton's Forward Interpolation, Hermit Interpolation, Inverse Interpolation

Unit II: Simultaneous Equations

Gauss Elimination Method, Partial Pivoting, Gauss Seidel Method, Gauss Jordan Method and Thomas Algorithms for Tridiagonal Matrix.

Unit III: Numerical Integration

Trpezoidal rule, Simpson's Rule (1/3rd and 3/8th), Gauss Quadrature2 point and 3 point method, Double Integration- Trapezoidal Rule, Simpson's 1/3rd Rule

Unit IV: Numerical Solution of Differential Equations

Euler Method, Modified Euler Method (Iterative), Runga-Kutta Fourth Order Method, Simultaneous Equations using Runga-Kutta Second Order Method, Introduction to Finite Difference Method.

Text books:	1. Numerical methods- Rao V. Dukkipati- New Age International Publishers 2. Introductory Methods of Numerical Analysis- S.S.Sastry-University Press

Reference books:	1.Numerical Methods in Engineering with Python 3 – Jaan Kiusalaas-Cambridge University Press 2. Numerical Methods -S. Balachandra Rao and C.K.Shantha, University Press

Open Elective-I Social Media Analytics (IOEUA42172E)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisites: Basic knowledge of Graphs, Data mining, Data Analysis.

Course Objectives:

- To understand foundations of Social Media Analytics.
- To Visualize and understand the data mining aspects in social networks.
- To solve mining problems by different algorithms.
- To understand network measures for social data.
- To understand behavioral part of web applications for Analysis.
- To analyze the data available on any social media applications.

Course Outcomes:

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

1. Understand the basics of Social Media Analytics and develop web crawler.
2. Understand the visualization of social networks and the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining by implementing clustering algorithms.
4. Compare and Apply network measures for social media data by implementing certain centrality measures.
5. Explain Behavior Analytics techniques used for social media data and implement local and global clustering coefficient technique.
6. Explore Facebook and Twitter API.

Unit I : Introduction to Social media analytics (SMA) and network Visualization

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas

The foundation for analytics, Social media data sources, defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics

The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks, A

Taxonomy of Visualization,

Unit II : Data and text Mining in social media

Data mining in Social Media- Introduction, Data mining methods for Social Media, Text Mining- Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering

Unit III : Network Measures

Centrality: Degree Centrality, Eigenvector Centrality, Katz Centrality, PageRank, Betweenness Centrality, Closeness Centrality, Group Centrality. Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence

Unit IV : Behavior Analytics

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction

Text books :

1. Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
2. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.
3. Matthew Ganis, Avinash Kohirkar Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media,Pearson publications,2016

Reference Books :

1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0. 2.
2. Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615.
3. Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860-901-6.
4. Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2nd Edition, ISBN: 978-3-642-19459-7

List Of Practical Assignments:

1	Implement a web crawler using Scrapy.
2	Implement hierarchical clustering in python.
3	Implement k-means clustering in python.
4	Plot the given graph in python and calculate its Degree centrality.
5	Plot the given graph in python and calculate its Betweenness centrality.
6	Plot the given graph in python and calculate its Closeness centrality

7	For the given graph compute local and global clustering coefficient.
8	Study Assignment-Explore Twitter's API and Facebook's social graph API.

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of Information Technology

Open Elective-II Financial Technology (IOEUA42173A)

Teaching Scheme	Examination Scheme						
Credits:2 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: NA

Course Objectives:

- To Introduce FinTech and it's sub sectors
- To Explain the classification of various models of FinTech
- To Describe the innovation in FinTech
- To Introduce an innovative Fin Tech strategy
- To Study the development of FinTech Application and about future trends in Fin Tech

Course Outcomes:

After completion of the course, student will be able to

1. Understand what FinTech is and the sub sectors that comprise it.
2. Classify various models of the Fintech
3. Illustrate various innovations done using latest technology trends in FinTech.
4. State the Critical Success Factors in Fin Tech.
5. Be able to adopt an innovative Fin Tech strategy within their own organization to lead a digital transformation project.
6. Develop the application using the concepts of FinTech as a case study

Unit I : 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, Ranking National Ecosystems, Downsides of Disruptive Fintech Initiatives.

Unit II : 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, Revenue—Focus on Customer Lifetime Value, Components of an effective marketing plan.

Unit III: Fintech Innovation

Introduction, Innovation and Fintech, Digital Transformation and Fintech, A model for an integrated innovation strategy, Types of Innovation : Product (or services), Process, Organization, Business models, Examples of Innovation, Fintech business model canvas, 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, Business Model Innovation, Robots, The V4 business model framework for Kreditech, Virtual Currencies, Technology Acceptance Model.

Unit IV: Critical Success Factors

The Model, Low-Profit Margin, Agility, Scalability, Security Management, Innovation, Ease of Compliance, Metrics, Fintech and Financial Services, Structure of fintech initiatives, The Challenges, Aspects to Consider, A Cooperation Model, Open Innovation

Unit V: Regulations

The Role of the Regulators, Equal Treatment and Competition, The Risks to Consider, Regtech, A Business Model for Insurtech Initiatives, Drivers of Disruption, The Impact of Technology, Insurance and Technology: Insurtech, Application of the Model to the Insurance Industry, The Empowerment of Customers, Mobility in Support of Insurance Companies, Digital Wholesale Insurance,

Unit VI: A Case Study

Introduction, Robotica, Business Model Canvas, The Value Proposition, Customer Experience, Channels, Processes and Activities, Resources and Systems, Partnership and Collaborations, Revenues, Costs and Investments, The Future: Financial Services as Platforms

Text Books:

1. B. Nicoletti, The Future of FinTech, 1st ed. Palgrave Macmillan, 2017
2. Kelvin Leong and Anna Sung "FinTech (Financial Technology): What is It and How to Use Technologies to Create Business Value in Fintech Way?" International Journal of Innovation, Management and Technology, Vol. 9, No. 2, April 2018

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., & 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.*

Open Elective-II Electronics for Agriculture (IOEUA42173B)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: Basic Electronics devices and their operations, Basic understanding of sensors and transducers, Basic Farming Activities.

Course Objectives:

- To empower the learner to recognize environmental problems and to provide solutions to agricultural sector.
- An over view of technology of advanced topics like DAS , SCADA and IOT .
- The ability to select the essential elements and practices needed to develop and implement the Engineering Automation for Agricultural sector.

Course Outcomes:

After completion of this course, students will be able to

1. Understand Role of Instrumentation & DAS.
2. Understand basics of Sensors and transducers.
3. Describe Instrument technology used in agriculture.
4. Apply knowledge of Electronics to achieve Precision Farming.
5. To design select and justify system components for different control Farming applications
6. Understand Smart Agriculture Technology & Role of Electronics Governance

Unit I: of Instrumentation system and Data acquisitions systems (DAS)

Introduction of Instrumentation system, Block diagram, Data loggers, Data acquisitions systems (DAS), Basics of PLC, Supervisory control and data acquisition (SCADA),

Unit II: Sensors and Transducers

Basic of sensors and transducers, Type of sensors, Performance terminology - Displacement, Velocity and Motion sensors - Proximity sensors, Force, Pressure, – **Soil parameter measurement sensors** - Flow, Level and Temperature sensors, Humidity, pH and Conductivity sensors, Specifications and selection criteria.

Unit III: Instrument technology for agriculture

Instruments for measurement of pH, Electrical conductivity, gas analysis, humidity, leaf area, chlorophyll content, and soil moisture & temperature.
Instrument for crop monitoring – moisture measurement – capacitive, infrared reflectance and

resistance. Monitoring soil and weather – measurement of soil properties and meteorological parameters

Unit IV: Precision Farming

An introduction to precision farming. GIS/GPS positioning system for precision farming, Yield monitoring and mapping, soil sampling and analysis. Computers and Geographic information systems. Precision farming- Issues and conditions. Role of electronics in farm machinery for precision farming. Technology for precision farming.

Unit V: Control Applications in Farming:

Irrigation control systems. Instruments for crop establishment monitoring. Crop spraying – selective crop spraying – flow control. Yield monitoring. Instruments for protected cultivation – Green house environment control – transducers and control system. Instruments and systems for crop handling processing and storage.

Unit VI: SMART agriculture

Introduction to IOT, IOT in Agriculture, Wireless sensor networks, IOT network using LoRaWAN.Open Agriculture Initiative (OpenAg),

Agriculture & Electronics Governance: Technological Difficulties in Indian Context, Governance products & services in agriculture sector, Role of Electronics Governance in Agricultural sector.

Text Books:

1. K. Krishna Swamy, "Process Control"; New Age International Publishers.
2. C.S. Rangan, G.R. Sarma, V.S.V. Mani; " Instrumentation Devices and Systems "; Tata McGraw Hill; 2nd Edition
3. Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education

Reference Books:

1. Shimon Y. Nof , "Springer Handbook of Automations", Springer.
2. Ernest O. Doebelin; " Measurement System Application and Design "; Mc-Graw Hill; 5th Edition
3. David G. Alciatore, Michael B Histand; " Introduction to Mechatronics and Measurement System "; Tata McGraw Hill
4. De Mess M. N. Fundamental of Geographic Information System. John Willy & sons, New York, Datta S.K.1987

Open Elective-II Operation Research (IOEUA42173C)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: Engineering Mathematics

Course Objectives:

- To familiarize the students with various tools of optimization, probability and statistics as applicable scenarios in industry for better management of various resources.

Course Outcomes:

After completion of this course, students will be able to

1. Solve linear programming problems using appropriate techniques
2. Propose the best strategy using decision making methods under uncertainty and game theory
3. Apply the concept of transportation/assignment models to optimize available resources
4. Develop mathematical skill to solve inventory and replacement problems
5. Perform minimization of process time
6. Use CPM and PERT techniques, to plan, schedule, and control project activities.

Unit I : Introduction to Operations Research

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem: Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, Two-phase method, Duality

Unit II : Decision Theory and Theory of Games

Decision Theory: Meaning and Steps in Decision Making, Types of Management Decisions, Decision under Certainty, Decision under Risk, Decision under Uncertainty, Decision Trees. Theory of Games: Introduction, Minimax and Maximin Principle, Solution of Game with Saddle Point, Solution by Dominance, Solution by Graphical Method, m x n size Game Problem

Unit III : Transportation and Assignment Model

Transportation Model: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.Assignment model: Formulation. Hungarian method for optimal solution. Solving unbalanced problem

Unit IV : Inventory Control and Replacement Analysis

Inventory Control: Basic Concepts, fixed order quantity inventory model, economic order quantity inventory models, probabilistic inventory model. Replacement Analysis: Replacement of Items that Deteriorate, Replacement of Items that Fail Suddenly: Individual replacement policy, Group replacement policy.

Unit V : Queuing Theory and Sequencing Model

Queuing Theory: Introduction, Basis Structure, Terminology (Kendal's Notations), Queuing Model M/M/1: /FIFO, M/M/c.

Sequencing models: Solution of sequencing Problem - Processing of n jobs through two machines, Processing of n jobs through three machines, Processing of two jobs through m Machines, Processing of n jobs through m Machines.

Unit VI : Project Management

Fundamentals of CPM and PERT networks, CPM: Construction of networks, Fulkerson's rule , Critical paths, Forward and backward pass, Activity Float analysis, Crashing Analysis, PERT: Time estimates, Construction of networks, Probability of completing projects by given date.

Text Books:

1. Sharma S.D., "Operations Research", Kedarnath Ramnath and company publications. ISBN-13:1234567142552
2. Gupta P.K., Hira D.S., "Operations Research", S Chand and Co. Ltd., New Delhi. ISBN 13:9788121902816
3. Taha H.A., "Operations Research - An introduction", Prentice Hall Pvt. Ltd. ISBN-13: 978-0132555937

Reference Books :

1. Hillier F.S., Lieberman G.J., "Introduction to Operations Research", Tata McGraw-Hill. ISBN 978-0-07-337629-5
2. Wagner H.M., "Principles of Operations Research", Prentice-Hall India ISBN 978-0-9843378-2-8
3. Ravindran A., "Operations Research", Tata McGraw-Hill. New Delhi ISBN-13: 978-0471086086
4. Basu S.K., Pal D.K., and Bagchi H., "Operations Research for Engineers", Oxford and IBH Publishing ISBN 81-204-1251-6
5. Panneerselvam R., "Operations Research", Prentice Hall of India Ltd., New Delhi ISBN 81-203-1923-0

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of Information Technology

Open Elective-II Total Quality Management (IOEUA42173D)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite:NA

Course Objectives:

To introduce the basic concepts of Quality management System and Management Information System.

Course Outcomes:

Upon the completion of the course, students will be able to,

1. Comprehend the aspects of Quality in Construction activity
2. Explain the application of Six Sigma and Seven Quality tools in the Total Quality Management
3. Explain the role of Quality Manual to monitor Total Quality Management System
4. Comprehend the aspects of benchmarking and certifications
5. Explain the techniques of TQM implementation and awards

Comprehend the aspects of Management Information System

Unit I :Quality in Construction

Quality – Various definitions and interpretation. Importance of quality on a project in the context of global challenges, Factors affecting quality of construction, Reasons for poor quality and measures to overcome, Contribution of various Quality Gurus (Juran, Deming, Crossby, Ishikawa), Evolution of TQM- QC, TQC, QA, QMS, TQM.

Unit II :TQM & Six Sigma

TQM – Necessity, advantages , 7QC tools, Quality Function Deployment(QFD), Six sigma – Importance, levels, Defects & it's classification in construction. Measures to prevent and rectify defects.

Unit III :ISO & Quality Manual

Study of ISO 9001 principles. Quality manual – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel reinforcement activity. Corrective and Preventive actions, Conformity and NC reports

Unit IV :Management Control & Certifications

Benchmarking in TQM, Kaizen in TQM. Quality Circle. Categories of cost of Quality. CONQAS, CIDC-CQRA certifications.

Unit V : Techniques in TQM Implementation and awards

5 _S' techniques. Kaizen. Failure Mode Effect Analysis (FMEA). Zero Defects. National & International quality awards- Rajeev Gandhi Award, Jamuna lal Bajaj Award, Golden Peacock Award, Deming Prize, Malcolm Baldrize award

Unit VI : Management Information System
Introduction to Management Information systems (MIS) Overview, Definition. MIS and decision support systems, Information resources, Management subsystems of MIS, MIS based on management activity whether for operational control, management control, strategic control. Study of an MIS for a construction organization associated with building works.
Text books:
1. Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra. 2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ. Company. 3. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar—Biztantra. 4. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.
Reference books:
1. Juran's Quality Handbook – Juran Publication. Importance of quality on a project in the context of global challenges. Importance of quality on a project in the context of global challenges. 2. Management –Principal, process and practices by Bhat – Oxford University Press. 3. Financial management by Shrivastava- Oxford University Press. 4. Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co. 5. Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd.
Weblink :www.nptel.ac.in , www.mobile.enterpriseappstoday.com

Open Elective-II Blockchain Technology (IOEUA42173E)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: NA

Course Objectives:

- To understand the basic fundamentals of Blockchain
- To introduce Bitcoin Blockchain
- To explain blockchain creation process
- To know the importance of Hyperledger
- To gain knowledge about the multi chaining
- To discuss the emerging trends in Blockchain and Use cases

Course Outcomes:

Upon completion of this course, students will be able to:

1. To understand the basic fundamentals of Blockchain
2. To introduce Bitcoin Blockchain
3. To explain blockchain creation process
4. To know the importance of Hyperledger
5. To gain knowledge about the multi chaining
6. To discuss the emerging trends in Blockchain and Use cases

Unit I: Overview of Blockchain

Basics of Blockchain, History of Blockchain, Network and protocols, Smart Contract and Consensus Algorithms, Blockchain users and adoption, Blockchain challenges

Unit II: Bitcoin Blockchain

Blockchain TOC Bitcoin/ Blockchain data structures, Keys as identity, Digital Signatures, Hashes, Hashes as Addresses, Hash Pointers and Data Structures, Blockchain transactions, Blockchain block structure

Unit III : Creating the Blockchain: Mining

Mining explained, The bitcoin network, The bitcoin Minning Process, Minning Developments

Unit IV : Hyperledger

Overview of Hyperledger, Hyperledger Projects, Hyperledger Architecture, Consensus model for permissioned Blockchains, Consensus and its interaction with architectural layers, Architecture of Enterprise level Blockchain applications.

Unit V : Blockchain on Multichain
Introduction to Multichain, Privacy and Permissions in Multichain, Features of Assets in Multichain, Multichain Streams, Mining in Multichain, Interactive mode commands, Round Robin Mining.
Unit VI : Emerging Trends in Blockchain and Use cases
Transaction limitations, Additional blockchains, Hyperledger, Ethereum, Ripple, R3, Blockchain and cloud computing, Cloud -Based Blockchains, Blockchain Use cases, Blockchain and Artificial Intelligence.
Text Books :
1.Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos 2 Blockchain by Melanie Swa, O'Reilly
Reference Books :
1.Hyperledger Fabric - https://www.hyperledger.org/projects/fabric

Introduction to Research (CSUA42174)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 1 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	-	-	-	-	-	25	25

Prerequisite: NA

Course Objectives:

- To study fundamental concepts of Research
- To study Technical Writing

Course Outcomes:

Upon completion of the course, student will be able to

1. Explain the basics of research methodology
2. Write and publish research article

Unit I : Introduction to Research

Overview of Research, Meaning of Research, Objectives, Types, Research Approaches, Significance, Research Methods vs Methodology, Research and Scientific Methods, Research Process. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Techniques involved in defining a problem Data Collection, Preparation and analysis.

Unit II : Technical Writing and Research Ethics

Technical Presentation and Technical Writing, Why Technical Writing, Layout of Technical Report/Article, Abstract, Introduction, Literature Survey-Overview of Literature Survey-Searching literature, Sources of Literature, Literature Survey and Reviewing Literature, Organizing Literature, Some Terminology-ISBN, New ISSN, DOI, Bib TeX, Strategies to Search-Keyword search, Backward and Forward Chronological Search, Adding References to document, New Findings, Experimental Details, Results and Discussion. Plagiarism tools, Publication process of Technical articles.

Text Books :

1. S. Kothari C.R., Research Methodology (2nd Ed.), Age International, (2004); ISBN(13): 978-81-224-1522-3 2.

Reference Books :

1. Berkman, Elliot T., A Conceptual Guide to Statistics Using SPSS, Sage Publications, 2011; ISBN: 978-1-4129-7406-6

2. Kumar, Ranjit, Research Methodology (3rd Ed); Sage Publications, 2011; IBSN: 978-1- 8492-0301-2 3.

Weblink	https://drive.google.com/file/d/1DVenZVYnCjLx1p0T5ZF-XC8pY_8FRADL/view

MODULE-IV

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
			L	T	P	ISE		CE	ESE	PR/OR		
						T1	T2					
ITUA42177	Semester Internship	CE-PR/OR	-	-	24	-	-	100	-	50	150	12
A4	Audit Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	24	-	-	100	-	50	150	12

List of Audit Courses: Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extra-curricular activities.