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.

(Pattern 2018)

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 the 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.

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Department of Information Technology

Final Year B.Tech.

2018 Pattern

Syllabus Structure

Final Year B. Tech. Information Technology - Semester VII (Pattern 2018) Module I

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
ITUA40181	Professional Elective-IV	TH	3	-	2	20	30	20	30	25	125	**4**
ITUA40182	Professional Elective-V	TH	3	-	2	20	30	20	30	25	125	**4**
IOEUA40183	Open Elective – II	TH	3	1	-	20	30	20	30	25	125	**4**
IOEUA40184	Open Elective – III	TH	3	-	2	20	30	20	30	25	125	**4**
ITUA40185	Intellectual Property Right (IPR)	CE	2	-	-	-	-	50	-	-	50	**2**
ITUA40186	Project Work	CE-PR/OR	-	-	10	100	-	-	-	50	150	**5**
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	**-**
	Total	-	**14**	**1**	**16**	**180**	**120**	**130**	**120**	**150**	**700**	**23**

Theory: 1Hr. = 1 Credit, Practical: 2Hrs. = 1 Credit, Tut:1 Hr. = 1 Credit, Mandatory course: No Credit

Professional Elective-IV:

1. Deep Learning (ITUA40181A)
2. Fundamentals of Blockchain Technology (ITUA40181B)
3. Image Processing (ITUA40181C)

Open Elective –II

1. Project Planning and Management (IOEUA40183A)
2. Software testing (IOEUA40183B)
3. 5G Mobile Networks (IOEUA40183C)
4. **Cloud Computing (IOEUA40183D)**
5. Solar and Wind Energy (IOEUA40183E)

Professional Elective-V:

1. UI/UX Design (ITUA40182A)
2. Distributed Systems (ITUA40182B)
3. Data Analytics and Science (ITUA40182C)

Open Elective-III

1. Robotics (IOEUA40184A)
2. Quantum Computing (IOEUA40184B)
3. Business Intelligence (IOEUA40184C)
4. Business Analytics (IOEUA40184F)

BoS Chairman | Dean Academics | Director

Final Year B. Tech. Information Technology - Semester VII (Pattern 2018) Module II

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR / TW		
ITUA40187	Semester Internship	CE-PR/OR	-	-	24	100	-	-	-	50	150	**12**
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	**-**	**-**	**-**	**24**	**100**	**-**	**-**	**-**	**50**	**150**	**12**

Theory: 1Hr. = 1 Credit, Practical: 2Hrs. = 1 Credit, Tut: 1 Hr. = 1 Credit, Mandatory course: No Credit

Mandatory Courses: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge

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

Final Year B. Tech. Information Technology - Semester VIII (Pattern 2018) Module III

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR / TW		
ITUA42181	Professional Elective-VI	TH	3	-	2	20	30	20	30	25	125	**4**
IOEUA42182	Open Elective-IV	TH	2	-	2	20	30	20	30	25	125	**3**
IOEUA42183	Open Elective-V	TH	2	-	2	20	30	20	30	25	125	**3**
ITUA42184	Introduction to Research	CE-PR/OR	1	-	2	-	-	-	-	25	25	**2**
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	**8**	**0**	**8**	**60**	**90**	**60**	**90**	**100**	**400**	**12**

Theory: 1Hr. = 1 Credit, Practical: 2Hrs. = 1 Credit, Tut: 1 Hr. = 1 Credit, Mandatory course: No Credit

Professional Elective VI:

1. Augmented and Virtual Reality (ITUA42181A)
2. Embedded Operating System (ITUA42181B)

Open Elective IV :

- Engineering Economics (IOEUA42182A)
- Computational Biology (IOEUA42182B)
- Software Quality Assurance System (IOEUA42182C)

- Technology and Financial Management IOEUA42182D
- Non-Destructive Techniques and Engineering Diagnosis (IOEUA42182E)

Open Elective V

- Inferential Statistics for Data Science (IOEUA42183A)
- E- Commerce (IOEUA42183B)
- Rural Technology (IOEUA42183C)
- Product Design Engineering (IOEUA42183D)
- Numerical Methods (IOEUA42183E)

BoS Chairman Dean Academics Director

Final Year B. Tech. Information Technology - Semester VIII (Pattern 2018) Module IV

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR / TW		
ITUA40187	Semester Internship	CE-PR/OR	-	-	24	100	-	-	-	50	150	**12**
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	**-**	**-**	**-**	**24**	**100**	**-**	**-**	**-**	**50**	**150**	**12**

Theory: 1Hr. = 1 Credit, Practical: 2Hrs. = 1 Credit, Tut: 1 Hr. = 1 Credit, Mandatory course: No Credit

Mandatory Courses: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge

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Department of Information Technology

Final Year B. Tech. Information Technology - Semester VIII (Pattern 2018) Module V

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
ITUA40181	Professional Elective-IV	TH	3	-	2	20	30	20	30	25	125	**4**
ITUA40182	Professional Elective-V	TH	3	-	2	20	30	20	30	25	125	**4**
IOEUA40183	Open Elective – II	TH	3	1	-	20	30	20	30	25	125	**4**
IOEUA40184	Open Elective – III	TH	3	-	2	20	30	20	30	25	125	**4**
ITUA40185	Intellectual Property Right (IPR)	CE	2	-	-	-	-	50	-	-	50	**2**
ITUA40186	Project Work	CE-PR/OR	-	-	10	100	-	-	-	50	150	**5**
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	**14**	**1**	**16**	**180**	**120**	**130**	**120**	**150**	**700**	**23**

Theory: 1Hr. = 1 Credit, Practical: 2Hrs. = 1 Credit, Tut:1 Hr. = 1 Credit, Mandatory course: No Credit

Professional Elective-IV:

1. Deep Learning (ITUA40181A)
2. Fundamentals of Blockchain Technology (ITUA40181B)
3. Image Processing (ITUA40181C)

Open Elective –II

1. Project Planning and Management (IOEUA40183A)
2. Software testing (IOEUA40183B)
3. 5G Mobile Networks (IOEUA40183C)
4. **Cloud Computing (IOEUA40183D)**
5. Solar and Wind Energy (IOEUA40183E)

Professional Elective-V:	**Open Elective-III**	
1. UI/UX Design (ITUA40182A)	1. Robotics	(IOEUA40184A)
2. Distributed Systems (ITUA40182B)	2. Quantum Computing	(IOEUA40184B)
3. Data Analytics and Science (ITUA40182C)	3. Business Intelligence	(IOEUA40184C)
	4. Business Analytics	(IOEUA40184F)

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.*

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Final Year B.Tech.

2018 Pattern

Semester - VII

Syllabus Curriculum

Professional Elective-IV
Deep Learning (ITUA40181A)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T):NA	20	30	20	30	25	-	125

Prerequisites: Basics of Machine learning

Course Objective

- Introduce fundamental problems in deep learning.
- Provide understanding of theoretical foundations, techniques, mathematical concepts, common architectures, and algorithms used in deep learning and the way to apply them to solve problems.
- Provide understanding of computational methods for deep learning and practice design and implementation of deep learning
- To find optimized solutions for a 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

After completion of the course, student will be able to

1. Identify the deep learning algorithms which are more appropriate for various types of learning Tasks.
2. Implement deep learning algorithms and solve real-world problems.
3. Apply CNN and RNN for techniques for various domains.
4. Understand overview under computer vision application.
5. Acquire implementation details for image processing.
6. Apply various libraries for python.

Unit I – Introduction to Deep learning

What is Deep learning? History of Deep Learning ,McCulloch Pitts Neuron, Thresholding Logic, Perceptrons Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, SigmoidNeurons, Gradient Descent, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks, deep neural networks, Bayesian Statistics

Unit II – GD & 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, Common Architectural Principles of Deep

Network, Deep Feedforward Networks.

Unit III – CNN

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. Case Study

Unit IV - RNN

Recurrent Neural Networks- Recurrent Neural Networks , Backpropagation through time (BPTT),Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Case study on Sentiment Prediction using RNN, Deep Recurrent Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales Other Gated RNNs, Optimization for Long-TermDependencies, Explicit Memory

Unit V – Applications of DeepLearning to Computer Vision

Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention models for computer vision tasks.

Unit VI – Future of Deep Learning

Applications of Deep learning, python fundamentals: tensorflow, keras , pytorch. Overview to FRAMEWORKS-Caffe, Torch7, Theano

Deep Learning Lab Assignments

1. Train neural network for cat vs non-cat classification.

2. To Write a program to implement Perceptron.

3. Build your first network with Python and NumPy. Use the modern deep learning framework PyTorch to build multi-layer neural networks and analyze real data.

4. Study and implement AlexNet and GoogleNet for Image Bird and Aeroplane dataset.

5. Build your own recurrent networks and long short-term memory networks with PyTorch to perform sentiment analysis

6. To study the use of Long Short Term Memory / Gated Recurrent Units to predict the stock prices based on historical data

7. Mini-project

Text books :	1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
Reference Books :	1. Nikhil Buduma, "Fundamentals of Deep Learning", O"REILLY publication, second edition 2017, ISBN:1491925612 2. 3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioners Approach", O"REILLY, SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.

Fundamentals of Blockchain Technology (ITUA40181B)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T):NA	20	30	20	30	25	-	125

Prerequisites : Data Structure and Files, Expertise in Programming, Database management system, Computer Security, Cryptography, Networking

Course Objectives:

- Explain what blockchain is and how it works
- Describe how bitcoin operates and how it relates to blockchain
- Explore Consensus algorithms
- Learn about Hyperledger and Ethereum
- Evaluate and describe other applications of blockchain
- Articulate and describe the limitations of blockchain

Course Outcomes:

After studying this course, students will be able to:

1. Explore the major components of Blockchain
2. Describe Cryptocurrency, Bitcoin, its operations and consensus.
3. Study approach to design blockchain applications
4. Demonstrate smart contract development in solidity using Ethereum Platform
5. Introduce Hyperledger Frameworks and Fabric Concepts
6. Evaluate potential Blockchain uses cases from a business, legal, and engineering perspective.

Unit I- Introduction To Blockchain

Introduction to Blockchain, Its characteristics, Opportunities using blockchain, Brief history of Blockchain, Evolution of computer applications, Centralized applications, Decentralized applications,Stages in blockchain evolution, Blockchain 1.0, Blockchain 2.0 Blockchain 3.0,Consortium-Business focused, Technology focused, Hybrid, ledgers, distributed ledgers, Restrictions on sharing ledgers-Types based on Authority to participate, Types based on Access to network, Forks, Public blockchain environment, Types of players in blockchain ecosystem, Players in market-Bitcoin,Multichain,Ethereum,Hyperledger,R3Corda etc.

Unit II –Blockchain Concepts

Chaining of blocks, Hasing, Markle tree, Consensus-Proof-of-Work, Proof-of-Stake, Byzantine general problem, Byzantine fault tolerant system, Directed Acyclic graph, Proof of capacity, Mining and finalizing blocks, Currency

(Tokens),Security on blockchain, Data storage on blockchain, UTXO Models, Global State Models, Wallets, Coding on blockchain smart contracts, Peer-to-peer network, Types of blockchain nodes-Miner, Full, Administrative, Light-weight, Risk assessment, Life cycle of blockchain transaction

Unit III- Architecturing Blockchain Solutions

Obstacles in blockchain usage, Blockchain relevance evaluation framework, Blockchain solution reference architecture-Core, platform, service, applications, Types of blockchain applications-Fully decentralized, simple solutions, enterprise solutions, Cryptographic tokens-Utility, Security, ERC, Typical solution architecture for Enterprise use case, Types of blockchain solution-Value transfer, Provenance, Identity management, Data sharing, Architecture Considerations, Architecture with blockchain platform, Approach for designing blockchain applications

Unit IV- Ethereum Blockchain

Tuna Fish tracking use case, Ethereum ecosystem and development, Tool stack, Ethereum virtual machine, Smart contract programming, IDE-Remix, Visual studio code, Truffle framework, Ganache, Unit testing, Ethereum accounts, MyEther wallet, Ethereum network, Infura, Etherscan, Ethereum clients, Decentralized applications, Metamask, Tuna Fish use case implementation,Open Zepplin contracts, Best practices for Ethereum smart contract development

Unit V- Hyperledger Blockchain

Car ownership tracking use case, Architecture of Hyperledger fabric, Transaction flow, Fabcar use case implementation-Fabric installation and application development, Golang, FabCar chaincode,Fabric network setup,invoking chaincode using CLI,Invoking chaincode functions using client applications,Best practices for chaincode development

Unit VI- Blockchain Use Cases

When to Use a Blockchain (Limitations and Misconceptions),Challenges for Blockchain, Internet of Things-Medical Record Management System-Blockchain in Government and Blockchain Security-Blockchain Use Cases – Finance,Blockchain in Supply chain traceability

List of Assignments

1. Study of various websites related Blockchain like
    a. http://emn178.github.io/online-tools/sha256.html
    b. https://timestampgenerator.com/generate-hash/sha256
    c. www.blockchain.com
    d. www.passwordsgenerator.net/sha256-hash-generator/
    e. https://etherscan.io/
    f. https://ethereum.org

2. Case Study on various use cases of Blockchain.
   a. Identify minimum FIVE use cases
   b. Identify various processes involved in each use case
   c. Identify drawbacks of existing system/process
   d. Provide solutions with Blockchain Technology
   e. Identify minimum TWO processes from each use case for writing smart contracts
3. Comparative study of various Blockchain Platforms (Bitcoin, Ethereum, Hyperledger, Ripple, Corda, R3…).
4. Studying basics of Bitcoin and Cryptocurrency
   a. Create a Wallet and Account
   b. Send and receive bitcoin
5. Study of SOLIDITY programming and REMIX Web based IDE.
6. Write Smart Contract in SOLIDITY
   a. To display "Hello World"
   b. To study Basic Data Types & Statements,enum,struct,string
   c. To study State Variables, Functions.
   b. To demonstrate passing values among two functions
   c. To use constructor
7. Write Smart Contract in SOLIDITY to demonstrate
   a. Working of arrays
   b. Working of address data type
   c. Working of Mapping
   d. Working of Events
   e. Working of inheritance
8. Create a simple block in Python

Textbooks:	1. Ambadas Tulajadas Choudhari, Arshad Sarfarz Ariff, Sham M R, "Blockchain for Enterprise Application Developers" Willey publications, ISBN: 9788126599967,2020 2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017. 3. Kevin Werbach, The Blockchain and the New Architecture of Trust 4. Mastering Ethereum Building Smart Contracts and DApps, Andreas M. Antonopoulos, Gavin Wood, O'Reilly 5. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
Reference Books:	1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017. 2. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits 3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016. 4. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin.

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Department of Information Technology

Image Processing (ITUA40181C)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T):NA	20	30	20	30	25	-	125

Prerequisites: NA

Course Objectives:

- Understand the fundamental concepts of Digital Image Processing with basic relationship of pixels and mathematical operations on 2-D data.
- Learn design and integrate image enhancement and image restoration techniques
- Understand object segmentation and image analysis techniques
- Learn the need for effective use of resources such as storage and bandwidth and ways to provide effective use of them by data compression techniques

Course Outcomes:

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

1. Develop and implement basic mathematical operations on digital images.
2. Analyze and solve image enhancement and image restoration problems.
3. Apply 2-D data compression techniques for digital images.
4. Identify and design image processing techniques for object segmentation and recognition.
5. Represent objects and region of the image with appropriate method
6. Understand the concept of object recognition and its application.

Unit I –Fundamentals of Image Processing

Steps in Image processing, Human visual system, Sampling & quantization, representing digital images, spatial and gray level resolution, Image file formats, Basic relationships between pixels, Distance Measures, Basic operations on images – image addition, subtraction, logical operations, scaling translation, rotation. Color fundamentals and models – RGB, HIS, YIQ

Unit II -Image Enhancement and Restoration

Point – Log transformation, Power law transformation, Piecewise linear transformation, Image histogram, histogram equalization, Mask processing of images, filtering operations- Image smoothing, image sharpening, frequency domains image enhancement: 2D DFT, smoothing and sharpening in frequency domain, Pseudo coloring. Image Restoration: Noise models, restoration using Inverse filtering and Wiener filtering.

Unit III – Image Compression

Types of redundancy, Fidelity criteria, Compression models - Information theoretic perspective – Fundamental coding

theorem, Lossless Compression: Huffman Coding- Arithmetic coding. Introduction to DCT, Lossy compression: DCT based compression, Wavelet based compression, Image compression standards JPEG and JPEG 2000.

Unit IV - Image Segmentation

Pixel classification, Bi-level thresholding, Multi-level thresholding, Adaptive thresholding, Otsu's method, Edge detection – First order derivative Prewitt and Sobel, Second order derivative – LoG, DoG, Canny. Edge linking, Hough transform, Region growing and region merging. Morphological operators: Dilation, Erosion, Opening, Closing, Hit or Miss transform, Boundary detection, Thinning, Thickening, Skelton.

Unit V –Representation and Description

Representation – Chain codes, Polygonal approximation, Signatures. Boundary Descriptors – Shape numbers, Fourier Descriptors, Statistical moments. Regional Descriptors – Topological, Texture. Principal Components for Description.

Unit VI –Object Recognition and Applications

Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier. Applications: Biometric Authentication, Character Recognition, Content based Image Retrieval, Remote Sensing, Medical application of Image processing.

Text books:	1. Gonzalez and Woods, "Digital Image Processing", Pearson Education, 3rd edition 2. Iain E. G. Richardson, ―H.264 and MPEG 3. Video Compression: Video Coding for Next Generation Multimedia‖, John Wiley and Son's Publication, 3rd Edition.
Reference Books:	1. A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989. 2. Pratt William K. "Digital Image Processing", John Wiley & sons. 3. A. Bovik, Handbook of Image & Video Processing, Academic Press, 2000.
	List of Assignment
	1. To perform basic operations on images. 2. To perform conversion between color spaces. 3. To perform histogram equalization. 4. To perform image filtering in spatial domain. 5. To perform image filtering in frequency domain. 6. To perform image restoration. 7. To perform image compression using DCT / Wavelet transform. 8. To perform edge detection using various masks. 9. To perform global and adaptive thresholding. 10. To apply morphological operators on an image. 11. To obtain boundary / regional descriptors of an image. 12. To perform image classification / recognition

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Professional Elective-V
UI/UX Design (ITUA40182A)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T):NA	20	30	20	30	25	-	125

Prerequisites : Human Computer Interaction, Software Engineering

Course Objectives:

- Understand what user experience (UX) means and how it matters?
- Understand how to approach UX and usability.
- Understand how to approach UI design.

Course Outcomes:

After completion of the course, student will be able to

- Understand the definition and practical application of user experience
- Learn multiple User Experience research methods and conduct at least one
- Create navigation structures
- Create a medium-fidelity wireframe and a high-fidelity prototype.
- Analyze research data to guide content, navigation and design decisions
- Learn and apply the principles of good interface design

Unit I - Intro to User Experience Design

Define User Experience: What Does A UX/UI Designer Actually Do?, User Experience Process: Universal Principles of User Experience Design – An Introduction, Components of any User Experience Process, Definition of a Good User Experience Design, Components of Good User Experience Design (Usability Heuristics), The 4 Golden Rules of UI Design, Examples of Good User Experience Design, Practical Activity - 1.

Unit II – User Experience Research

What Is User Experience Research?, A Guide to Competitive Analysis for UX Design, Putting Personas to Work in UX Design: What They Are and Why They're Important, User Experience Personas and User Profiles, Other Types of User Experience Research - User Research: Best Practices and Methodologies, Qualitative and Quantitative User Experience Research - Comprehensive Guide to User Experience Research: Methods, Running Interviews, and Observations for User Experience Research - Top UX Research Interview Questions to Ask Users, Understanding User-Testing Data and Results: Translating User Research into User Experience Design, Practical Activity - 2.

Unit III - Visual Design
Definition of Visual Design: The Role of Visual Design In User Experience, Introduction to Atomic Design: Atomic Design Principles & Methodology, Elements of any Visual Design - Language: Universal Principles of User Experience Design: Language & Typography, Color and Shape: The Role of Color in Product Design: UX of Color Palettes, Imagery: Effective Use of Images & Graphics in UX Design, Typography in UI Design, Buttons: How to Design and Integrate Buttons Into Your UI, Composition of Visual Design Elements: Key Principles for Better Design Composition, Structure & Grid Layout Grids for Wireframes, Hierarchy of Content- Visual Hierarchy in UX Design, States - Designing States for Buttons & UI Interactions, Examples of Visual Design Elements across Multiple Platforms & Screen Sizes - Adaptive Design vs. Responsive Design, Practical Activity - 3.
Unit IV - User Experience Design Strategy
Guide to Information Architecture in UX, Techniques & Best Practice for Developing an Information Architecture - Information Architecture: The Intersection of Users, Content and Context, Developing an Information Architecture for a Software Product or Solution, Examples of Effective Information Architecture, Developing a Sitemap for a Website - Sitemaps & Information Architecture (IA), Examples for Website Designs, What Is Navigation and Hierarchy?, Examples of Navigation Architecture and Hierarchy of Information, Practical Activity - 4.
Unit V - Design Mock-Ups
The Fundamentals of Wireframing and Prototyping, User Personas, Scenarios and Stories: Understanding User Journey vs. User Flow, Design Ideation and Sketching: Product Design Guide: Research, Analysis, Ideation, Storyboarding User Experiences: The What, Why, & When of Storyboarding in UX Design, Design Wireframes, Wireframing: A Blueprint to Your Site, Design Prototyping and Types of Prototypes: Low Fidelity vs. High Fidelity Prototyping, Practical Activity - 5.
Unit VI - UI/UX Design Tools
Overview of **UI/UX Design Tools:** Figma, Adobe XD, Sketch

Textbooks:	Sketching User Experiences: Getting the Design Right and the Right Design, Bill Buxton and William Buxton. http://www.amazon.com/Sketching-User-Experiences-InteractiveTechnologies/dp/0123740371
Reference Books:	1. A Project Guide to UX Design: For User Experience Designers in the Field Or in the Making, Carolyn Chandler and Russ Unger 2. The Design of Everyday Things, Don Norman 3. UX for Beginners: A Crash Course in 100 Short Lessons, Joel Marsh

List of Assignments	
1	Go to your favorite website and explore what is easy to use, and what is difficult. **INSTRUCTIONS:** Using the principles and guidelines learned in Module 1, identify the elements of good user experience design within your selected website, and explain why they are good (or bad). Screen capture the good and bad elements and categorize your findings in Adobe XD. Use Adobe XD to save your screen shots. Divide the canvas into 2 parts. One side for the good UX and one for the bad. Make sure to add copy explaining why each element is either good or bad. Document your overall findings.
2	You have been tasked with designing an e-commerce mobile app for a local business. Describe how you would approach the research, which methodologies would be used. Generate a persona or user prole template to be used to summarize your findings. **INSTRUCTIONS:** For this activity make use of brainstorming applications for ideation and documenting research strategies. Get started quickly by using Adobe XD's Whiteboard plugin's easy to use templates for persona development, and brainstorming.
3	Select any consumer mobile app. Understand the user experience process. Re-design the visual elements of the app by applying the basic principles of visual design. **INSTRUCTIONS:** Adobe XD has many powerful features that help you build the best user experiences, but first you need to learn how to use XD's design, prototype and sharing capabilities.
4	Using an example of a desktop website of your choice, redesign the navigational experience by creating a sitemap structure (user o w) to ensure the best user experience. **INSTRUCTIONS:** A sitemap is a visual representation of the pages of a website. It often can look like a flow chart diagram of how the pages connect and the path the user would take to navigate the website. In XD it's easy to create a sitemap by using shapes and lines to organize the flow of the website. You can also use one of the pre-made Whiteboard plugin templates to give you a head start! Whiteboard has several templates that can be used to create your sitemap. https://spark.adobe.com/page/HWkDHkbd2Jc7s/
5	Develop a wireframe and a working prototype of a mobile app. Understand the user persona and user stories for the mobile app. Tools such as Adobe XD can be used for this. **INSTRUCTIONS:** Wireframing in XD allows you to focus on the core structure and concept of your interface so you can iterate early in the process, user test and explore various concepts for structure of your user interface. Once you've created your wireframe it is easy to add color, graphics, photos and more to your design to make a real-life high-fidelity prototype. For this activity use the skills you've already mastered in XD to make your mobile app wireframe and high-fidelity mock-up.

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

Distributed Systems (ITUA40182B)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T):NA	20	30	20	30	25	-	125

Prerequisites: Operating System and Advance Operating System

Course Objectives:

- To introduce concepts related to distributed computing systems.
- To focus on performance and flexibility issues related to systems design decisions
- To expose students to current literature in distributed systems.
- To prepare students for an real world distributed application design

Course Outcomes :

1. Study software components of distributed computing systems. Know about the communication and interconnection architecture of multiple computer systems.
2. Recognize the inherent difficulties that arise due to distributed ness of computing e sources. Understanding of networks & protocols, mobile & wireless computing and their applications to real world problems.
3. understand basic problems in distributed computing, especially in relation to concurrency, parallelism, synchronization, deadlocks, safety and live ness properties
4. understand differences between various distributed computing models and widely used distributed computing schemes
5. Understanding communication mechanism among the distributed entities
6. Authentication and self-stabilization issues in distributed system

Unit I : Introduction to Distributed Computing

A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state of a distributed system, Cuts of a distributed computation, Past and future cones of an event, Models of process communications. Logical time: Introduction, A framework for a system of logical clocks, Scalar time, Vector time, Efficient implementations of vector clocks, Jard–Jourdan's adaptive technique, Matrix time, Virtual time, Physical clock synchronization: NTP.

Unit II : Global state and snapshot recording algorithms

Global state and snapshot recording algorithms: System model and definitions, Snapshot algorithms for FIFO channels, Variations of the Chandy–Lamport algorithm, Snapshot algorithms for non-FIFO channels, Snapshots in a causal delivery system, Monitoring global state, Necessary and sufficient conditions for consistent global, snapshots, consistent global snapshots in a distributed computation.

Unit III : **Message ordering and group communication**

Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order, A nomenclature for multicast, Propagation trees for multicast, Classification of application-level multicast algorithms, Semantics of fault-tolerant group communication, Distributed multicast algorithms at the network layer.

Unit IV : Termination detection, Distributed mutual exclusion algorithms

Termination detection: System model of a distributed computation, Termination detection using distributed snapshots, Termination detection by weight throwing, A spanning-tree-based termination detection algorithm, Message-optimal termination detection, Termination detection in a very general distributed computing model, Termination detection in the atomic computation model, Termination detection in a faulty distributed system.

Distributed mutual exclusion algorithms: Lamport's algorithm, Ricart–Agrawala algorithm, Singhal's dynamic information-structure algorithm, Lodha and Kshemkalyani's fair mutual exclusion algorithm, Quorum-based mutual exclusion algorithms, Maekawa's algorithm, Agarwal–El Abbadi quorum-based algorithm, Token-based algorithms, Suzuki–Kasami's broadcast algorithm, Raymond's tree-based algorithm.

Unit V : Deadlock detection in distributed systems

Deadlock detection in distributed systems: System model, Models of deadlocks, Knapp's classification of distributed deadlock detection algorithms, Mitchell and Merritt's algorithm for the single resource model, Chandy–Misra–Haas algorithm for the AND model, Chandy–Misra–Haas algorithm for the OR model, Kshemkalyani–Singhal algorithm for the P-out-of-Q model.

Authentication in distributed systems: Protocols based on symmetric cryptosystems, Protocols based on asymmetric cryptosystems, Password-based authentication, and Authentication protocol failures.

Unit VI : Self-stabilization

Self-stabilization: System model, Definition of self-stabilization, Issues in the design of self-stabilization algorithms, Methodologies for designing self-stabilizing systems, Communication protocols, Self-stabilizing distributed spanning trees, Self-stabilizing algorithms for spanning-tree construction, An anonymous self-stabilizing algorithm for 1-maximal independent set in trees, A probabilistic self-stabilizing leader election algorithm, The role of compilers in self-stabilization, Self-stabilization as a solution to fault tolerance, Factors preventing self-stabilization.

Text books :

1. Ajay D. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press
2. Vijay K. Garg, Elements of Distributed Computing, Wiley Paperback , 2014

Reference Books :

1. Hagit Attiya, Jennifer Welch, Distributed Computing: Fundamentals, Simulations, and Advanced Topics, Wiley
2. Andrew S. Tanenbaum, Maarten van Steen, Distributed Systems: Principles and Paradigms, Prentice Hall of India

Prerequisites: Knowledge of Java or C or Cpp

List of Practical Assignments: Use API if required	
1	Design, Implementation and analysis of logical time any technique
2	Design, Implementation and analysis of A spanning-tree-based termination detection algorithm
3	Design, Implementation and analysis of Singhal's dynamic information-structure algorithm,
4	Design, Implementation and analysis of Lodha and Kshemkalyani's fair mutual exclusion algorithm
5	Design, Implementation and analysis of Knapp's classification of distributed deadlock detection algorithms
6	Design, Implementation and analysis of Mitchell and Merritt's algorithm for the single resource model
7	Design, Implementation and analysis Chandy–Misra–Haas algorithm for the OR model
8	Design, Implementation and analysis Self-stabilizing algorithms for spanning-tree construction

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

Data Science and Analytics (ITUA40182C)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T):NA	20	30	20	30	25	-	125

Prerequisites: Linear Algebra and Calculus, Probability Basics

Course Objectives:

- Understand the data science life cycle
- Learn the principles and methods of statistical analysis
- Practice statistical methods using large data-sets
- Understand forecasting model
- Interpret classification outcome
- Learn effective data visualization

Course Outcomes :

After completion of the course, student will be able to

1. Describe the Data Science Process and explore components interaction. (Remember)
2. Apply statistical methods to the application dataset. (Understand)
3. Build inference using different statistical concepts. (Apply)
4. Develop a regression model for data forecasting. (Apply, Analyze)
5. Categorize the data using classification methods for predictive analysis. (Analyze)
6. Analyze and organize data using visualization techniques. (Apply)

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 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	Write Program using R to Perform a K-means Analysis for any dataset.
3	Write Program using R to Perform a linear regression Analysis for any dataset.
4	Write Program using R to Perform a logistic Analysis for any dataset.
5	Write Program using R to Hypotheses Testing with type1 and Type 2 Error.
6	Write Program using R to Hypotheses Testing with t-test , Z Score
7	Write Program using R to naïve bayes classifier Analysis for any dataset.
8	Write Program using R to naïve Decision Tree Analysis for any dataset.

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Department of Information Technology

Open Elective –II

Project Planning and Management (IOEUA40183A)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): 1 hrs./week Practical (P): NA	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Course Objective(s):

1. To impart knowledge of project life cycle.
2. To introduce students to Project Identification Process, Project Initiation, Pre-Feasibility Study and Project feasibility Studies,
3. To construct CPM, PERT network for a project.
4. To introduce students to Steps in Risk Management, Risk Identification, Risk Analysis and Reducing Risks
5. To introduce students to process of project Performance Measurement, Evaluation and closeout.

Course Outcomes:

Upon completion of the course, students will be able to

1. Understand what a Project is, Essential of Project Management.
2. Understand the Project Identification Process, Project Initiation, Pre-Feasibility Study and Project feasibility Studies,
3. Learn and Apply project planning and controlling techniques.
4. Identify risks in a project and strategies for managing the project risks
5. Understand project risk Management and Quality control in a project.
6. Understand the process of project Performance Measurement, Evaluation and closeout.

Unit I: Basics of Project Management

Introduction, Need, Project Management Knowledge Areas and Processes, Concept of Organizational Structure and types, The Project Life Cycle (preferably with case study), Essentials Project Management Principles.

Unit II: Project Identification and Selection

Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point. Case study is preferred

Unit III: Project Planning and controlling

Introduction, Need for Project Planning, Work Breakdown Structure (WBS), LOB, CPM and PERT, Resource Allocation, Monitoring and Control of project, Crashing, Resource Leveling, Updating

Unit IV: Project Risk Management

Identifying potential risks in a project, categorizing of project risks, and defining the strategies for managing the project risks

Unit V: Project Monitoring

Project monitoring Progress reporting, review meetings and report. Common causes of schedule delays, measuring productivity, methods of enhancing productivity, issue in project delays, Concept

of quality, aspects of quality, quality control and assurance, inspection, preparation of manuals and checklists
Unit IV: Project Performance Measurement, Evaluation and closeout
Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Project Close-out, Steps for Closing the Project, Project Termination, and Project Follow-up. Case study is preferred
Term Work:
Assignments on all units
Textbooks:
1. Operations Research by Premkumar Gupta and D.S.Hira, S. Chand Publications (2014) 2. Project Management – K Nagrajan – New age International Ltd. 3. Project Management – Ahuja H.N. – John Wiely, New York. 4. Project Management-Planning and Control---Rory Burkey 4th ed.—Wiley,India.
Reference Books:
1. Project Risk Management - Bruce Barkley- McGraw-Hill, 2004

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Information Technology

Software Testing (IOEUA40183B)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): NA Tutorial/Week(T): 1Hrs/week	20	30	20	30	-	25	125

Prerequisites : Software Engineering, Java Programming

Course objectives:

- To study and understand software testing terminologies and framework
- To study and understand the basics of software testing life cycle
- To study and understand test and defect management
- To study and understand an automation testing
- To study and understand an automation testing tools
- To study and understand automation testing for web application

Course Outcomes:

After completion of the course, student will be able to

1. Understand complete software testing life cycle and various terms and technologies used in testing domain
2. Demonstrate understanding of generating test plan and designing test cases
3. Demonstrate understanding of test and defect management process
4. Demonstrate understanding of automation testing
5. Create test script and execute automated tests using Selenium IDE
6. Create test script and execute automated tests using TestNG Framework

Unit I – Introduction to Testing

Why is testing necessary? What is testing? Role of Tester, Testing and Quality, Overview of Software Testing Life Cycle, V model, SDLC vs STLC, different stages in STLC, document templates generated in different phases of STLC, different levels of testing, different types of testing

Unit II - Basics of test design techniques

Static techniques, reviews, walkthroughs, Various test categories, test design techniques for different categories of tests. Designing test cases using MS-Excel.

Unit III – Test and Defect Management

Test Management: Documenting test plan and test case, effort estimation, configuration management, project progress management. Use of Testopia for test case documentation and test management. Defect Management Test Execution, logging defects, defect lifecycle, fixing / closing defects. Use of Bugzilla for logging and tracing defects.

Unit IV - Basics of Automation testing

Introduction to automation testing, why automation, what to automate, tools available for automation testing.

Unit V – Automation testing using Selenium

Understanding to Selenium, using Selenium IDE for automation testing, using Selenium Web driver for automation testing.
Unit VI – Automation testing using TestNG Framework
Understanding TestNG framework, Automation testing using TestNG Framework.

Text books :	1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata Mcgraw Hill, ISBN: 9780070139909 0070139903 2. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X
Reference Books :	1. Naresh Chauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847 2. Dr.K.V.K. Prasad , "Software Testing Tools", Dreamtech Press ISBN: 10:81-7722-532-4

List of assignment:

With intent to get some exposure in the software testing domain, students apply Technical, Behavioral, Process concepts learnt in the course by executing near real-life project and working in teams (project teams will ideally comprise of 4 members)

There will be 3 projects:
Project 1: Use of Testopia for test case management. The project will consists of test plan, test design for a sample web application and maintaining Requirement Traceability Matrix using the tool

Project 2: Use of Bugzilla for defect management. The project will include execution of tests designed in previous project, identifying, logging and tracing the defect and maintaining the Requirement Traceability Matrix

Integrated Project: Use of Selenium for automation testing. The project will consists of identifying which tests from project 1 can be automated, then creating script for those tests using tool, executing the tests with the help of tool and generating report for the tests cases.

5G Mobile Networks (IOEUA40183C)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Tutorial (T): 1 hrs./week Practical (P): NA	20	30	20	30	25	-	125

Prerequisites: Students are expected to know the concepts studied in following courses:

1. Basics of Analog and Digital Communication
2. Basics of Mobile Communication
3. Basics of Networking

Course Objectives:

- To understand evolution of 5G technologies with its challenges
- To describe 5G cellular structure and design to achieve appropriate gain
- To discuss fundamentals of 5G functional and physical architecture and its requirements
- To understand design principles for multi-user communications
- To design and interpret the 5g Use cases

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand evolution of 5G technologies with its challenges
2. Interpret the 5G cellular structure and design to achieve appropriate gain
3. Illustrate and explain the 5G functional and physical architecture and its requirements
4. Comprehend the Radio access technology in 5G
5. Understand Cooperation in 5G systems and analysis in terms of QOS
6. Design and analysis of 5G Use Cases

Unit- I: Drivers For 5G

Historical Trend for Wireless Communication - Mobile Communications Generations: 1G to 4G – Evolution of LTE Technology to Beyond 4G – Pillars of 5G – Standardization Activities -Use cases and Requirements – System Concept – Spectrum and Regulations: Spectrum for 4G – Spectrum Challenges in 5G – Spectrum Landscape and Requirements – Spectrum Access Modes and Sharing Scenarios(R1)

Unit- II: Small Cells for 5G Mobile Network

Introduction to Small Cells, WiFi and Femtocells as Candidate Small-Cell Technologies ,performance-Indoor and Outdoor, Capacity Limits and Achievable Gains with Densification , Gains with Multi-Antenna Techniques, Gains with Small Cells,Demand vs Capacity,Small Cell challenge
(R1)

Unit –III: 5G Architecture And Channel Models

5G Architecture: Software Defined Networking, Network Function Virtualization , Basics about RAN Architecture ,High-Level Requirements for 5G Architecture ,Functional Architecture and 5G Flexibility ,Physical Architecture and 5G Deployment, 5G wireless propagation channel models: Modeling requirements and scenarios, Channel model requirements, Propagation scenarios, The METIS channel models, Map-based model, Stochastic model(R2)

Unit IV : - 5G Radio-Access Technologies and Millimeter wave communication

Access design principles for multi-user communications, Multi-carrier with filtering: a new waveform, Non-orthogonal schemes for efficient multiple access, Radio access for dense deployments, Radio access for V2X communication, Millimeter Wave Communication: Channel Propagation – Hardware Technologies for mmW Systems – Deployment Scenarios – Architecture and Mobility – Beamforming – Physical layer Techniques.

Unit V: Cooperation for Next Generation Wireless Networks

Introduction to Cooperative Diversity and Relaying Strategies ,Cooperation and Network Coding,Cooperative ARQ MAC Protocols,PHY Layer Impact on MAC Protocol Analysis ,Impact of Fast Fading and Shadowing on Packet,Reception for QoS Guarantee,Impact of Shadowing Spatial Correlation

Unit VI: 5G Use Cases and Deployment

NB-IoT Devices, Smart Parking, Smart City, Smart Home, Message Queue Telemetry Transport (MQTT), MQTT telemetry. NB-IoT Baseline Deployment, Deployment bands and modes

Textbooks:	1. Jonathan Rodriguez "Fundamentals of 5G Mobile Networks",Wiley Publication 2. Afif Osseiran, Jose F . Monserrat, Patrick Marsch "5G Mobile and Wireless Communications Technology", Cambridge University Press. 3. Hossam Fattah "5G LTE Narrowband Internet of Things(NB-IoT) ,CRC Press
Reference Books:	1. Fei Hu, "Opportunities in 5G Networks: A research& development perspective", CRC Press 2. Krzysztof Wesolowski, "Mobile Communication Systems", Wiley Student Edition 3. Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press 4. AdityaJagannatham, "Principles of Modern Wireless Communication Systems"
List of Experiments:	**After completion of this course student should be able to** 1. NS-3 simulation basics. Basic client server paradigm 2. Study of TCP internals and the difference between each of the variants. NS-3 tracing mechanism 3.Study of Queues, packet drops and their effect on congestion window size 4.Study of Optimised Link State Routing(MANETS) 5. Study of 802.11 working with and without RTS/CTS. An insight into why its hard to setup efficient wireless networks. 6. Study of effect of Radio channel models transmission. An insight into Identifying the channel model that is more appropriate for each case (indoor, outdoor, LoS, NLoS, etc.). mmWave network simulator project implementation **Mini Project/Seminar (SCE)**

Cloud Computing (IOEUA40183D)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Tutorial (T): 1 hrs./week Practical (P): NA	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 - Amazon Web Services

Services offered by Amazon Hands-on Amazon, EC2 - Configuring a server, Virtual Amazon Cloud, AWS Storage and Content Delivery Identify key AWS storage options Describe Amazon EBS Creating an Elastic Block Store Volume Adding an EBS Volume to an Instance Snap shooting an EBS Volume and Increasing Performance Create an Amazon S3 bucket and manage associated objects. AWS Load Balancing Service Introduction Elastic Load Balancer Creating and Verifying Elastic Load Balancer.

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, The Docker Workflow. Docker compose file, Docker volume, Docker storage. Kubernetes : introduction to Kubernetes, Features of Kubernetes, Kubernetes API, Basic Architecture, Minikube.

Textbooks:	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/)
Reference Books:	1. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication, ISBN10: 8126536039 2. Buyya, "Mastering Cloud Computing", Tata McGraw Hill, ISBN-13: 978-1-25-902995-0 3. Barrie Sosinsky,"Cloud Computing", Wiley India, ISBN: 978-0-470-90356-8 4. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press

5. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Pearson, 1st Edition, ISBN :978 9332535923, 9332535922
6. Tim Mather, Subra K, Shahid L.,Cloud Security and Privacy, Oreilly, ISBN-13 978-81-8404-815-5

List of Assignments

1. Case study on Case Study: Google Cloud Platform
2. Write a web based application and use Firebase.
3. Create a sample web based application using PhP/Pyhton and deploy it on AWS.
4. Assignment to install and use Docker. Create Docker file.
5. Assignment to install and use Kubernetes.

Solar and Wind Energy (IOEUA40183E)

Prerequisite: Basic Mechanical Engineering, Basic Electrical and Electronics Engineering and

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): NA Tutorial/Week(T): 1Hrs/week	20	30	20	30	-	25	125

Heat Transfer

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 Basics

Present solar energy scenario in India, 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 Cell Operation

Solar Spectrum, Solar Radiation Spectrum, Worked Problem - Total Irradiance, Solar Cell Fundamentals, Worked Problem - The I-V Characteristic, Solar Cell Types and Technologies, Multi-junctions. Conversion Efficiency Limitations, Worked Problem - Solar Cell under Concentration, From Cell to Module, Energy Audit of Home/Residence

Unit III: Design of Solar PV Systems

PV Sizing and Output, Orientation and Tilt, Temperature Dependent Output, Temperature Dependent Output as a Percent, Module and array conditions, shading calculations using PV Watts, PV Sizing and output under different conditions, Inverter Sizing and Selection, Case Studies

Unit IV: Wind Energy and its assessment

Wind power scenario in India, Characteristics of Wind Energy: Wind movement, wind profile, roughness, effects of obstacles in wind path. wind data and site selection considerations, Comparison with Solar Energy, Types of Wind Turbine Blades, Blade Profile

Unit V: Wind Power Plants

Types of Wind Power Plants (WPPs): Small and large wind turbines; Horizontal and Vertical axis;
Upwind and Downwind, One, Two and Three blades; constant and variable Speed; Geared, Direct- Drive and Semi-Geared (Hybrid) WPPs; WECS, WEGs, WTs, WPPs, WPP Tower Types: Lattice; tubular: steel, concrete, hybrid, ladders, cables WPP substation: Switchgear, transformers, electronic components.

Unit VI: Design and Control Aspects of Wind Mill/Plant

Design: horizontal and vertical axis wind turbines, blades, control mechanisms, drive train, tower, nacelle, foundation, choice of materials, manufacture, adaptation to different climates
Control: control targets, system modelling, control strategies (pitch and stall regulation), hardware Systems: wind power parks, transports, erection, grid connection, operation, maintenance

List of Practical:

1: Design of solar food drier for domestic purpose referring existing system. 2: Measurement of Solar Insolation at Residence.
3: Design of Solar Pump for Farm Irrigation.

4: Design of solar photovoltaic system for domestic/ commercial building purpose.

5. Design of Solar Operated home appliance.

6. Case study on designing miniature wind mill for domestic purpose referring existing system.

7. Visit to Solar PV System/wind power system used in commercial building.

Text Books:

1. S. P. Sukhatme, 'Solar Energy: Principles of thermal collections and storage', McGraw Hill
2. G. D. Rai, 'Non-Conventional Energy Sources', Khanna Publisher
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

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 –III

ROBOTICS (IOEUA40184A)

Teaching Scheme	**Examination Scheme**						
Credits: 04 Lecture (L): 03 hrs./week Practical (P): 02 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Mathematic, SOME, KOM

Course Objectives:

- To acquire basic understanding of Industrial Robots and its technological applications
- To understand peripherals of Robotic system and their use.

Course Outcomes:

Upon completion of the course, students will be able to

2. Understand industrial applications of Robots.
3. For the given industrial application students will be capable of selecting the appropriate Robot considering all the parameters.
4. Recognize different concepts related to industrial Robotics like end effectors, sensors, actuators etc.
5. Generate Robot Programming
6. Understand the social relevance of Robos

Unit I: Fundamental of Robotics

Evolution of Robots, Types of Robots, Reason behind use of Robot, Robot Uses cases, Advantages of Robot, Disadvantages of Robot, Defining Robot, Laws of Robotics, Future of Robot,

Unit II: Performance Specifications of Industrial Robots

DOF of Robot, Joints and Links in Robot, Singularity in Robots, Industrial Applications of Robot, Selection parameters and Robot Specification.

Unit III: Insight Industrial Robot and System Peripherals

Actuators: Pneumatic, Hydraulic and Electric, Brakes, Transmission, Gears, Soft limits and Hard Limits. Controller, Teach Pendant, End Effectors, Fixtures, Pneumatic System, Communication between System Peripherals.

Unit IV: Automation and Control Systems

Introduction to Automation, Introduction to Artificial Intelligence, Industry 4.0, Fundamentals of PLC, Relay, Encoder, Field Sensors, Communication Protocols, HMI, SCADA, IIOT.

Unit V: Robot Programming

Robot Programming Concepts, Programming Methods, Offline Programming, Programming Languages, Program Organization, Writing Robot Program of Instructions, Robot Simulation, Coordinate Systems.

Unit VI: Social Issues Related to Robotics

Reasons for installing Robots, Economic costs and benefits of installing industrial Robots, Acceptability of industrial Robots by the workforce, Employment and Other social issues of Robotics.

Text/Reference Books :

01. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012.
02. Craig. J. J. "Introduction to Robotics- mechanics and control", Addison- Wesley, 1999.
03. Saeed B. Niku, "Introduction to Robotics – Analysis, Systems and Application" : PHI 2006
04. D J Todd, "Fundamentals of Robot Technology" Kogan Page, 1986

Practical :

1. System Peripherals
2. Control system for robotics
3. Drives system used in robots
4. Forward Kinematics
5. Backward kinematics
6. Robot Programming
7. Robot proposal preparation with costing
8. Industrial visit

Quantum Computing ((IOEUA40184B)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T):NA	20	30	20	30	25	-	125

Prerequisites : Data Structures and Algorithms, Programming in Python / C#, Machine Learning and Data Science Basics, Neural Networks and Deep Learning Basics, Information Theory and Models of Computation, Classical Fourier Transform

Course Objectives:

- To provide introduction and necessary expertise to the learner in the upcoming discipline of Quantum Computing and Machine Learning.
- To enable the students to learn Quantum Computing and Quantum Machine Learning in practical-oriented learnin sessions so that he/she can independently use existing open-source Quantum Computing Hardware and Software Frameworks.
- To teach the students to develop hybrid solutions by applying Quantum Machine Learning to potential business application areas.
- To study Quantum Information Theory and Quantum Computing Programming Model of Computation.
- To study Quantum Algorithms and apply these to develop hybrid solutions.
- To study Quantum Concepts necessary for understanding the Quantum Computing Paradigm and compare the available hardware and software infrastructure and frameworks made available open source by major players in th Industry and Academia.

Course Outcomes:

After completion of the course, student will be able to

7. Explain the working of a Quantum Computing program, its architecture and programming model.
8. Develop quantum logic gate circuits.
9. Develop quantum algorithm(s).
10. Program quantum algorithm on major toolkits.
11. Develop Hybrid Solutions in Quantum Machine Learning for potential applications / use cases.
12. Compare existing features provided by potential hardware and software infrastructure and frameworks service providers.

Unit-1: Introduction to Quantum Computing
Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing, Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement
Unit-2: Mathematical Foundation of Quantum Computing
Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigenvectors.
Unit-3: Building Blocks for Quantum Program
Architecture of a Quantum Computing platform, Hybrid Approach for Application Development, Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perspective e.g. Bell State, Operation on qubits: Measuring and transforming using gates, Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc., Programming model for a Quantum Computing Program, Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits, Models of Computation used by key players as OEMs in Quantum Computing
Unit-4: Quantum Algorithms
Basic techniques exploited by quantum algorithms, Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks, Major Algorithms, Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch -Jozsa Algorithm, OSS Toolkits for implementing Quantum program, IBM quantum experience, Microsoft Q#, Rigetti PyQuil (QPU/QVM) OR Cambridge Quantum Computing, Google's Tensorflow Quantum, Amazon Bracket, D-Wave Frameworks
Unit-5: Machine Learning and Deep Learning
Machine Learning, Deep Learning and Artificial Intelligence Basics, Machine Learning Algorithms, Deep Learning Algorithms, Evolutionary Learning Algorithms
Unit-6: Quantum Machine Learning
Quantum Machine Learning and Quantum AI, Quantum Neural Networks, Quantum Natural Language Understanding, Quantum Cryptography, Application Domains for Quantum Machine Learning: Chemistry/Material Science, Space Tech, Finance related Optimisation Problems, Swarm Robotics, Cybersecurity

Text Books:	6. Quantum Machine Learning (What Quantum Computing Means to Data Mining) by Peter Wittek, University of Boras, Sweden - Elsevier Publications 7. Principles of Quantum Artificial Intelligence by Andreas Winchert, Instituto Superior Técnico - Universidade de Lisboa, Portugal - World Scientific Publishing, British Library Cataloguing-in-Publication Data
Reference Books :	7. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge

	University Press. 8. David McMahon, "Quantum Computing Explained", Wiley 9. IBM Quantum Experience: https://quantumexperience,ng,bluemix.net https://quantum-computing.ibm.com/docs/ 10. Microsoft Quantum Development Kit https://www.microsoft.com/en-us/quantum/development-kit 11. Forest SDK PyQuil: https://pyquil.readthedocs.io/en/stable/ 12. Amazon Bracket Documentation on AWS: https://aws.amazon.com/braket/ 13. D-Wave Systems Documentation: https://docs.dwavesys.com/docs/latest/index.html

List of Assignments:

1	Building Quantum dice
2	Building Quantum Random Number Generator
3	Composing simple quantum circuits with q-gates and measuring the output into classical bits.
4	Implementation of Shor's Algorithms
5	Implementation of Grover's Algorithm
6	Implementation of Deutsch's Algorithm
7	Implementation of Deutsch-Jozsa's Algorithm
8	Mini Project such as implementing an API for efficient search using Grover's Algorithms or Integer factorization using Shor's Algorithm
9	Graph Partitioning using Quantum Machine Learning
10	Implementing Quantum Neural Network
11	Basics program implementing Quantum Natural Language Understanding Solution
12	Comparative study of Quantum Software Frameworks

Business Intelligence (IOEUA40184C)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2 Hrs/week Tutorial/Week(T): NA	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 Visualisation 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 :

After completion of the course, student will be able to

1. Describe the importance of Business Intelligence and need of data visualisation 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:	**Introduction to Analytics and Data Preparation**

Introduction to Analytics: What isAnalytics?Need of Analytics, Types of Analytics, Role of Analytics in Business
Data Sources: Data Collection, Transactions Entry, Organizational Systems, Data Sources and Data Source Categories, Issues in Data and Need of Data Preparation
Power BI Desktop: Need of visualisation, Different Visualisation tools, Why Microsoft Power BI?Installation and configuration of Power BI Desktop, Setup of required connector
Data Visualization: What are KPIs?Dashboards, Reports and Scorecards, Types of Dashboards, Slicers and Filters, Setting interactivity, Drilldowns and Drill-through, Formatting your visualizations, Best practices of visualizations

Unit II:	**Data& BI 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, Type of Data: Structured, Unstructured and Semi-structured

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

BI Project Lifecycle: Requirements Understanding, Data Understanding, Data Integration and Data warehouse, Reporting and Analysis, Dashboard development, Deployment, Documenting, Project Team and Roles, Challenges in Projects

Unit III:	**Data Preparationand Data Modelling**

Data Integration and Data Warehouses: What is Data Integration?Need of DataIntegration, ETL, what is Data Warehouse?Need of Data Warehouse, Facts and Dimensions

Star Schema and Snowflake Schema, Data Marts

Need of Data Preparations: What is Data Preparation?Joining data, Appending Data, New Calculations, Removing Inconsistencies, Transposing
Data Transformation [Basics]: Merging and Appending Data, Filtering, Cleaning Data, Fixing Errors, Transforming Data, Aggregating Data

Data Modelling: Setting Relationships, Creating Data Models

Unit IV :	**Custom Calculations And Analytics**

Data Transformations [Advanced]: Pivot/Unpivot data, Split data, Handling inconsistent data, Conditional Column, Custom column. **Calculations:** Introduction to DAX, Calculated Column, Calculated Measures, M-Query calculations, YTD, QTD, MTD calculations, Moving Averages and Running Total. **Statistical Analysis:** Central Tendency: Mean, Mode, Median, Dispersion: Variance and Standard Deviation, Summarization data by using histogram

Unit V :	**Power BI Deployment, Administration And Mobility**

Power BI Deployment: Overview of Power BI Service, Publishing reports to Power BI Service, Understanding the Power BI Service User Interface, Creating Dashboards in Power BI Service, Subscriptions, Comments and Data Driven Alerts, authoring reports within Power BI Service, sharing dashboards across your organization, Configuring Power BI Gateway, scheduling automated refresh of your reports using Data Gateway

Power BI Mobile: Creating Dashboards for Mobiles, using dashboards and reports using Mobile App

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

Unit VI :	**Industry Analytics Landscape**

Tableau Overview: Introduction to Tableau, Tableau Products, Tableau architecture, Installation and Setup of Tableau Desktop, Visualizing with Tableau, Tableau online and Tableau server, Publish and share reports on Tableau online

Applications of Business Intelligence: Manufacturing Use Cases, Retail Use Cases, Marketing use Cases, Banking 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 Finch
4. Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things" by Bernard Marr, KoganpagePublicaitons, 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 Assignments:

1	Creating multiple sample tables and joining them in Power BI
2	Connecting to data source and transforming data in Power BI
3	Connecting to data source and creating data models by establishing relationships
4	Connecting to data source and visualizing and analysing data
5	Connecting to data source and creating custom calculations
6	Deploying the dashboards and reports to Power BI Service
7	Administering and using advanced features of Power BI Service
8	Creating Mobile layouts in Power BI Desktop

Business Analytics (IOEUA40184F)

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T): NA	20	30	20	30	-	25	125

Prerequisites : Database Management System, MS-Excel

Course Objectives :

- To study and understand the importance of Business Analytics and need of data Visualisation for Business Analytics.
- 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 implementation and evaluation ways of adding custom calculations needed and BI deployments
- To study and understand the descriptive statistics, inferential statistics, normal distribution and prediction analysis by performing regression.
- To study and understand Tableau background and concepts in the areas of analytics and their industrial applications through study of different use cases.

Course Outcomes :

After completion of the course, student will be able to

1. Describe the importance of Business Analytics and need of data visualization and analysis for Business.
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 requirements and Author BI deployments, BI environments.
5. Perform descriptive and inferential statistics and prediction analysis by performing regression
6. Describe and compare industrial BA implementations, use cases and current and future trends.

Unit I:	**Introduction to Analytics and Data Preparation**

Introduction to Analytics: What is Analytics? Need of Analytics, Types of Analytics, Role of Analytics in Business

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

Power BI Desktop: Need of visualisation, Different Visualisation tools, Why Microsoft Power BI? Installation and configuration of Power BI Desktop, Setup of required connector

Data Visualization: What are KPIs? Dashboards, Reports and Scorecards, Types of Dashboards, Slicers and Filters, Setting interactivity, Drilldowns and Drill-through, Formatting your visualizations, Best practices of visualizations

Unit II:	**Data & Analytics 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, Type of Data: Structured, Unstructured and Semi-structured

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

BI Project Lifecycle: Requirements Understanding, Data Understanding, Data Integration and Data warehouse, Reporting and Analysis, Dashboard development, Deployment, Documenting, Project Team and Roles, Challenges in Projects

Unit III:	**Data Preparation and Data Modelling**

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

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

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

Data Modelling: Setting Relationships, Creating Data Models

Unit IV :	**Calculations And Power BI Deployment**

Data Transformations [Advanced]: Split data, Handling inconsistent data, Conditional Column, Custom column

Calculations: Introduction to DAX, Calculated Column, Calculated Measures, M-Query calculations, YTD, QTD, MTD calculations

Power BI Deployment: Overview of Power BI Service, Publishing reports to Power BI Service, Understanding the Power BI Service User Interface, Creating Dashboards in Power BI Service, Subscriptions, Comments and Data Driven Alerts, authoring reports within Power BI Service, sharing dashboards across your organization,

Power BI Mobile: Creating Dashboards for Mobiles, using dashboards and reports using Mobile App

Unit V :	**Business Analytics using Excel**

Statistical Analysis: Central Tendency: Mean, Mode, Median, Central Tendency exercise in Excel. Dispersion: Variance and Standard Deviation, Dispersion exercise in Excel. Coefficient of variation, rule of thumb for Standard deviation. Outliers. Summarization data by using histogram, Descriptive Statistics. Interpretation of excel result of descriptive statistics. Inferential statistics, Sample and population, Point estimate, true value, sampling error, Normal Distribution,

Regression and forecasting: Simple Regression Model and Type, Regression line, Relationship between two variables, Forecasting using Excels, Interpreting Regression Result, Example of single regression in Excel and forecasting.

Unit VI :	**Industry Analytics Landscape**

Tableau Overview: Introduction to Tableau, Tableau Products, Tableau architecture, Installation and Setup of Tableau Desktop, Visualizing with Tableau, Tableau online and Tableau server, Publish and share reports on Tableau online

Applications of Business Analytics: Manufacturing Use Cases, Retail Use Cases, Marketing use Cases, Banking 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 Finch
4. Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things" by Bernard Marr, Kogan page 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)

Intellectual Property Right (ITUA40185)

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 2Hrs/week Practical/Week(P): NA Tutorial/Week(T): NA	-	-	50	-	-	-	50

Prerequisites :

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 :

After studying this 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 (ITUA40186)

Teaching Scheme	Examination Scheme						
Credits: 5 Lecture's/Week(L): NA Practical/Week(P): 10 Hrs/week Tutorial/Week(T): NA	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
	100	-	-	-	50	-	150

Prerequisites :

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 :

After studying this 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.

Professional Elective VI
Augmented and Virtual Reality (ITUA42181A)

Teaching Scheme	Examination Scheme						
Credits: 3	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T):NA	20	30	20	30	25	-	125

Prerequisites : Computer Graphics, Multimedia Techniques

Course Objectives:

- Explain the importance of AR and VR.
- 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:

After studying this course, students will be able to:

1. Infer that tomorrow's world will be ruled by ideas, concept, and creativity.
2. Explore various input and output interfaces of VR.
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 of Virtual Reality

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

Unit II-Input and Output Interface in VR

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

Unit III-Visual Computation in VR

Visual Computation in Virtual Reality: Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management ofs Large Scale Environments & Real Time Rendering.

Unit IV-Interactive Techniques in VR

Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus,Object Grasp. Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools etc.

Unit V-Application of VR in Digital Entertainment

Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR

Unit VI-Augmented and Mixed Reality

Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality,Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

Text books :

1) Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

2) Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

Reference Books :

1) Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.

List of Assignments

1. Introduction to Unity
    a. Interface Overview
    b. Scene Navigation
    c. Game Objects
2. Creating basic scenes in Unity
    a. Creating Objects
    b. Creating Prefabs
    c. Creating Components
    d. Creating basic materials
    e. Creating lighting
    f. Creating player character
3. Introduction to Unity Scripting
    a. Implementing Game manager
    b. Instantiating Prefab during runtime
    c. Changing color/opacity via script
    d. Changing scale/position via script

Embedded Operating System (ITUA42181B)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture's/Week(L): 3Hrs/week Practical/Week(P): 2Hrs/week Tutorial/Week(T):NA	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
	20	30	20	30	25	-	125

Prerequisites : Concepts of Operating systems, Basics of task management and task scheduling ,Knowledge on RTOS and memory management, Basic knowledge on performance metrics and RTOS tools

Course Objectives:

- To acquire knowledge about concepts related to OS such as Scheduling techniques, threads, inter-thread communications, memory management.
- To acquire knowledge about different types of scheduling algorithms
- To study about FreeRTOS
- To understand the various functions of RTOS

Course Outcomes:

After studying this course, students will be able to:

1. Describe the fundamental concepts of RTOS
2. Develop programs for real time services, firmware and RTOS.
3. Develop programs for multithreaded applications on FreeRTOS

Unit I- Real time systems and Resources

Real-Time Systems and Resources: Brief history of Real Time Systems, A brief history of Embedded Systems, Requirements of Embedded System, Challenges in Embedded System. System Resources, Resource Analysis, Real-Time Service Utility

Unit II- PROCESSING WITH REAL TIME SCHEDULING:

Scheduler Classes, Preemptive Fixed Priority Scheduling Policies with timing diagrams, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies, Worst case execution time, Deadlock and livelock.

UnitT III- Real Time Operating Systems

Operating System basics, The Kernel and its subsystems, Kernel Space and User Space, Kernel Architecture, Types of operating system, Task, process and Threads, Multi-Processing and Multitasking, Types of multitasking, Task Scheduling, Task states, Non-Preemptive scheduling, Preemptive Scheduling, Round Robin Scheduling, Idle Task,

Task Communication, Task Synchronization, Thread Safe Reentrant Functions.
Unit IV- : Embedded Firmware Design
Embedded Firmware Design Approaches, Super-loop based approach, Embedded Operating System based approach, Programming in Embedded C, Integrated development environment (IDE), Overview of IDEs for Embedded System Development..
Unit V-Development And Free Rtos
Introduction to FreeRTOS, multitasking on an LPC17xx Cortex-M3 Microcontroller, LPC17xx Port of FreeRTOS, Resources Used by FreeRTOS, Task Management, Task Functions, Task Priorities, Idle task and task hook function, Creation and Deletion of tasks.
Unit VI -Embedded System Design With Free Rtos
Queue Management, Characteristics of a Queue, Working with Large Data, Interrupt Management, Queues within an Interrupt Service Routine, Critical Sections and Suspending the Scheduler, Resource Management, Memory Management
Laboratory Experiments: 1. Write a C Program to perform the task Management in FreeRTOS, using win32 port on Visual Studio IDE: a. Create Two Tasks and Pass the "Task-Name" as an argument to the task function. b. Demonstrate the use of idle task hook function. c. Update the task priority dynamically. 2. Write a C Program to create a task in FreeRTOS, using win32 port on Visual Studio IDE; that periodically generates a software interrupt for every 1sec. 3. Write a C Program to Demonstrate Inter-Task Communication using Queues in FreeRTOS, use ARM Cortex-M3 Port (LPC1768 MCU Kit) a. Task-1 creates data (stores in a structure) and sends it to the queue b. Task-2 reads the message packet from the queue and reacts accordingly. 4. Write a C Program to Demonstrate Task Synchronization and Resource Sharing among multiple tasks in FreeRTOS, use ARM Cortex-M3 Port (LPC1768 MCU Kit) a. Assume multiple tasks trying to write data to a serial port. b. Use Mutex semaphore to gain exclusive access to serial port.

Text books :

1. Sam Siewert , "Real-Time Embedded Systems And Components".

2. Shibu K V, "Introduction to Embedded System

Reference Books :

1. "Using the FreeRTOS Real Time Kernel" From FreeRTOS.

2. Manuals and Technical Documents from the ARM Inc, web site.

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 IV
Engineering Economics (IOEUA42182A)

Teaching Scheme	Examination Scheme						
Credits: 3	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 2 hrs./week Tutorial (T): 1 hr/week Practical (P): -hrs/week	20	30	20	30	-	25	125

Prerequisite: Students are expected to know the concepts studied in following courses:

1.Basic Maths

Course Objectives:

- To learn the basics of economics and cost analysis relevant to engineering
- To identify conditions for present worth comparison and future worth comparison and find appropriate solutions for the information challenges.
- To learn and calculate the Rate of interest, different costs and overheads ,profit and loss accounts

Course Outcomes: At the end of this course, students will demonstrate the ability to

1.Understand the economics and cost analysis
2.Compare present worth and future worth
3.Identify rate of return and different taxes
4.Calculate profit and loss

Unit- I: Introduction (6 Hrs)

Engineering and Economics, Law of demand and supply, Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income), Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment. Price Indices(WPI/CPI),

Unit- II: Present-Worth and Annual Worth Comparisons(6 Hrs)

Present-Worth Comparisons: Conditions for present worth comparisons, Basic Present worth comparisons, Present-worth equivalence, Net Present worth, Future-worth comparison, Pay-back comparison, Exercises, Discussions and problems. Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method.

Unit –III: Rate-Of-Return And Depreciation(6 Hrs)

Rate of return, Minimum acceptable rate of return, Investment Analysis – NPV, ROI, IRR, Payback Period, Time value of money, Components of costs such as Direct Material Costs, Direct Labor Costs Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, corporate income tax.

Unit IV: Finance and Banking(6 Hrs)

Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, and Profit and Loss account, relation between Balance sheet and Profit and Loss account.Financial Institutions, Finance Commissions, BudgetAnalysis. Indian Banking, Role of Reserve bank of India International Economy

Text Books :

1 Leland T. Blank and Anthony J. Tarquin , "Engineering Economy" 4th Edition ,McGraw Hill Publication .
2 Chan S. Park "Contemporary Engineering Economics", 3rd Edition,PHI Publications.
3 Dr.K.K.Dewett and M. H. Navalur ," Modern Economic Theory"RevisedEdition,S Chand Publication.

Reference Books :

1.V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill
2. Misra, S.K. and Puri (2009), Indian Economy, Himalaya

List of Tutorials:

1. Study of cash flow diagram and interest rates
2. Study of Present worth Comparison
3. Study of Annual worth Comparison
4. Study of Investment Analysis
5. Study of Financial statements and Balance sheet

Computational Biology (IOEUA42182B)

Teaching Scheme	Examination Scheme						
Credits: 3	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 2 hrs./week Tutorial (T): 1 hr/week Practical (P): -hrs/week	20	30	20	30	-	25	125

Prerequisites :	
•	
Course Objectives :	
•	To study and understand the concept of information generation from protein sequences, DNA sequences, whole genome.
•	To study information extraction from large databases and Computer modelling
•	To study and understand various elements of computational biology such as genomic networks, algorithms, and models.
•	To design and develop current applications of computational biology.
Course Outcomes :	
	Students will be able to:
1.	Demonstrate the concept of information generation from protein sequences, DNA sequences, whole genome.
2.	Extract information from large databases and to use this information in computer modelling.
3.	Evaluate various elements of computational biology such as genomic networks, algorithms, and models
4.	Design and develop current applications of computational biology.
Unit I:	**Introduction**

Molecular Biology Introduction, Cell, Nucleus, Genes, DNA, RNA, Proteins, And Chemical structure of DNA, RNA, Transcription and Translation Process. Protein Structure and Functions, Nature of Chemical Bonds Molecular Biology tools, Polymerase chain reaction [6 Hrs]

Unit II:	**Sequence Alignment**
Simple alignments, Gaps, Scoring Matrices, Global and Local Alignments, Smith-Waterman Algorithm, Multiple sequence Alignments, Gene Prediction, Statistical Approaches to Gene Prediction	
Unit III:	**Genome Algorithms**
Genome Rearrangements, Sorting by Reversals, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Sub-quadratic Time, Protein Sequencing and Identification, the Peptide Sequencing Problem	
Unit IV:	**Microarray Data Analysis**
Microarray technology for genome expression study, Image analysis for data extraction, Data analysis for pattern discovery, gene regulatory network analysis	
Text Books :	

	1	• Dan E. Krane, Michael L. Raymer, "Fundamental Concepts of Bioinformatics,", Pearson Education, Inc. Fourth Edition, 9780805346336. •Harshvardhan P. Bal, "Bioinformatics Principles and Applications", Tata McGraw-Hill, seventh reprint, 9780195692303. Reference Books
	2	• Teresa Attwood, David Parry-Smith, "Introduction to Bioinformatics", Pearson Education Series, 9788180301971
Reference Books :		
	1	• R. Durbin, S. Eddy, A. Krogh, G. Mitchison., "Biological Sequence Analysis: Probabilistic Models of proteins and nucleic acids", Cambridge University Press9780521629713.,

List of Assignment:

List of lab assignment will be framed by the subject teacher based on theory syllabus.

Software Quality Assurance System (IOEUA42182C)

Teaching Scheme:	**Examination Scheme**					
Credits : 3	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures / Week :2 Hrs/week Tutorial/ week : 1Hrs/week	20	30	20	30	25	125

Prerequisites : Software Engineering, Java Programming

Course Objectives :

- To study and understand software testing terminologies and framework
- To study and understand the basics of software testing life cycle
- To study and understand test and defect management
- To study and understand an automation testing
- To study and understand an automation testing tools
- To study and understand automation testing for web application

Course Outcomes :

After completion of the course, student will be able to

1. Understand complete software testing life cycle and various terms and technologies used in testing domain.
2. Demonstrate understanding of generating test plan and designing test cases.
3. Demonstrate understanding of test and defect management process.
4. Demonstrate understanding of automation testing.
5. Create test script and execute automated tests using Selenium IDE.

Unit I:	**Introduction to Testing**

Why is testing necessary? What is testing? Role of Tester, Testing and Quality, Overview of Software Testing Life Cycle, V model, SDLC vs STLC, different stages in STLC, document templates generated in different phases of STLC, different levels of testing, different types of testing

Unit II:	**Basics of test design techniques**

Static techniques, reviews, walkthroughs, Various test categories, test design techniques for different categories of tests. Designing test cases using MS-Excel.

Unit III:	**Test and Defect Management**

Test Management: Documenting test plan and test case, effort estimation, configuration management, project progress management. Use of Testopia for test case documentation and test management. **Defect Management** Test Execution, logging defects, defect lifecycle, fixing

/ closing defects. Use of Bugzilla for logging and tracing defects.

Unit IV :	**Basics of Automation testing**

Introduction to automation testing, why automation, what to automate, tools available for automation testing. Understanding to Selenium, using Selenium IDE for automation testing, using Selenium Web driver for automation testing.

List of assignment:

With intent to get some exposure in the software testing domain, students apply Technical, Behavioral, Process concepts learnt in the course by executing near real-life project and working in teams (project teams will ideally comprise of 4 members)

There will be 3 projects:
Project 1: Use of Testopia for test case management.
The project will consists of test plan, test design for a sample web application and maintaining Requirement Traceability Matrix using the tool

Project 2: Use of Bugzilla for defect management.
The project will include execution of tests designed in previous project, identifying, logging and tracing the defect and maintaining the Requirement Traceability Matrix

Project 3: Use of Selenium for automation testing.
The project will consists of identifying which tests from project 1 can be automated, then creating script for those tests using tool, executing the tests with the help of tool and generating report for the tests cases.

Text Books :

1.	M G Limaye, "Software Testing Principles, Techniques and Tools", Tata Mcgraw Hill, ISBN: 9780070139909 0070139903
2.	Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X

Reference Books :

1.	Naresh Chauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847
2.	Dr. K. V. K. Prasad , "Software Testing Tools", Dreamtech Press ISBN: 10:81-7722-532-4

Technology and Financial Management (IOEUA42182D)

Teaching Scheme	**Examination Scheme**						
Credits : 3	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L) : 2hrs./week Tutorial (T): -- 1hr. Practical (P): -- hrs./week	20	30	20	30	-	25	125

Prerequisite: Statistical and quality control

Course objectives:
The rapid strides in competitiveness in global markets, it is felt that successful corporate managers will be those who can take advantage of the growing sophistication of financial markets, cost accounting, management of projects, human resources and quality. To make mechanical engineers a successful corporate manager in their professional career this course is introduced.

Course Outcomes:
By the end of this course, students will
1. Understand the importance of budget and impact of it.
2. Implement various costing techniques.
3. Learn analysis of engineering economics.
4. Implement various Human Resource and quality management techniques.

Unit 1 - Finance

Definition and scope of finance; Real & financial assets, Investment Decision, Financing decisions, Dividend decisions and liquidity decisions. Long term financing, Primary & secondary capital markets, Role of merchant banking, Types of shares and debentures. Need, sources and functions - Investment banks, portfolio management, Domestic institutional investors, ADB, IMF, World bank and IMF, Importance of finance Methods of capital budgeting, Production, sales, production cost budget and flexible budget along with the numerical problems related to these budgets.

Unit 2 – Costing

Concept of cost centre and profit centre, Elements of cost with illustrations. Procedure/Methodology, limitations of absorption costing along with numerical problems. Marginal costing concept, CVP analysis along with numerical problems, Applications and limitations of marginal costing. Methodology, Recording cost in contracts, value and profit of contract, Profit of incomplete contracts along with numerical problems. Meaning, stages and flow of costs in ABC, classification of activities, advantages and limitations (No numerical problems) Characteristics, procedures, process costing having no opening and closing WIP along with numerical problems.

Unit 3 – Engineering Economic Analysis

Macro and micro economics differences and price theory. Law of demand and supply, Elasticity of demand, Methods to measure elasticity, Exceptions to the law of demand and assumptions. Utility analysis & indifferent curve analysis, Marshalians law of diminishing marginal utility, Income

effect and substitution effect Law of production, Law of variable proportion, Law of return to scale for long term production Monopoly, oligopoly, monopolistic and pure competition & their equilibrium Inflation and its effect on business and economy, types Importance of foreign trade & hedging Balance of payments – exchange rates, Fixed and flexible exchange rates

Unit 4 - Human Resource and Quality Management

Definition of HR and personnel management, significance and the differences. Describe the HR manager's role. Objectives, importance & process of manpower planning. Merit rating methods, need and benefits. Need, importance and methods of training & development. Meaning of retirement and separation, types of separation like VRS, resignation, sacking etc., Meaning and fundamentals of Organizational Behavior (OB), OB models MBO, Process of MBO and benefits.
Characteristics of quality, TQM principles and critical processes, TQM cycle, Deming fourteen points of QM, PCDA, Juran ten steps to quality improvement and trilogy diagram Concept of Kaizen Concept and components of JIT, push and pull system, Kanban, Critical success factors in JIT, Application of JIT and JIT cycle Quality management system, ISO – 9001-2000 series, Objectives, principles and categories ISO 14000 family of standards, Benefits of implementing ISO 14000.

Tutorial Assignment

Case Study on each unit.

Text Books

1. Pandey, Financial Management, Tata McGraw-Hill publications, New Delhi. ISBN: 812591658X.
2. A.R. Aryasri, Managerial Economics and Financial Analysis, Tata McGraw-Hill Publications, New Delhi. ISBN: 0070078033

Reference Books :

1. Prasanna Chandra, Financial Management, Tata McGraw-Hill publications, ISBN:0070656657
2. Jawaharlal, Cost Accounting, Tata McGraw-Hill publications, New Delhi. ISBN: 0070221626.
3. K. K. Dewett, Modern Economic Theory, S. Chand publications, New Delhi. ISBN: 8121924634.
4. J. Juran, Juran's Quality handbook, McGraw-Hill International. ISBN: 0-07-034003-X.
5. Sahay and Saxena, World Class Manufacturing, McMillan publications, New Delhi. ISBN: 9780333934746.
6. Vohra, Quantitative Techniques in Management, ISBN: 0070611939.
7. C.B. Mamoria, Personnel Management, Himalaya publishing house, ISBN: 8178669951.
8. French & Bell, Organizational Behavior, ISBN: 013242231X.

Non-Destructive Techniques and Engineering Diagnosis (IOEUA42182E)

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

Prerequisite: Applied Physics, Basic Electronics, Engineering Chemistry

Course Objectives: The course will help students

1. To **understand** basic concepts and need of health monitoring.
2. To **recognize** the purpose of specific nondestructive technique and **interpret** its results for damage evaluation.

Course Outcomes:

Upon completion of the course, students will be able to

1. **Understand** and **explain** the need for health monitoring in the field of engineering.
2. **Explain** working principle and applications of transducers under stress.
3. **Demonstrate** use of ultrasonic pulse velocity technique for damage detection.
4. **Demonstrate** use of acoustic emission technique for damage detection.

Unit I: Concept of Health monitoring

Basic concepts of health monitoring with regard to structures, machines and electronic components.

Unit II: Transducers

Introduction, types of transducers, working principle of transducers, applications of transducers to various fields of engineering.

Unit III: NDT - Ultrasonic pulse velocity

Introduction, working principle of ultrasonic pulse velocity technique, application to various fields of engineering.

Unit IV: NDT- Acoustic Emission

Introduction, working principle of acoustic emission technique, application to various fields of engineering.

Term Work:

1) At least two assignments on each unit
2) Demonstration of NDT for damage detection

Reference Books:

1. Ian R. Sinclair – "Sensors and Transducers"
2. Christian u. Grosse and Masayasu Ohtsu -"Acoustic emission Testing" Basics for Research – Applications in Civil Engineering.
3. IS13311 (Part1):1992 "Non-destructive testing of concrete - methods of test" Part 1 Ultrasonic Pulse Velocity

Open Elective V

Inferential Statistics for Data Science(IOEUA42183A)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): -1 hr/week Practical (P): - hrs/week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Readers/students are expected to know the following concepts:

1. 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 (6 HRs)

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(6 HRs)

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 (6 HRs)

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(6 HRs)

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**, SantiRanjan, **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.

3.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

Tutorials : Tutorials can be done using Python/R

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

E- Commerce (IOEUA42183B)

Teaching Scheme	Examination Scheme						
Credits: 3	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 2 hrs./week Tutorial (T): -1 hr/week Practical (P): - hrs/week	20	30	20	30	-	25	125

Prerequisites :	
•	
Course Objectives :	
•	Demonstrate an understanding of the foundations and importance of E-commerce
•	Understand the impact of Information and Communication technologies, especially of the Internet in business operations
•	Comprehend risk, legal issues and privacy in E-Commerce and Assess electronic payment systems 4. Analyze the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders
•	Evaluate the opportunities and potential to apply and synthesize a variety of ECommerce concepts and solutions to create business value for organizations, customers, and business partners.
Course Outcomes :	
1.	Demonstrate an understanding of the foundations and importance of E-commerce
2.	Understand the impact of Information and Communication technologies, especially of the Internet in business operations
3.	Comprehend risk, legal issues and privacy in E-Commerce and Assess electronic payment systems 4. Analyze the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders
4.	Evaluate the opportunities and potential to apply and synthesize a variety of ECommerce concepts and solutions to create business value for organizations, customers, and business partners.
Unit I:	**Introduction**
E-Commerce: meaning advantages & disadvantages, incentives for engaging in electronic	

commerce, impact of e-commerce on business and e business, electronic commerce framework, types of e-commerce, web background		
Unit II:	**Risk and Legal Issues in E-Commerce**	
Risks and barriers in the adoption of e-business environment, the impact of ICT in contemporary business operations, entrepreneurial development in e commerce, cloud computing and e Commerce, e-commerce in India – laws for e-commerce in India, cryptocurrency and e commerce		
Unit III:	**Ethical and Social and Political issues related to Electronic Commerce**	
Protecting privacy, protecting Intellectual property, copyright, trademarks and patents, taxation, and encryption policies		
Unit IV:	**E-Commerce Business Models**	
Key element of a business model, major B2C business models, major B2B business models, business models in emerging e-commerce areas E-Government: issues in e-governance applications, benefits, and reasons for the introduction of e- governance, e-governance models		
Text Books :		
	1	Kenneth C Lauden, Carol G. Traver, "E-Commerce", Perason Education, ISBN 97881317812.
	2	• Doing Business on the Internet E-COMMERCE (Electronic Commerce for Business): S. Jaiswal, Galgotia Publications, ISBN 9788175153059.
	3	• E-Business, Bookseller Code (AG) OXFORD, 1st edition ParagKulkarni, SunitaJainabadkar&PradipChande, ISBN 9780198069843.
Reference Books :		
	1	P. T. Josef, "Electronic Commerce- A managerial perspective" Prentice-Hall International, ISBN 8120320891.
	2	•Kamlesh K. Bajaj, Debjani Nag, "Electronic Commerce: The cutting edge of business", Tata McGraw-Hill Publishing Co. Ltd, 2000, ISBN 9780070585560.
	3	• Jeffrey F. Rayport, Bernard J. Jaworski, "e-Commerce", Tata McGraw Hill, 2002, ISBN 9780072510249.
	4	• Pete Loshin, Paul A. Murphy, "Electronic Commerce", Jaico Publishing House, 2000, ISBN 9788172246662.
	5	• Ravi Kalakota, Andrew B. Whinston, "Frontiers of Electronic Commerce", Addison Wesley,2002, ISBN 0201845202

List of Assignments	
1	Study of different e Commerce Platform e.g. Prestashop, WooCommerce, Kickstart, OpenCart or any other. Installation of any one EC platform (Any one you want)
2	Adding categories, product and product details, attributes, tags to the e commerce development tool you have chosen in activity 1.
3	Adding header, footer, slider and any other design as per your project to the e commerce development tool you have chosen in activity
4	Adding theme and various module management to the e commerce development tool you have chosen from activity 1
5	Restoring DB, payment taxes promotion discount to the e commerce development tool you have chosen from activity 1
6	Adding order management to the e commerce development tool you have chosen from activity 1

Rural Technology (IOEUA42183C)

Teaching Scheme:	Examination Scheme					
Credits : 3 Lectures / Week :2 Hrs/week Tutorial/ week : 1Hrs/week	CIE	ISE	SCE	ESE	TW	Total
	20	30	20	30	25	125

Pre-requisites: -

Course objectives:

- Understand theories and practices in the rural development model.
- Learn and analyze rural life and rural economy.
- Understand different measures and technologies used in rural development.
- To participate in visits and case studies for better understanding for rural development and its impact on overall economy.

Course Outcomes:

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

1. Understand rural development model
2. Learn different measures in rural development and its impact on overall economy
3. Understand and learn importance of technologies in rural and community development
4. Understand challenges and opportunities in rural development

UNIT-I INTRODUCTION TO RURAL DEVELOPMENT

Concepts and connotations, Basic Elements, Growth Vs. Development, Why rural development, Rising expectations and development, Development and Change, Human beings as cause and consequences of development.

RURAL ECONOMY OF INDIA - Introduction, size and structure, The characteristics of rural sector, The role of agricultural sub-sector, The role of non-agricultural sub-sector, Challenges and opportunities.

UNIT - II: RURAL DEVELOPMENT – MEASURES AND PARADIGMS

Measures Of Development - Introduction, Measures of level of rural development, Measures of income distribution, Measures of development simplified, Concepts and measures of rural poverty

Paradigms Of Rural Development - Introduction, The modernization theory, The dependency theory of Marxist School, Rosenstein- Rodan's theory of 'Big Push', Lewis' model of economic development,The human capital model of development, The Gandhian Concept of Rural

Development theories from other social sciences.

UNIT - III TECHNOLOGIES FOR RURAL DEVELOPMENT

Using Water Resources - Water quality testing, Water filtering ,Extraction from Groundwater ,Pumps Rope and washer pump ,Manuel pumps, Treadle pump, Irrigation for agriculture, Channel systems, Sprinkler systems, Drip systems Water diversion ,Water storage

Building Infrastructures, Creating Energy - Basic energy uses , Energy Sources - Firewood, Solar Energy, Hydroelectricity, Hydromechanical, Wind Energy, Energy Storage,Connecting to the Electrical Network, Environmental Considerations

UNIT-IV COMMUNITY DEVELOPMENT – RURAL ENTREPRENEURSHIP

- Introduction, Service Learning and community development, Theory and practice of community development, Community development issues. The diverse meaning of community development, The knowledge base of community development, International community development,

Different forms of Rural Entrepreneurship, Significance , Business planning for a new venture: the concept of planning paradigm, Forms of business enterprises-Sole proprietorship, partnership and corporations, Product and Process development, Marketing analysis and competitive analysis, strategies; Financial resources; debt financing, banks and financial institutions and other non-bank financial sources; Government programmes : direct loan assistance and subsidies; Industrial and legal issues for rural enterprises

Text Books:	1. "Rural Development: Principles, Policies and Management" - Katar Singh , Sage Publications 2. "Introduction to Community Development - Theory, Practice and Service Learning", Edited by J W Robinson, Sage Publications 3. G. N. Tiwari, Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa, 2002. 4. "Fundamentals of Entrepreneurship", H. Nandan, Third Edition, PHL Learning Pvt. Ltd., **5.** "Monetary Economics-Institutions, Theory and Policy" , First Edition, S B Gupta, S Chand Publications, ISBN - 9788121904346
Reference Books:	1. KURUKSHETRA" - A Journal on Rural Development 2. "Energy conversion" , R. Y. Goswami, Frank Kreith, CRC Press, 2007. 3. "Solar Energy: Fundamental and Application" , H. P. Garg and S. Prakash,Tata McGraw Hill, 1997. 4. "Technologies for Sustainable Rural Development: Having Potential of Socio Economic Upliftment" , TSRD 2014 , edited by Jai Prakash Shukla, Allied Publishers Pvt. Ltd.

Assignment List: Rural Technology

Case Studies and Field Visit :

1. **Use of ICT in Rural and agricultural development** - Education, Healthcare, Agriculture, Business, Resource Mapping, Digital and Social Media Marketing
2. **Decision Support Systems for soil conservation and farm management**
3. **Waste Management and Sanitation**
4. **Water management :** Watershed Management - Water-Cup Competition by Paani Foundation, Community Safe Water Solutions
5. **Energy resources**
6. **Role of Micro-Finance institutions in rural development:** Visit to a 'Woman Self help group' nearby and study of its functioning and its role in development.
7. **Visit to model villages in nearby region -** Ralegan-Siddhi, Dist - Ahemadnagar, Hiware Bazar Dist - Ahemadnagar, Tikekarwadi - Dist. - Pune, Buchekarwadi Dist- Pune etc.

Product Design Engineering (IOEUA42183D)

Teaching Scheme	**Examination Scheme**						
Credits:3 Lecture (L): 2hrs./week Tutorial (T): 1 hr. Practical (P): -- hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Basic Engineering Science , Material Science, Engineering Metallurgy, Manufacturing processes, Machine Design, Computer Aided Engineering

Course Objectives:

- To understand basic techniques for particular phases of product development.
- To understand basic Customer needs, satisfaction and commercialization of product.
- To understand Forward and Reverse Engineering and its role in designing a product

Course Outcomes:

Upon completion of the course, students will be able to

- Describe an engineering design and development process.
- Design product as per customer needs and satisfaction.
- Apply engineering, scientific, and mathematical principles to execute a design from concept to finished product.
- Analyze methods and processes of Forward and Reverse engineering and methods of Design for manufacturing and analysis.

Unit I : Introduction to Product Design

Definition of product design, Essential Factors for product design, Modern approaches to product design, Characteristics of Successful Product Development, Innovative Thinking, Challenges to Product Development, product development versus product design. Customer Needs and Satisfaction.

Unit II: Product Development Process

Product development process- Identification of customer needs- customer requirements, product development process flows, Product specifications, concept development and concept generation, concept selection, concept screening, concept scoring, concept testing.

Unit III: Reverse Engineering

Introduction of reverse engineering, Product Teardown Process, Tear Down Methods, Force Flow Diagrams, Measurement and Experimentation, Applications of Product Teardown, Benchmarking Approach and Detailed Procedure, Tools Used in Benchmarking, Indented Assembly Cost Analysis, Function –Form Diagrams, Trend Analysis, Setting Product Specifications, Introduction to Product Portfolio and Product Architecture.

Unit IV: Design for X

Design for manufacture, Design for assembly, Design for robustness, Design for safety, Design for reliability, Design for environment, Design for piece part production, manufacturing cost analysis. Local, Regional and Global issues, basic life cycle assessment - basic method, Design Failure mode effect analysis.

List of Tutorial Assignment:

1) Design of concept of Innovative product.
2) Development of concept of Innovative product using any modelling software.
3) Development of standard process for gathering customer needs related to new product.
4) Prepare product development process flows for new innovative product.
5) Application of reverse engineering technique using benchmarking of product.
6) Application for design for manufacturing and assembly.

Text Books:

1. Product Design-Techniques in Reverse Engineering and New Product Development, Kevin Otto, Kristion Wood, Pearson Education, ISBN 978-81-7758-821-7.
2. Karl T.U. And Steven D.E., Product Design and Development, McGraw Hill, Ed 2000
3. K. Chitale; R.C. Gupta, Product Design and Manufacturing, Prentice Hall India.

Reference Books :

1. Dieter George E., Engineering Design McGraw Hill Pub. Company, 2000
2. Grieves, Michael, Product Lifecycle Management McGraw Hill

Bralla, James G., Handbook of Product Design for Manufacturing, McGraw Hill Pub

Numerical Methods (IOEUA42183E)

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

Course Objective:

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

Course Outcomes:

Upon 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 ($1/3^{rd}$ and $3/8^{th}$), Gauss Quadrature2 point and 3 point method, Double Integration- Trapezoidal Rule, Simpson's $1/3^{rd}$ 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.

Term Work:

Students are required to submit at least two assignments on each unit.

Textbooks:

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

List of Tutorial Assignments:	
1	Study of different e Commerce Platform e.g. Prestashop, Woo Commerce, Kickstart, OpenCart or any other. Installation of any one EC platform (Any one you want)
2	Adding categories, product and product details, attributes, tags to the e commerce development tool you have chosen in activity 1.
3	Adding header, footer, slider and any other design as per your project to the e commerce development tool you have chosen in activity
4	Adding theme and various module management to the e commerce development tool you have chosen from activity 1
5	Restoring DB, payment taxes promotion discount to the e commerce development tool you have chosen from activity 1
6	Adding order management to the e commerce development tool you have chosen from activity 1

Introduction to Research (ITUA42184)

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

Course Objective:

- To prepare the students to understand significance of research.

Course Outcomes:

Upon completion of the course, students will be able to

1. To understand foundations of research and its scientific methods.
2. To identify problem and formulate it.

Unit I: Foundations of Research

Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process

Unit II: Problem Identification & Formulation and Design

Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance
Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

Term Work:

Students are required to submit at least two assignments on each unit covering problem identification, feasibility, hypothesis and design..

Textbooks:

3. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
4. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press

Reference Books:

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p

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.

2018 Pattern

Semester - VIII

Syllabus Curriculum

Final Year B. Tech. Information Technology - Semester VIII (Pattern 2018)

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

Theory: 1Hr. = 1 Credit, Practical: 2Hrs. = 1 Credit, Tut:1 Hr. = 1 Credit, Mandatory course: No Credit