MKSSS's Cummins College of Engineering for Women, Pune
(An Autonomous Institute Affiliated to SavitribaiPhule Pune University)

Autonomous Program Structure of
Final Year B. Tech. Eighth Semester
(Information Technology)
Academic Year: 2023-2024 onwards

Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme				Total Marks	Credit
		Lecture	Tutorial	Practical	In Sem	End Sem	Oral	Practical		
20IT 801	Distributed Systems	3	0	0	50	50	0	0	100	3
20PEIT 801	Program Elective-IV	3	0	0	50	50	0	0	100	3
20PEIT 802	Program Elective-V	3	0	0	50	50	0	0	100	3
20OE 801	Open Elective-III	3	0	0	50	50	0	0	100	3
20OE 802	Open Elective-IV*	3	0	0	50	50	0	0	100	3
20IT 801L	Distributed Systems Lab	0	0	2	25	0	25	0	50	1
20PEIT 801L	Program Elective–IV Lab	0	0	2	25	0	25	0	50	1
	Total	**15**	**0**	**4**	**300**	**250**	**50**	**0**	600	17
	Grand Total	19			600					

*** Inter-disciplinary Course**

Programme Elective – IV 20PEIT 801 A Advanced Machine Learning 20PEIT 801 B Introduction to DevOps 20PEIT 801 C Design Patterns	**Programme Elective – IV Lab** 20PEIT 801L A Advanced Machine Learning 20PEIT 801L B Introduction to DevOps 20PEIT 801L C Design Patterns
Programme Elective – V 20PEIT 802 A Advanced Databases 20PEIT 802 B Unified Communication 20PEIT 802 C Information Retrieval	

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APPROVED BY
Department of Information Technology
Secretary Governing Body
MKSSS's Cummins College of Engineering
For Women, Pune-411052

APPROVED BY
Chairman Governing Body
MKSSS's Cummins College of Engineering
For Women, Pune-411052

20OE801 Open Elective-III			**Eligible Departments**				
Sr. No.	**Course Code**	**Course Title**	**EnTC**	**Comp**	**IT**	**Mech**	**Instru**
1	20OE801A	Big Data and Analytics	Y	Y	Y	Y	Y
2	20OE801B	Cyber Physical Systems	Y	Y	Y	N	Y
3	20OE801C	Digital Control	Y	N	N	Y	Y
4	20OE801D	Industrial Engineering and Management	Y	Y	Y	Y	Y
5	20OE801E	Introduction to Cyber-crime and Forensics	Y	Y	Y	Y	Y
6	20OE801F	Instrumentation in Food and Agriculture	Y	Y	Y	Y	Y
7	20OE801G	Medical IoT	Y	Y	Y	N	Y
8	20OE801H	Quantum Computing	Y	Y	Y	N	Y
9	20OE801I	Renewable Energy Sources	Y	Y	Y	Y	Y
10	20OE801J	Soft Computing	Y	Y	Y	Y	Y
11	20OE801K	Software Testing and Quality Assurance	Y	Y	Y	Y	Y

20OE802 Open Elective-IV			**Eligible Departments**				
Sr. No.	**Course Code**	**Course Title**	**EnTC**	**Comp**	**IT**	**Mech**	**Instru**
1	20OE802A	Applied statistics with R Programming	Y	N	N	Y	Y
2	20OE802B	Automobile Engineering	Y	Y	Y	N	Y
3	20OE802C	Autonomous Robots	N	Y	Y	Y	N
4	20OE802D	Building Automation and Energy Audit	Y	Y	Y	Y	N
5	20OE802E	Data Analysis and Visualization	Y	N	Y	Y	Y
6	20OE802F	Data Science using Python	Y	N	Y	Y	Y
7	20OE802G	Industrial Drives and Control	Y	Y	Y	Y	N
8	20OE802H	Smart Sensors and Structures	Y	Y	Y	Y	N
9	20OE802I	Wireless Networks	N	Y	Y	N	Y

20IT 801 Distributed Systems

Teaching Scheme:	**Examination Scheme:**
Lectures : 3 hours/week	**In-Semester : ** 50 Marks
Tutorial : --	**End-Semester :** 50 Marks
	Credit : 3

Prerequisites: Web Technology, Computer Networks, Operating Systems, Database Management Systems

Course Objectives:

Familiarize students with

1. Fundamental knowledge of distributed systems architectures and models.
2. Process Communication and synchronization in a distributed environment.
3. Methods of fault tolerance and replication for distributed systems
4. Distributed File Systems and naming services

Course Outcomes:

Students should be able to

1. Apply basic concepts of Distributed systems for communication
2. Apply various synchronization and mutual exclusion algorithms
3. Recommend appropriate techniques for fault tolerance, resource and process management
4. Explain concepts of Distributed File System and naming services for distributed environment

Unit – I Introduction to Distributed Systems 7 Hours

Characterization of Distributed Systems: Issues, Goals, and Types of distributed systems, Distributed System Models, Hardware concepts, Software concepts, Middleware: Models of Middleware, Services offered by middleware, Client Server model.

Case Study: The World Wide Web

Unit – II Communication 7 Hours

Layered Protocols, Inter process communication (IPC): MPI, Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI), Message Oriented Communication, Stream Oriented Communication, Group Communication.

Unit – III Synchronization 7 Hours

Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion - Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, and Performance measure.

Election Algorithms- Non token based algorithm, Token based algorithm.

Case Study: IBM's Websphere Message-Queuing System

Unit – IV Resource and Process Management 7 Hours

Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach, Introduction to process management, process migration, Threads, Virtualization, Clients, Servers, Code Migration.

Unit – V Replication and Fault Tolerance 7 Hours

Introduction to replication and consistency, Data-Centric and Client- Centric Consistency Models, Replica Management, Fault Tolerance: Introduction, Process resilience, Reliable client-server and group communication, Recovery, Distributed Commit, checkpoints

Case Study: Catching and Replication in Web

Unit – VI Distributed File Systems and Name Services 7 Hours

Introduction and features of DFS, File models, File Accessing models, File-Caching Schemes, File Replication, Case Study: Distributed File Systems (DSF), Network File System (NFS), Introduction to Name services and Domain Name System, Directory Services, Case Study: The Global Name Service, The X.500 Directory Service

Designing Distributed Systems: Google Case Study

Text Books

1. Andrew S. Tanenbaum and Maarten Van Steen, "Distributed Systems: Principles and Paradigms", 2nd edition, Pearson Education.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005.

Reference Books

1. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
2. M. L. Liu, "Distributed Computing Principles and Applications", Pearson Addison Wesley, 2004.

3. Sunita Mahajan, Seema Shah, "Distributed Computing", Oxford University Press, 2nd Edition, ISBN-13: 978-0198093480.
4. Abhijit Belapurkar, Anirban Chakrabarti, Harigopal Ponnapalli, Niranjan Varadarajan, Srinivas Padmanabhuni, Srikanth Sunder rajan, "Distributed System Security: Issues, Processes and solutions", Willey online Library, ISBN: 978-0-470-51988-2.
5. "Linux System Programming", 2nd Edition, Robert Love, O'reilly

20PEIT 801A Advanced Machine Learning

Teaching Scheme:	**Examination Scheme:**
Lectures : 3 hours/week	**In-Semester : ** 50 Marks
Tutorial : --	**End-Semester :** 50 Marks
	Credit : 3

Prerequisites: Machine Learning

Course Objectives:

Familiarize students with

1. Selection of appropriate features of the dataset for processing
2. Various algorithms in Ensemble Learning
3. Fundamentals of Reinforcement Learning
4. Basic concepts of Neural Network and Deep Learning

Course Outcomes:

Students should be able to

1. Perform preprocessing tasks such as dimensionality reduction, vectorization of an image and so on
2. Explain wide variety of advanced Machine Learning algorithms and techniques
3. Apply advanced Machine Learning techniques to solve real-world problems
4. Compare various advanced Machine Learning algorithms

Unit – I Dimensionality Reduction 7 Hours

Introduction to Dimensionality Reduction, Feature Selection, Subset Selection, Principal Component Analysis, Linear Discriminant Analysis

Unit – II Ensemble and Reinforcement Learning 9 Hours

Ensemble Learning: Wisdom of crowd, Bagging – Bootstrap, Random Forest, Boosting – AdaBoost

Reinforcement Learning: Concept, elements of RL, K-armed Bandit problem, Q-learning

Incremental Learning: Concept, an adaptive incremental learning framework

Unit – III Neural Network and Artificial Neural Network 9 Hours

Biological motivation, neurons, McCulloch Pitts neurons, logic gates, Limitations of McCulloch Pitts neurons, Perceptron, Limitations of perceptron, Single Layer Perceptron, Activation layers, Artificial Neural Network and XOR and Multi-layer Perceptron, Error in output, Backpropagation, Gradient Descent

Unit – IV Convolutional Neural Network 9 Hours

Vectorization of an image, concept of Convolutional Neural Network, Properties of Convolutional Neural Network, Convolutions, Filters, Strides, layers, padding, Channels, Pooling, Flattening, fully connected network, Convolutional Neural Network and image datasets.

Unit – V Sequence Modeling: Recurrent Neural Network 8 Hours

Unfolding Computational Graphs, Recurrent Neural Network, Bi-directional Recurrent Neural Network, Encoder-Decoder Sequence to Sequence Architecture, The challenge of Long-Term Dependencies, Long Short-Term Memory.

Text Books

1. Etham Alpaydin, "Introduction to Machine Learning", PHI 2nd Edition – 2013.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press – 2016.

Reference Books

1. Nikhil Buduma, "Fundamentals of Deep Learning – Designing Next Generation Machine Intelligence Algorithms", O'Reily – 1st Edition – 2017.
2. Parag Kulkarni, "Reinforcement Learning and Systemic Machine Learning for Decision Making", IEEE Press – 2015.
3. Haibo He, "Self-Adaptive Systems for Machine Intelligence", Wiley – 2011.

Other Resources

1. MNIST datasets: https://www.kaggle.com/datasets?search=mnist
2. CIFAR datasets: https://www.kaggle.com/datasets?search=cifar

20PEIT 801B Introduction to DevOps

Teaching Scheme:	**Examination Scheme:**
Lectures : 3 hours/week	**In-Semester : ** 50 Marks
Tutorial : --	**End-Semester :** 50 Marks
	Credit : 3

Prerequisites: Operating Systems and Cloud Computing

Course Objectives:

Familiarize students with

1. DevOps Continuous Development and Continuous Integration.
2. DevOps Operation Services.
3. DevOps Architecture.
4. DevOps Technologies.

Course Outcomes:

Students should be able to

1. Explain DevOps framework and security aspects in DevOps
2. Apply advanced strategies for software deployment
3. Employ appropriate type of testing in DevOps environment
4. Analyze data to detect anomalies

Unit – I Introduction to DevOps 7 Hours

Introduction, Why DevOps?, DevOps Perspective, DevOps and Agile, Team Structure, Co- ordination and barriers. The cloud as a platform, Operations, Operations Services, Service Operation Functions, Continual Service Improvement, Operation and DevOps.

Unit – II Deployment Pipeline 6 Hours

Overall Architecture, Does DevOps require architectural change? Overall architecture structure, Microservice architecture, Amazon’s rules for teams, Microservice adoption for existing systems.

Unit – III Building and Testing 7 Hours

Moving a system through the deployment pipeline, Crosscutting aspects, Development and pre-Commit testing, UAT/Staging/Performance Testing, Production, Incidents, Deployment – Strategies for managing a deployment, logical consistency, packaging, deploying to multiple Environments, partial deployment, rollback, tools

Unit – IV Deployment 7 Hours

Introduction, Strategies for Managing a Deployment, Logical Consistency, Packaging, Deploying to multiple environments**,** partial deployments, Rollback, Tools.

Unit – V Monitoring 7 Hours

Introduction, what to monitor, How to monitor, When to change the monitoring configuration, Interpreting monitoring data, challenges, tools, diagnosing an anomaly from monitoring data.

Unit – VI Trends in DevOps 8 Hours

GitOps, MLOps, AIOps, DataOps, DevSecOps

Text Books

1. Len Bass, Ingo Weber, Liming Zhu, DevOps A software Architect's Perspective, Pearson, First edition.
2. Sanjeev Sharma, The DevOps Adoption Playbook, A guide to adopting DevOps in a Multi Speed IT Enterprise. Wiley, IBM Press.

Reference Books

1. Jennifer Davis and Katherine Daniels, "Effective DevOps", O'Reilly, First Edition
2. Deepak Gaikwad, Viral Thakkar, "DevOps Tools from practitioner's Viewpoint", Wiley, First Edition
3. Mark Treveil, Nicolas Omont, Clément Stenac, Kenji Lefevre, Du Phan, Joachim Zentici, Adrien Lavoillotte, Makoto Miyazaki, Lynn Heidmann, "Introducing MLOps", O'Reilly Nov 2020
4. Billy Yuen, Jesse Suen, Alex Matyushentsev, Todd Ekenstam, "GitOps and Kubernetes", O'Reilly, April 2021
5. John Schnidt and Kirit Basu, "DataOps: The Authoritative Edition", Sept 2019
6. Geradus Blokdyk, "DevSecOps: A Complete Guide", 2019 Edition

20PEIT 801C Design Patterns

Teaching Scheme:	**Examination Scheme:**
Lectures : 3 hours/week	**In-Semester : ** 50 Marks
Tutorial : --	**End-Semester :** 50 Marks
	Credit : 3

Prerequisites: Object Oriented Analysis and Design Laboratory

Course Objectives:

Familiarize students with

1. Principles of software design
2. Necessity of Design Patterns
3. Different types of Design Patterns
4. Applications of design patterns

Course Outcomes:

Students should be able to

1. Identify low cohesion and high coupling in a given problem statement
2. Apply behavioral design Patterns to incorporate enhanced class collaboration
3. Apply structural design patterns to overcome the structural incompatibility
4. Analyze scenarios for application of creational design patterns

Unit – I Role of Design Patterns in Software Design 10 Hours

SOLID principles, classification of design Patterns, applying SOLID principles using Design Patterns

Unit – II Behavioral Design Patterns 10 Hours

Strategy as algorithmic loose cuping, State, Template method as skeleton of algorithm, Chain of responsibility as request handlers" chain , Observer as publish subscribe

Unit – III Structural Design Patterns 11 Hours

Adapter as resolving interface incompatibilities, Proxy as placeholder, Façade simplification in handling complex components, Composite compression of has a relationship to is a relationship, Decorator

Unit – IV Creational Design Patterns 11 Hours

Singleton as object instantiation restrictor, Factory method as interface for creating subclass objects at run time, Abstract Factory as creating families of objects without specifying their concrete classes

Text Books

1. Alan Shalloway and James Trott, "Design Patterns Explained: A new Perspective on object oriented design", Addison Wesley
2. Kethy Seirra , "Head first Design Patterns", SPD 2020

Reference Books

1. Eric Gamma "Design Patterns: Elements of reusable object oriented software" Addison Wesley

20PEIT 802A Advanced Databases

Teaching Scheme:	**Examination Scheme:**
Lectures : 3 hours/week	**In-Semester :** 50 Marks
Tutorial : --	**End-Semester :** 50 Marks
	Credit : 3

Prerequisites: Data structures, database management systems.

Course Objectives:

Familiarize students with

1. Concepts and applications of advanced database architectures.
2. Different ways to process queries in advanced databases.
3. Storage and indexing structures.
4. Security management in database management systems.

Course Outcomes:

Students should be able to

1. Examine different database architecture of advanced databases.
2. Analyze the techniques of transactions and query processing in advanced databases.
3. Devise appropriate ways to store and index data.
4. Apply appropriate database security techniques.

Unit – I Parallel Databases 7 Hours

Database system architecture, client server architecture, parallel database architecture, shared memory, shared disk, shared nothing, hierarchical, I/O parallelism, inter query parallelism, intra query parallelism, interoperation parallelism, intra operation parallelism, design of parallel systems.

Unit – II Distributed Databases 7 Hours

Distributed system architecture, homogenous and heterogeneous databases, distributed data storage, distributed transaction, commit protocol, concurrency control in distrusted databases, availability, distributed query processing, cloud databases.

Unit – III Transaction processing in advance databases 7 Hours

Distributed transactions, commit protocols, concurrency control in distributed databases, replication, extended concurrency control protocols, coordinator selection, Consensus in Distributed Systems

Unit – IV Big Databases 7 Hours

Introduction to Big Data, NoSQL database system – Column based and key value based

Column based Database (Cassandra) : Architecture, Managing data, Data Caching, Tuning, Data backup, Cassandra Query Language, CQL Data Model, Indexing Key Value based Database (DynamoDB) : Data Model, Operations, Data Access, Indexing.

Unit – V Database Indexing and hashing 7 Hours

Basics of query processing, Introduction to indexing, ordered indices, B+ tree index files, B+ tree extensions, Hash indices, Multiple key access, creation of indices, write optimized index structure, bitmap indices, indexing of spatial and temporal data, static and dynamic hashing.

Unit – VI No SQL and semi structured Data Management 7 Hours

Introduction to Big Data, No SQL Databases, MongoDB, Map reduce. XML Databases, DTD, XML Schemas, XQuery, XPath. JSON

Text Books

1. Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, ISBN- 0-07-120413-X, Sixth Edition.
2. Ramez Elmasri, Shamkant B. Navathe**,** Fundamentals of Database Systems, Pearson Publication, ISBN-13: 978-0-136-08620-8

Reference Books

1. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Publication, ISBN-978-81- 317-6092-5.
2. C J Date, "An introduction to Database Systems", Addition-Wesley.
3. Raghurama Krishnan, Johannes Gehrke, "Database Management Systems", TATA McGrawHill, 3rd Edition, 2003.
4. Reema Thareja, "Data warehousing", Oxford University Press. ISBN 0195699610.

20PEIT 802B Unified Communications

Teaching Scheme:	**Examination Scheme:**
Lectures : 3 hours/week	**In-Semester : **50 Marks
Tutorial : --	**End-Semester :** 50 Marks
	Credit : 3

Prerequisites: Network Fundamentals, Computer Networks

Course Objectives:

Familiarize students with

1. Compare Circuit switching and packet switching related to performance parameters.
2. Choose VOIP protocols for unified communications.
3. Analyze contact center as application of unified communications.
4. Interpret emerging technologies/protocols in VOIP communications.

Course Outcomes:

Students should be able to

1. Understand and apply VOIP unified communications and analytics concepts to Contact Center Working.
2. Design and Implement VOIP protocols for telecommunication systems/applications.
3. Interpret and apply current or emerging knowledge in telecommunication engineering.
4. Use relevant mathematics and computer science concepts as tools.

Unit – I Introduction to digital and lP Telephony 7 Hours

Digital Telephony: circuit switched networks, ss7, ISDN, Exchanges, E.164 Numbering Plans IP Telephony: Packet switched Networks, signaling & Media separation' Media Encapsulation ' RTP and RTCP, Audio and Video Codecs.

Unit – II VolP Protocols 7 Hours

H.323 Network Elements: Terminals, Gateway, Gatekeeper, Multi point Control Unit

H.323 protocol: RAS Channel, H.225 Call signaling, H.245 Media signaling

H.323 Call flows: Basic Audio and Video Call flows

SIP Network Elements: Registrar, Proxy, UAS, UAC, B2BUA

SIP Protocol: Requests and Responses, Methods, Headers and Parameters, Message structure, Transactions and Dialogs, Session Description Protocol SIP Call Flows: Basic Audio and Video Call Flows

H.248 protocol : Media Gateways, Media Gateway controllers, commands, Transactions, Contexts, Terminations, Descriptors' Packages

Unit – III Unified Communications 7 Hours

Local and Network features: Call Forward, Call coverage, Automatic Call Back, User Displays, Resource Optimization.

Voice & Data Integration: IM, presence, voice mail,

Collaboration: call Conferencing, Voice, Video, Data and content integration.

Mobility: Mobile Clients, Session Border Controllers.

Business Applications: Framework for custom applications, computer Telephony Interface, Application Sequencing.

Unit – IV Inbound Contact Center 7 Hours

Call Centers: Introduction, Evolution and classification of Contact Centers.

Inbound Contact Center :Introduction Self Service / Interactive Voice Response, Routing, Intelligent Routing, VXML

Agent : Skills, Selection Algorithms, Modes, Service Observing, Recording

Unit – V Outbound Contact Center and Reporting 7 Hours

Outbound contact center: Introduction, Proactive contact: voice, SMS, E-mail & chat. Contact Center Reporting: Types of Reports, Business use cases. Analytics: Agent Performance, Occupancy

Unit – VI Emerging technologies in Telecommunications 7 Hours

High Availability: Load balancing, Reliability, Failover & Failback, Location Redundancy, Hardware footprint, cloud Computing : Applications in Telecommunications Analytics in Voice & Data, Diagnostics & Management

Emerging Technologies: Google Glass, WebRTC, Hosting on Cloud.

Text Books

1. Allan Sulkin, "PBX Systems for IP Telephony", McGraw-Hill Professional

Reference Books

1. ITU-T H.323 Packet-based multimedia communications systems
2. ITU-TH.225Call Signaling Protocols and media stream packetization
3. ITU-T H-245 Control protocol for multimedia communication
4. IETF RFC 326131P: Session Initiation Protocol
5. IETF RFC4566 SDP: Session Description Protocol
6. Contact Center for' Dummies, Wiley Publishing Inc.
7. Real Time Communication with WebRTC, O'reilly Publishing

20PEIT 802C Information Retrieval

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hrs/week	**In-Semester:**50 Marks
Tutorial: --	**End-Semester:** 50 marks
	Credits:3

Prerequisites: Data structures

Course Objectives:

Familiarize students with

1. Concepts of Information Retrieval System.
2. Indexing techniques of Information Retrieval System
3. Clustering in Information Retrieval System
4. Information sharing on semantic web

Course Outcomes:

Students will be able to:

1. Apply various algorithms for Information Retrieval System
2. Analyze Search Strategies used in Information Retrieval System
3. Apply different web mining concepts
4. Explain modern trends in Information Retrieval System

Unit – I Introduction 7 Hours

Basic Concepts of Information Retrieval, IR system architecture. Automatic Text Analysis: Luhn’s ideas, Conflation Algorithm, Porter Stemmer, Retrieval Evaluation: Precision, Recall, F-Score, Mean Average Precision, Mean Reciprocal Rank, User oriented measures

Unit – II Finite Automata with application 7 Hours

Indexing and Index Term Weighing, Probabilistic Indexing, Inverted file, Suffix trees & suffix arrays, Signature Files, Clustered files, Cluster Hypothesis, Clustering Algorithms: Single Pass Algorithm, Single Link Algorithm, Complete Link Algorithm

Unit – III Search Strategies 7 Hours

Retrieval strategies: Vector Space model, Probabilistic retrieval strategies, Language models, Inference networks, Extended Boolean retrieval, Latent semantic indexing, Fuzzy set retrieval

Unit – IV Web Mining 7 Hours

Searching the Web: Challenges, Characterizing the Web, Search Engines, Browsing, Mata-searchers, Web crawlers, Meta-crawler, Web data mining, Finding needle in the Haystack,

Searching using Hyperlinks

Unit – V Semantic Search Systems 7 Hours

Semantic Search systems, Semantic Web, Ontology, Searching across ontologies, semantic web search, Google knowledge graphs

Unit – VI Trends In Information Retrieval 7 Hours

Case Study: Google Analytics, Search Engine Optimization, Ranking Algorithms, Recommendation Systems: Collaborative Filtering

Text Books

1. Yates & Neto, "Modern Information Retrieval", Pearson Education, ISBN:81-297-0274-6
2. C.J. Rijsbergen, "Information Retrieval", (www.dcs.gla.ac.uk).,2ndISBN:978- 408709293

Reference Books

1. Grigoris Antoniou and Frank van Harmelen, "A semantic Web Primer", Massachusetts.
2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutzen, "Introduction to Information Retrieval", Cambridge University Press, Online book, ISBN:978-0-521-86571-5.

20OE 801K Software Testing and Quality Assurance

Teaching Scheme:	**Examination Scheme:**
Lectures : 3 hours/week	**In-Semester : ** 50 Marks
Tutorial : --	**End-Semester :** 50 Marks
	Credit : 3

Prerequisites:

Course Objectives:

Familiarize students with

1. Testing strategies in projects.
2. Levels of testing strategies
3. Various quality assurance models
4. Automated Testing Tools

Course Outcomes:

Students should be able to

1. Explain different terminologies in software testing.
2. Apply appropriate testing technique based on the project scenario
3. Choose quality assurance models for the project
4. Make use of modern testing tools suitable for the project

Unit – I Fundamentals 7 Hours

Testing as a Process, Software testing principles, The tester's role in a software development organization, Origins of defects, Defect classes, Testing fundamentals, the defect repository and test design, Defect examples, Developer /Tester support for developing a defect repository. Process model to represent Different phases, Lifecycle models

Unit – II Levels of testing 7 Hours

Need for levels of testing, Unit testing, Integration testing, System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing, Stress testing, Regression testing, Alpha, Beta and Acceptance testing.

Unit – III Testing techniques 7 Hours

Using White Box Approach to Test design - Static Testing, Structural Testing, Unit Functional Testing, Challenges in White box testing, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing.

Unit – IV Fundamentals of software quality assurance 7 Hours

SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.

Unit – V Quality assurance models 7 Hours

Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM, Clean-room software engineering, Defect Injection and prevention, Inspections & Walkthroughs, Case Tools and their effect on Software Quality.

Unit – VI Software test automation 7 Hours

Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug. Combining Manual and Automated Testing

Text Books

1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices", Pearson
2. Ilene Burnstein, "Practical Software Testing", Springer International edition

Reference Books

1. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Auerbach Publications
2. William Perry, "Effective Methods of Software Testing", Wiley Publishing, Third Edition
3. Stephen Kan, "Metrics and Models in Software Quality", Addison – Wesley, Second Edition
4. Watts S Humphrey, "Managing the Software Process", Pearson Education Inc.

20OE 802A Applied Statistics with R programming

Teaching Scheme:	**Examination Scheme:**
Lectures : 3 hours/week	**In-Semester : ** 50 Marks
Tutorial : --	**End-Semester :** 50 Marks
	Credit : 3

Prerequisites: Mathematics

Course Objectives:

Familiarize students with

1. Fundamentals in Statistics
2. Evaluation and Interpretation of applied statistics
3. Hypothesis Test
4. R programming used in statistical analysis

Course Outcomes:

Students should be able to

1. Apply probability for statistical analysis.
2. Draw inferences from statistical analysis of data
3. Apply statistical methods and hypothesis tests on data
4. Explain Multivariate Analysis

Unit – I Probability 7 Hours

Introduction, conditional probability, Bayes Theorem and independence, random variable and Probability distribution, normal distribution.

Unit – II Basic statistical measures 9 Hours

Introduction to statistics, type of data, processing the data, classification, graphical representation.
Introduction Measures of central Tendency: Arithmetic Mean, Weighted Arithmetic Mean, Median, mode, Measurement of variation: Quartile, Average and Standard Deviations, Coefficient Variation, Measurement of skewness

Case Study with R programming

Unit – III Analysis of Variance 8 Hours

Normal distribution, evaluating normal distribution, Binomial distribution, confidence Intervals, central limit Theorem, ANOVA, Completely randomized design, Latin square Design, Duncan's Multiple Range Test

Case Study with R programming

Unit – IV Types of hypothesis 9 Hours

Introduction , types of hypothesis, Tests of hypothesis concerning means, hypothesis concerning proportions, Hypothesis concerning variations (Chi-square and F-tests), Chi square test for checking independence of categorized data, goodness of Fit Test

Case Study with R programming

Unit – V Multivariate Analysis 9 Hours

Correlation: Introduction , types of correlations, Correlation Analysis, correlation coefficients,
Regression: Introduction, Linear Regression, Regression analysis, regression coefficients.
MANOVA, Discrimination Analysis, Factor Analysis, Principle Component Analysis and Independent Component Analysis

Case Study with R programming

Text Books

1. S.P. Gupta, “Statistical Methods”, Sultan Chand and sons Publication, 41st Edition.
2. B.L. Agarwal, “Basic Statistics”, New Age Publication, 9th Edition
3. A. Papoulis, S.U. Pillai, “Probability Random Variables and Stochastic Processes”, Tata McGraw Hill, (4th Edition)

Reference Books

1. S. M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists”, Elsevier Publication, 5th Edition
2. Piegorsch W.W, “Statistical Data Analytics”, Wiley Publication.
3. E. Rukmangadchari, E.K.Reddy, “Probability and Statistics”, Pearson India Pvt.Ltd.,1st Edition
4. Rohatgi A.K. Md e. Saleh, “Introduction to Probability and Statistics”, Wiley Publication Pvt. Ltd. 3rd Edition.

Web References

1. NPTEL NOC: Descriptive Statistics with R software, Prof. Shalabh, IIT Kanpur,
2. NPTEL NOC: Applied Statistics and Econometrics, Prof. Mukherjee, IIT Kanpur

20IT 801L Distributed Systems Laboratory

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hrs/week	**In-Semester:** 25 marks
	Oral: 25 marks
	Credits: 1

Prerequisites: Computer Networks, Operating Systems, Database management Systems

Course Objectives:
Familiarize students with

1. Design and Implementation methodology for distributed systems applications
2. Applications of middleware technologies in distributed systems.
3. Methods of communication in distributed environment
4. Algorithms for synchronization and mutual exclusion

Course Outcomes:
Students should be able to

1. Implement middleware technologies that support distributed applications
2. Execute various communication protocols in distributed environment
3. Implement algorithms for distributed mutual exclusion and synchronization
4. Develop interoperable communication system using distributed object paradigm

Suggested List of assignments:

1. Apply concepts of Remote Procedure Call (RPC) to implement a middleware technology for any distributed application
2. Establish a client server communication using:
   a. Socket Programming
   b. Remote Method Invocation (RMI)
3. Implement Message Passing Interface (MPI) for any distributed application
4. Develop an interoperable communication system using distributed object concepts
5. Implement any one token based and one non-token-based leader election algorithm and evaluate the same
6. Develop any distributed application using Message queuing system in Publish-Subscribe paradigm.

Text Books

1. Andrew S. Tanenbaum and Maarten Van Steen, “Distributed Systems: Principles and Paradigms”, 2nd edition, Pearson Education.
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems: Concepts and Design”, 4th Edition, Pearson Education, 2005.

Reference Books:

1. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
2. M. L. Liu, "Distributed Computing Principles and Applications", Pearson Addison Wesley, 2004.
3. Sunita Mahajan, Seema Shah, "Distributed Computing", Oxford University Press, 2nd Edition, ISBN-13: 978-0198093480.
4. Abhijit Belapurkar, Anirban Chakrabarti, Harigopal Ponnapalli, Niranjan Varadarajan, Srinivas Padmanabhuni, Srikanth Sunderrajan, "Distributed System Security: Issues, Processes and solutions", Willey online Library, ISBN: 978-0-470-51988-2.
5. "Linux System Programming", 2nd Edition, Robert Love, O'reilly

20PEIT 801L A Advanced Machine Learning Laboratory

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hours/week	**In-Semester:** 25 Marks
	Oral: 25 marks
	Credits: 1

Prerequisites: Machine Learning

Course Objectives:

Familiarize students with

1. Dimensionality Reduction techniques
2. Programming of Machine and Deep Learning algorithms
3. Libraries for Ensemble Learning, Deep Learning etc.
4. Usage of large datasets

Course Outcomes:

Students will be able to:

1. Write programs for reducing dimensionality of datasets
2. Apply Machine Learning algorithms to large datasets
3. Implement Deep Learning algorithms for classifying images
4. Compare various Machine Learning algorithms

Implement the following assignments using Python.

1. Select a suitable dataset having a large number of dimensions from UCI/Kaggle/Weka. Statistically analyze this dataset.
   a. Classify this dataset using any classification algorithm. Note down accuracy, precision, recall, etc.
   b. Using this dataset apply Principal Component Analysis. Classify this data using the same classification algorithm and note down accuracy, precision, recall etc.
   c. Compare both the performances.
2. Select a suitable dataset from UCI/Kaggle/Weka.
   a. Classify the dataset using any classification algorithm. Note down accuracy, precision, recall etc.
   b. Classify the same dataset Ensemble Learning algorithm (any one).
      i. Boosting
      ii. Random Forest
   c. Compare both the performances.

3. Use any image dataset from MNIST (handwritten digits or clothing) and classify using Neural Network. Compare both the performances.
   a. Artificial Neural Network
   b. Convolutional Neural Network

Text Books

1. Andrea Muller and Sarah Guido, "Introduction to Machine Learning with Python", O"Reily – 2017.
2. Michael Bowles, "Machine Learning in Python", Wiley – 2018.

Reference Books

1. Ian H. Witten, Eibe Frank, Mark A Hall, "Data Mining: Practical Machine Learning Tools and Techniques", Elsevier 3rd Edition.

Other Resources

1. UCI Machine Learning Repository https://archive.ics.uci.edu
2. WEKA Collection of datasets https://waikato.github.io/weka-wiki/datasets/
3. Kaggle datasets https://www.kaggle.com/datasets

20PEIT 801L B Introduction to DevOps Laboratory

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hours/week	**In-Semester:** 25 Marks
	Oral: 25 marks
	Credits: 1

Prerequisites: Operating Systems and Cloud Computing

Course Objectives:

Familiarize students with

1. Insights of the DevOps environment
2. An overview of different DevOps tools
3. Continuous integration and testing
4. DevOps containerization

Course Outcomes:

Students will be able to:

1. Apply version control software for development
2. Apply continuous integration tool for the application developed
3. Apply containerization tool for the application deployment
4. Apply continuous monitoring tool for the application monitoring

List of Assignment

Build an application using DevOps. Use the following guidelines.

1. Use Version Control System for a document/program (check in/check out/update/pull/push modifications, create tags/branches)
2. Build a prototype of an application using tools (such as Maven). Prepare unit test case and execute
3. Test the prototype/application using Integration tests
4. Using Continuous Integration (CI)/Continuous Deployment (CD) automation tool (Jenkins), build pipeline. Integrate build stage. Integrate/API test stage with pipeline.
5. Set up DevOps environment for CI, CD (creation of non-root account, S3 bucket, IAM Role, attach policies, secret keys)
6. Integrate Jenkins with DevOps environment (secret keys exchange)
7. Define Jenkins pipeline incorporating, build, test and deploy (publish) stages – I
8. Define Jenkins pipeline incorporating, build, test and deploy (publish) stages - II
9. Deploy the application, run and troubleshoot

Text Books

1. Ethan Thorpe, “Devops: A comprehensive beginners guide to learn DevOps step by step”
2. Deepak Gaikwad, Viral Thakkar, “Devops Tools from Practioners” viewpoint, Wiley

Reference Books

1. David Johnson, “Devops for Beginners Handson guide”, Createspace Independent.

20PEIT 801L C Design Patterns Laboratory

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hrs/week	**In-Semester**: 25 marks
	Oral: 25 marks
	Credits: 1

Prerequisites: Object Oriented Analysis and Design Laboratory
Object Oriented Software Engineering

Course Objectives:

Familiarize students with

1. Achieving extendibility using Design Patterns
2. Incorporating creational design patterns in software design
3. Incorporating structural design patterns in software design
4. Incorporating behavioral design patterns in software design

Course Outcomes:

Students should be able to

1. Model scenarios to a creational design pattern code
2. Apply behavioral design pattern to overcome the class collaboration mismatch
3. Apply structural design pattern to reduce the structural incompatibility
4. Analyze the design document to meet extendibility and modifiability

List of assignments to be implemented in Java

1. Implement strategy design pattern
2. Implement decorator design pattern
3. Implement composite design pattern
4. Implement observer design pattern
5. Implement factory method design pattern
6. Implement proxy design pattern
7. Implement all applicable design patterns to the given design document

Text Book

1. Alan Shalloway and James Trott, “Design Patterns Explained: A new Perspective on object oriented design”, Addison Wesley

Reference Book

1. Eric Gamma “Design Patterns: Elements of reusable object oriented software”, Addison Wesley.