Hindi Vidya Prachar Samiti's

Ramniranjan Jhunjhunwala College of Arts, Science & Commerce (Autonomous), Ghatkopar (W)

Affiliated to

University of Mumbai

Syllabus for MSc IT Part I (Semester I & II)

Program: M.Sc. Information Technology
Program Code: RJSPIT

Choice Based Credit System Syllabus

(With effect from the academic year 2019-20)

Course Structure

Semester-I

Course Code	Course Nomenclature	Total Lectures	Credits	% of Assessment		
				Internal	EA	Total
RJSPIT101	Foundation of Data Science	40	04	40	60	100
RJSPIT102	Distributed Systems	40	04	40	60	100
RJSPIT103	Image and Vision Processing	40	04	40	60	100
RJSPIT104	Cloud Computing	40	04	40	60	100
RJSPIT1P1	Foundation of Data Science	20	02	-	50	50
RJSPIT1P2	Distributed Systems	20	02	-	50	50
RJSPIT1P3	Image and Vision Processing	20	02	-	50	50
RJSPIT1P4	Cloud Computing	20	02	-	50	50
	Total		24	-	-	**600**

Semester-II

Course Code	Course Nomenclature	Total Lectures	Credits	% of Assessment		
				Internal	EA	Total
RJSPIT201	Advanced Artificial Intelligence	40	04	40	60	100
RJSPIT202	Wireless Sensor Networks - CISCO	40	04	40	60	100
RJSPIT203	Big Data Analytics	40	04	40	60	100
RJSPIT204	Virtualization	40	04	40	60	100
RJSPIT2P1	Advanced Artificial Intelligence	20	02	-	50	50
RJSPIT2P2	Wireless Sensor Networks - CISCO	20	02	-	50	50
RJSPIT2P3	Big Data Analytics	20	02	-	50	50
RJSPIT2P4	Virtualization	20	02	-	50	50
	Total		24	-	-	**600**

Total credits for M.Sc. Part I = Semester I: 24 + Semester II: 24 = 48

Semester I

Course Code: RJSPIT101		
Course Name: Foundation of Data Science		
Lectures /Hrs.: 40	**Total Marks: 100**	**Credits: 04**

Course Objectives:
1. To enhance the student's skills with the concepts of data science.
2. To introduce mathematical statistical computing with practical approach.
3. To introduce the machine learning algorithms.

Unit	Description	No. of Lectures
Unit I	**Introduction to Data Science** Era of data science, business intelligence, Business Intelligence vs. Data Science, Life cycle of Data Science, Tools of Data Science, Big data and Hadoop, business analytics, machine learning and artificial intelligence, Introduction to Statistics. **Mathematics for Data Science** Eigen values and Eigen vectors, Basics of Linear algebra, Transformation of matrix, Linear algebra, Derivatives and Gradients, Multivariable Calculus. **Exploratory Data Analysis** Elements of structured data, rectangular data: Data frames and indexes, non-rectangular data structures, estimates of location: Mean, Median and Robust, Estimates of variability: Standard deviation and related estimates, Exploring the data distribution: Percentiles and Boxplots, Frequency table and Histograms, density estimates. **Exploring Binary and categorical data** Mode, expected value, Correlation: Scatterplots, Exploring two or more variables: Hexagonal binning and Counters, Two categorical variables, Categorical and numeric data, Visualizing multiple variables.	8

Unit II	**Data and Sampling Distributions** Random sampling and sample bias: Bias, Random selection, Selection Bias: Regression to mean, Sampling distributions of a statistic: Central limit theorem, Standard error, Bootstrap, Resampling, Confidence Intervals. **Distributions** Normal distribution: Standard normal and QQ plots, Long-tailed distributions, Student's t-distribution, Binomial distribution, Poisson distribution, Exponential distribution and Weibull distributions. **Significance Testing** A/B Testing, Hypothesis test: Null hypothesis, Alternative hypothesis, One-way and Two-way hypothesis test, Resampling.	8
Unit III	**Basic Probability and Terms** Events and their Probabilities, Rules of Probability, Conditional probability and independence, Permutations and combinations, Bayer's Theorem, Descriptive Statistics, Compound probability, Conditional probability. **Data Transformations and quality analysis** Merge, Rollup, Transpose and Append, Missing Analysis and Treatment, Outlier analysis and treatment.	8
Unit IV	**Hypothesis testing** Null hypothesis, Alternative hypothesis, One-way and Two-way hypothesis test, Permutation test, Exhaustive and bootstrap permutation test, P-values, t-Test, Multiple testing, Degree of Freedom, ANOVA: F-statistics and two-way ANOVA, Chi-square test, Fisher's exact test, Power and sample size. **Regression and Prediction** Linear regression, Multiple linear regression, Cross-validation, Model selection and stepwise selection, Weighted regression, Factor variables in regression, Interpreting the regression equation, Regression diagnostic, Polynomial and spline regression.	8

Unit V	**Classification** Naïve Bayes classification, Discriminant analysis, Logistic regression, Confusion matrix, strategies for imbalanced data. **Statistical Machine Learning** K-Nearest neighbors, Tree models, Bagging and the Random forest, Boosting. **Unsupervised Learning** Principal Components Analysis, K-means clustering, Hierarchical clustering, Model-based clustering, Scaling and Categorical variables, **Time Series** Time Series data, Time Series variables, Different components of Time Series data, Visualize the data to identify Time Series Components, Implement ARIMA model for forecasting, Exponential smoothing models, identifying different time series scenario based on which different Exponential Smoothing model can be applied, Implement respective ETS model for forecasting.	8

References:
1. Peter Bruce, Andrew Bruce, "Practical Statistics for Data Science", O'Reilly, 2017.
2. James D. Miller, "Statistics for Data Science", Packt, 2017.
3. Dr. J. Ravichandran, "Probability and Statistics for Engineers", 2010.
4. Hadley Wickham, Garrett Grolemund, "R for data Science: Import, Tidy, Transform, Visualize and Model Data".
5. Tony Fischetti, "Data Analysis with R", 2015.
6. Gergely Daroczi, "Mastering Data Analysis with R", 2015.
7. Paul Teetor, "R Cookbook", O'Reilly, 2017.
8. Prabhanjan Tatter, Tony Ojeda, Sean Patrik Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", 2nd Edition, Packt, 2014

Learning Outcomes
1. The students will get in-depth knowledge of data science related Mathematical and statistical computing concepts.
2. The students will be able to implement the basic machine learning algorithms.

Unit	Course Outcome	Description
I	CO1	To Understand and Describe the various concepts of Data Science and Artificial Intelligence Technology.
	CO2	To Understand and Apply the concepts of Python libraries like

		NumPy, Pandas, Matplotlib and Seaborn to various types of data.
	CO3	To Understand and Apply the Data Pre-processing, Data Exploration and Data Analysis techniques.
	CO4	To Describe, Summarize and Analyze the various statistical measures for the given rectangular and non-rectangular data/dataset.
II	CO5	To Describe, Summarize and Analyze the binary and Categorical Data/ Dataset.
	CO6	To Understand and Apply Data Transformation techniques.
	CO7	To Understand and Apply the various statistical concepts to the Sampling Distributions and Evaluate the shape of distribution.
III	CO8	To Understand and Apply the various statistical concepts to the Probability Distributions.
	CO9	To Understand, Generate and Visualise the Probability and Probability Distributions.
	CO10	To Understand and Apply the concepts of probability to data sets and Predict the outcome.
	CO11	To Identify, Evaluate and Conclude the Hypothesis.
V	CO12	To Understand and Apply the various Machine Learning algorithms to datasets and Predict the output.
	CO13	To Understand, Apply and Analyze the various machine learning algorithms of classification and Clustering and Evaluate the Results.

Course Code: RJSPIT1P1   **Course Name: Foundation of Data Science**

Lectures/ Hrs.:20	**Total Marks :100**	**Credits: 02**

Course Objectives:
1. To introduce data analysis and visualization using mathematical and statistical computing concepts using R studio.

Practical List:
1. Exploratory data analysis.
2. Exploring Binary and categorical data

3. Data and sampling distributions.
4. Significance testing.
5. Data transformations and quality analysis.
6. Hypothesis testing.
7. Regression and prediction.
8. Classification.
9. Supervised and unsupervised learning.
10. Time series Analysis.

Learning Outcome:
1. The students will be able to analyze data using mathematical and statistical models using R studio / Python.

Unit	Course Outcome	Description
	CO1	Collect and organize the data and Create the Dataset.
	CO2	Perform Descriptive Statistics and Exploratory Data Analysis for the given Dataset.
	CO3	Generate random number and data distribution of discrete and continuous type as well and Apply Sampling Methods.
	CO4	Evaluate Distribution and Find the Point Estimates.
	CO5	Perform Hypothesis Testing using various tests.
	CO6	Build the model and Predict the Outcome.

Course Code: RJSPIT102
Course Name: Distributed Systems

Lectures /Hrs.: 40	Total Marks: 100	Credits: 04

Course Objectives:
1. To introduce efficient distributed algorithms, used to solve large problems where data and control is distributed over different nodes.
2. To understand process and communication between client and server
3. To understand synchronization of clock and nodes in distributed systems and explore consistency model
4. To manage replication and security of systems. To make system fault tolerant

Unit	Description	No. of Lectures
	5. To study Distributed Object Based Systems, Distributed File Systems, Distributed Web-Based Systems	
Unit I	**Characterization of Distributed Systems** Introduction, Examples of Distributed Systems, Trends in Distributed Systems, Challenges, Types Of Distributed Systems. Architectural Styles: System Architecture, Architectures Vs Middleware.	8
Unit II	**Processes** Threads, Virtualization, Clients, Servers, Code Migration. Communication: Fundamentals, Remote Procedure Call, Message Oriented Communication, Stream Oriented Communication, Multicast Communication.	8
Unit III	**Synchronization** Clock Synchronization, Physical Clocks, Logical Clocks, Mutual Exclusion Algorithms, Global Positioning of Nodes, Election Algorithms. **Consistency** Introduction, Data Centric Consistency Models, Client Centric Consistency Models.	8
Unit IV	**Replication** Replica Management, Consistency Protocols. **Fault Tolerance** Introduction, Reliable Client Server Communication, Reliable Group Communication, Distributed Commit, Recovery. **Security** Introduction to Security, Secure Channels, Access Control, Security Management.	8
Unit V	**Distributed Object Based Systems, Distributed File Systems, Distributed Web-Based Systems** Comparison of Object Based, File Systems and Web Based **Distributed Systems** Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance and Security.	8

References:
1. Distributed Systems: Principles and Paradigms 2nd Edition by Andrew S. Tanenbaum, Maarten van Steen.
2. Distributed Systems - Concepts and Design by George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair.

Learning Outcome:

Students will be able to:
1. Use the knowledge of the basic elements and the concepts related to distributed system technologies skillfully.
2. Demonstrate the knowledge of core architectural aspects of distributed systems.
3. Design and implement distributed applications.
4. Demonstrate details of the main underlying components of distributed systems (such as RPC, file systems).
5. Use and apply important methods in distributed systems to support scalability and fault tolerance.
6. Demonstrate experience in building large-scale distributed applications.

Unit	Course Outcome	Description
I	CO1	Describe and Demonstrate the knowledge of the basic elements and the concepts related to distributed system technologies.
	CO2	Understand and Demonstrate the knowledge of core architectural aspects of distributed systems.
II	CO3	Understand and Demonstrate details of the main underlying components of distributed systems (such as RPC, file systems).
	CO4	Describe, Understand and Apply the basic of processes and communication
III	CO5	Understand, Apply and Compare Clock synchronization and election algorithms
	CO6	Understand and Apply consistency model in distributed systems.
IV	CO7	Understand and Use important methods in distributed systems to support scalability and fault tolerance.
	CO8	Analyze security mechanism in distributed system
V	CO9	Describe, Understand, Use and Compare Distributed Object Based

		Systems, Distributed File Systems, Distributed Web-Based Systems

Course Code: RJSPIT1P2
Course Name: Distributed Systems

Lectures/ Hrs.:20	Total Marks: 50	Credits: 02

Course Objectives:

The students will learn to:
1. To implement the concept for sharing the resources using a distributed system.
2. To implement communication via TCP, RPC, RMI, two phase commit protocol between client and server.

Practical List
1. Implement the concept for sharing the resources using distributed system.
2. Write a program for implementing Client Server communication model.
3. Write a program to show the object communication using RMI.
4. Show the implementation of Remote Procedure Call.
5. Show the implementation of web services.
6. Write a program to execute any one mutual exclusion algorithm.
7. Write a program to implement any one election algorithm.
8. Show the implementation of any one clock synchronization algorithm.
9. Write a program to implement two phase commit protocol.
10. Implement the concept of distributed file system architecture.

Learning Outcome:

The students will be able to:
1. Implement the concept for sharing the resources using distributed system.
2. Implement Client Server communication model and show the object communication using RMI.
3. Implement Remote Procedure Call, web services, mutual exclusion algorithm, election algorithm and clock synchronization algorithm.
4. Implement two phase commit protocol.
5. Implement the concept of distributed file system architecture.

Unit	Course Outcome	Description
	CO1	Understand the concept for sharing the resources using a distributed system.

	CO2	Understand Client Server communication model and show the object communication using RMI.
	CO3	Understand and Implement Remote Procedure Call, web services, mutual exclusion algorithm, election algorithm and clock synchronization algorithm.
	CO4	Understand and Implement two phase commit protocol.
	CO5	Implement the concept of distributed file system architecture.

Course Code: RJSPIT103 Course Name: Image and Vision Processing		
Lectures /Hrs.: 40	**Total Marks: 100**	**Credits: 04**

Course Objectives:
1. To understand the fundamental concepts of digital image processing, Image enhancement and image segmentation techniques.
2. To learn Color image processing techniques.
3. To learn Image compression algorithms.
4. To understand and apply Morphological operations.
5. To understand and learn vision processing.

Unit	Description	No. of Lectures
Unit I	**Introduction to Image Processing** Example of fields that uses image processing, Steps of image processing, Components, Applications, Image sensors and Image formats. Visual Preliminaries Brightness adaptation and contrast, Acuity and contour, Texture and pattern discrimination, Shape detection and recognition, perception of color, Computational model of perceptual processing, Image sampling and quantization, Basic relationship between pixels.	8
Unit II	**Intensity transformations** Introduction, Basic intensity transformation functions, Histogram equalization, Local histogram processing, Using histogram statistics for image enhancement.	8

	Spatial filtering	
	Fundamentals of spatial filtering, Smoothing and sharpening spatial filters, combining spatial enhancement methods, Using fuzzy techniques for intensity transformations and spatial filtering.	
Unit III	**Color Image Processing** Color fundamentals, Color models, Pseudo color image processing, Basic of full-color image processing, color transformations, Smoothing and sharpening, Image segmentation bases on color, Noise in color images, Color image compression. **Image compression** Fundamentals, Basic methods, Digital image watermarking, Full motion video compression.	8
Unit IV	**Morphological Image Processing** Introduction, Erosion and Dilation, Opening and closing, Histor-Miss transformation, Basic morphological algorithms, Gray scale morphology. **Segmentation** Fundamentals, Point, Line and Edge detection, Thresholding, Region based segmentation, Segmentation using morphological watersheds, Use of motion in segmentation – Spatial techniques.	8
Unit V	**Content-Based Image Retrieval** Image database examples, Image database queries, Query-by-example, Image distance measures, Database organization. **Motion from 2D Image Sequences** Motion phenomena and applications, Image subtraction, Computing motion vectors, Computing the paths of moving points, Detecting significance changes in video. **Image Segmentation** Identifying regions, representing regions, Identifying contours, Fitting model to segments, Identifying higher level structure, Segmentation using motion coherence.	8

References:
1. Digital Image Processing , Gonzalez and Woods, 3rd Edition, Pearson Education
2. Digital Image Processing and Analysis, Bhabatosh Chanda, Dwijesh Dutta Majumder, 2nd Edition, PHI
3. Fundamentals of Digital Image Processing, Anil K Jain, 1st Edition, PHI

Learning Outcome:
Student will be able to:

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques.

Unit	Course Outcome	Description
I	CO1	Understand the fundamental concepts of a digital image processing system and various application areas of image processing.
	CO2	Understand the various Steps in image processing starting from acquisition of the image.
	CO3	Understand the basic relationship (Neighbourhood and Connectivity) between pixels and calculate the Euclidean and city-block distance between pixels.
II	CO4	Understand, Apply, Analyze the basic intensity techniques for image enhancement,
	CO5	Understand and Solve histogram equalization concept for image enhancement.
	CO6	Understand, Apply and Analyze Smoothing and sharpening spatial filters
III	CO7	Understand and describe color fundamentals and compare different color models.
	CO8	Understand Pseudo colour image processing and full-color image processing
	CO9	Understand and calculate data redundancy and compression ratio using variable length coding.
	CO10	Understand and describe general image compression system.
	CO11	Understand, Analyze and evaluate Compression Methods, like- Huffman Coding, LZW Compression.
IV	CO12	Understand and apply Morphological Image Processing.
	CO13	Understand Point, Line and Edge detection, and Apply gradient operators for edge detection.
V	CO14	Understand and compare text-based image retrieval and CBIR and Analyze Image distance measures in CBIR.
	CO15	Understand Motion phenomena, image field and Describe change detection using image subtraction method.
	CO16	Computing motion vectors and the paths of moving points.

Course Code: RJSPIT1P3		
Course Code: RJSPIT1P3 **Course Name: Image and Vision Processing**		
Lectures /Hrs.:20	**Total Marks: 50**	**Credits: 02**

Course Objectives:
1. To uunderstand and implement various image enhancement and image segmentation techniques using GNU Octave, an open-source tool.

Practical List
1. Image Visualization.
2. Analyze images in the frequency domain using various transforms.
3. Image Filtering.
4. Color Image Processing.
5. Image compression techniques.
6. Interpret image segmentation Techniques.
7. Image representation techniques.
8. Image enhancement techniques.
9. Image restoration techniques.
10. 2D Image sequencing.

Learning Outcome:
1. The students will be able to apply various image processing techniques.

Unit	Course Outcome	Description
	CO1	Understand and implement the basic intensity transformations on gray scale images.
	CO2	Implement the piecewise transformation of grayscale images.
	CO3	Understand, Implement and Analyze the histogram equalization.
	CO4	Implement and Analyze the result of low pass and high pass filtering.
	CO5	Implement and Analyze the Image Compression Techniques.
	CO6	Implement and Analyze the result of basic morphological techniques on an image.

Course Code: RJSPIT104		
Course Name: Cloud Computing		
Lectures /Hrs. : 40	**Total Marks :100**	**Credits : 04**

Course Objectives:
1. To understand and identify various cloud services.
2. To explain the cloud characteristics and service attributes.
3. To generalize the cloud category and evaluate various cloud delivery models.
4. To learn various cloud environment and Explain various Cloud Applications in Use.

Unit	Description	No. of Lectures
Unit I	**Introduction** Cloud computing at a glance, Vision of cloud computing, Defining a cloud, A closer look, The cloud computing reference model, Characteristics and benefits, Challenges ahead, Historical developments, Distributed systems, Virtualization, Web2.0, Service-oriented computing, Utility-oriented computing, Building cloud computing environments, Application development, Infrastructure and system development, Computing platforms and technologies. **Principles of Parallel and Distributed Computing** Eras of computing , Parallel vs. distributed computing, Elements of parallel computing, What is parallel processing, Hardware architectures for parallel processing, Approaches to parallel programming, Levels of parallelism, Laws of caution, Elements of distributed computing, General concepts and definitions, Components of a distributed system, Architectural styles for distributed computing, Models for interprocess communication, Technologies for distributed computing, Remote procedure call, Distributed object frameworks, Service-oriented computing.	8
Unit II	**Virtualization** Introduction, Characteristics of virtualized environments, Increased security, Managed execution, Portability, Virtualization and cloud computing, Technology examples: Xen: paravirtualization VMware: full virtualization, Microsoft Hyper-V. **Cloud Computing Architecture** The cloud reference model, Architecture, Infrastructure-and hardware-as-a-service, Platform as a service, Software as a service,	8

	Types of clouds, Public clouds, Private clouds, Hybrid clouds, Community clouds, Economics of the cloud: Open challenges, Cloud definition, Cloud interoperability and standards, Scalability and fault tolerance.	
Unit III	**Public Cloud Platforms** GAE, AWS, and Azure: Public Clouds and Service Offerings, Google App Engine (GAE), Amazon Web Service (AWS), Microsoft Windows Azure. **Inter-cloud Resource Management** Extended Cloud Computing Services, Resource Provisioning and Platform Deployment, Virtual Machine Creation and Management. **Cloud Security and Trust management** Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques. **Cloud Programming and Software Environments** Features of Cloud and Grid Platforms: Cloud Capabilities and Platform Features, Traditional Features Common To Grids and Clouds, Data Features and Databases, Programming and Runtime Support. Parallel and Distributed **Programming Paradigms** Parallel Computing and Programming Paradigms, MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache.	8
Unit IV	**Programming Support of Google App Engine** Programming the Google App Engine, Google File System (GFS), Bigtable, Google's NOSQL system, Chubby, Google's Distributed Lock service. **Programming on Amazon AWS and Microsoft Azure** Programming on Amazon EC2, Amazon Simple Storage Service S3, Amazon Elastic Block Store EBS and SimpleDB, Microsoft Azure **programming support. Emerging Cloud Software Environments** Open Source Eucalyptus and Nimbus, OpenNebula, Sector/Sphere, and OpenStack, Manjrasoft Aneka Cloud and Appliances.	8
Unit V	**Energy efficiency in clouds** Energy-efficient and green cloud computing architecture, Market-based management of clouds: Market-oriented cloud computing, A reference model for MOCC, Technologies and initiatives supporting MOCC. **Cloud Applications** Scientific applications, Healthcare: ECG analysis in the cloud, Biology: protein structure prediction, Biology: gene expression	8

data analysis for cancer diagnosis, Geoscience: satellite image processing, Business and consumer applications, CRM and ERP, Productivity, Social networking, Media applications, Multi player online gaming.	

References:
1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing Foundations and Applications Programming, Morgan Kaufmann Publishers,2013.
2. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 208 .
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
4. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
5. V.K Pachghare, "Cloud Computing, PHI Learning,2016.

Learning Outcome:
Students will be able to:
1. Understand distributed models and enabling technologies.
2. Design of computer clusters for scalable parallel computing skillfully.
3. Introduction to distributed system environment and programming models along with Performance, Security, and Energy-Efficiency factors.
4. Virtualization of clusters and Data centers along with various cloud computing and Service models-PaaS, SaaS, IaaS.
5. Elaboration of cloud programming, its Software environments features of Cloud and Grid Platforms.
6. Learning of programming on Google app engine Amazon AWS and Microsoft Azure.
7. Performance of Distributed Systems Quality of Service in Cloud computing and its Applications of Social Networks- Facebook.

Unit	Course Outcome	Description
I	CO1	Understand and Describe the core concepts of the cloud computing paradigm, its characteristics, advantages and its challenges.
	CO2	Understand and Describe the principles of parallel and distributed computing.
II	CO3	Analyze different virtualization techniques and their role in enabling the cloud computing system model.

	CO4	Describe and Analyze the Technology and mechanisms in generalising various cloud delivery models.
	CO5	Describe different cloud deployment models available and Understand to differentiate between various cloud computing models.
III	CO6	Describe and Understand the various public cloud platforms
	CO7	Identify and Apply the various cloud security mechanisms.
	CO8	Understand Various Programming paradigm and cloud platforms.
IV	CO9	Understand and Evaluate the various cloud platforms like AWS, Google App Engine and Microsoft Azure.
	CO10	Understand and Use emerging cloud software Environment.
V	CO11	Explain and Apply the energy efficiency in cloud architecture.
	CO12	Describe and Understand the Market oriented cloud computing.
	CO13	Describe and Summarize different cloud applications.

Course Code: RJSPIT1P4 Course Name: Cloud Computing		
Lectures/ Hrs. :20	Total Marks: 50	Credits : 02

Course Objectives:
1. To Understand and configure various Cloud deployment models using open-source virtualization tools.

Practical List
1. Implement Windows / Linux Cluster
2. Developing application for Windows Azure.
3. Implementing private cloud with Xen Server.
4. Implement Eucalyptus.
5. Develop application using GAE
6. Implement VMware ESXi Server.
7. Native Virtualization using Hyper V.
8. Using Open Nebula to manage heterogeneous distributed data center infrastructures.

Learning Outcome:

1. They will learn to implement private cloud, search engine, server cluster, Mapreduce and Hadoop, social networking site, blog site, grid computing, and various types of clouds.

Unit	Course Outcome	Description
	CO1	Understand and Configure Windows Cluster.
	CO2	Understand and Design application for Windows Azure cloud.
	CO3	Understand, Install and Configure private cloud with Xen Server.
	CO4	Understand, Install and Configure Iaas in Eucalyptus platform.
	CO5	Understand and Design application application using Google App Engine.
	CO6	Understand, Install and Configure private cloud VMware ESXi Server.
	CO7	Understand, Install and Configure Native Virtualization using Hyper V.
	CO8	Understand, Install and Configure Iaas Using Opennebula platform.

Semester II

Course Code: RJSPIT201		
Course Name: Advanced Artificial Intelligence		
Lectures /Hrs. : 40	**Total Marks :100**	**Credits : 04**

Course Objectives:
1. To introduce the concepts of artificial intelligence.
2. Exposure to related components of artificial intelligence, Knowledge representations, non-monotonic reasoning, statistical technique, semantic network, frame and scripts.
3. Insight into some advanced topics like game playing, Natural Language Processing, Robotic Process Automation and some more.

Unit	Description	No. of Lectures
Unit I	**Introduction** Introduction to AI problems, Introduction to AI Technique, Level of the Model, Criteria for Success. **Problems, Problem Spaces and Search** Defining the Problem as a State Space Search, Introduction to Production Systems, Problem Characteristics, Production System Characteristics. **Heuristic Search Techniques** Generate-and-Test, Hill Climbing, Best-first Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis.	8
Unit II	**Knowledge Representation Issues** Introduction to Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, Frame Problem. **Using Predicate Logic** Representing Simple Facts in Logic, Representing Instance and *ISA* Relationships, Introduction to Computable Functions and Predicates, Resolution, Natural Deduction. **Representing Knowledge Using Rules** Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge.	8
Unit III	**Symbolic Reasoning Under Uncertainty**	8

	Introduction to Non monotonic Reasoning, Logic for Non monotonic Reasoning, Implementation Issues, Augmenting a Problem-solver, Implementation of Depth-first Search, Implementation of Breadth-first Search. **Statistical Reasoning** Probability and Bayes' Theorem, Certainty Factors and Rule-based Systems, Introduction to Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. **Weak Slot-and-Filler Structures** Introduction to Semantic Nets, Introduction to Frames.	
Unit IV	**Strong Slot-and-Filler Structures** Conceptual Dependency, Scripts, CYC. **Knowledge Representation Summary** Syntactic-semantic Spectrum of Representation, Logic and Slot-and-filler Structures. **Game Playing** Minimax Search Procedure, Adding Alpha-beta Cutoffs, Iterative Deepening.	8
Unit V	**Planning** An Example Domain: The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems. **Understanding** What is Understanding? What Makes Understanding Hard? Understanding as Constraint Satisfaction. **Natural Language Processing** Introduction to Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking. **Parallel and Distribution AI** Psychological Modeling, Parallelism in Reasoning Systems, Distributed Reasoning Systems. **Robotic Process Automation** Difference between Robotic Process Automation and Traditional Automation, Working of RPA, Types of RPA: Programmable Bot, Intelligent Bot, Benefits of Robotic Process Automation, Future of RPA.	8

References:
1. Kevin Knight, Elaine Rich, B. Nair "ARTIFICIAL INTELLIGENCE" McGraw

Hill 3rd Edition 2017.

2. Stuart Russell and Peter Norvig "Artificial Intelligence 3e: A Modern Approach", 3rd Edition.

Learning Outcome:

1. The students will learn the concepts of artificial intelligence, algorithms and related components of artificial intelligence.

Unit	Course Outcome	Description
I	CO1	Understand the Various AI problems, AI techniques, AI models and criteria of success.
	CO2	Understand and Identify the AI Problems and their space.
	CO3	Understand and Apply AI Search Algorithms.
II	CO4	Understand and Analyze various concepts of knowledge representation and predicate logic.
	CO5	Understand knowledge representation using rules.
III	CO6	Understand and Analyze various concepts of Symbolic and Statistical Reasoning.
	CO7	Understand and Apply weak slot-and-filler structures.
IV	CO8	Understand and Apply strong slot-and-filler structures.
	CO9	Conclude the spectrum of Knowledge Representation.
	CO10	Understand the Game Playing techniques.
V	CO11	Understand and Apply Planning and Understanding techniques.
	CO12	Understand Natural Language Processing, Robotic Process Automation and parallel and distributed AI.

Course Code: RJSPIT2P1 Course Name: Advanced Artificial Intelligence		
Lectures /Hrs. :	Total Marks :50	Credits : 02

20		

Course Objectives:
1. To introduce various machine learning techniques, used to do data analysis.
2. To program facts and rules using Prolog.

Practical List
1. Heuristic search Techniques
2. Reinforcement Learning: Markov decision.
3. Reinforcement Learning: Montecarlo Prediction.
4. Predictive Analytics - Forecasting (Logistic, Time Series - ARIMA, Case Study).
5. Ensemble Techniques (Boosting, Bagging).
6. Facts about Marcus.
7. Travelling Salesman problem.
8. Mutilated checker board.

Learning Outcome:
The students will be able to:
1. Implement the machine learning techniques,
2. Program facts and rules using Prolog.

Unit	Course Outcome	Description
	CO1	Understand and Implement heuristic search technique.
	CO2	Understand and Implement reinforcement learning.
	CO3	Implement time series analysis on a given dataset.
	CO4	Describe and Apply ensemble technique.
	CO5	Implement code for travelling salesman problem and Design checkerboard.

Course Code: RJSPIT202		
Course Name: Wireless Sensor Networks		
Lectures /Hrs. : 40	Total Marks :100	Credits: 04

Course Objectives:
1. To introduce the concepts of wireless sensor technology.
2. To understand the various MAC Protocols for WSNs.
3. How Network is managed using Traditional Network Management Models.
4. How Performance and Traffic Management takes place in Wireless sensor networks.

Unit	Description	No. of Lectures
Unit I	**Sensor networks overview** Introduction, Applications of WSN, Range of Applications, Design Issues. **Basic Wireless Sensor Technology** Sensor node architecture, Hardware and Software, Sensor Taxonomy, WSN Operating Environment, Trend. **Wireless Transmission Technology and Systems** Introduction, Radio Technology Primer, Propagation & Propagation Impairments, Available Wireless Technologies.	8
Unit II	**Fundamentals of MAC Protocols** Performance Requirements, Common Protocols, MAC Protocols for WSNs, Schedule-Based Protocols, Random Access-Based Protocols, Sensor-MAC Case Study, Protocol Overview, Periodic Listen and Sleep Operations, Schedule Selection and Coordination, Schedule Synchronization, Adaptive Listening, Access Control and Data Exchange. **Routing Protocols for Wireless Sensor Networks** Routing Challenges and Design Issues in Wireless, Sensor Networks, Network Scale and Time-Varying Characteristics, Resource Constraints, Sensor Applications Data Models, Routing Strategies in Wireless Sensor Networks, WSN Routing Techniques, Flooding and Its Variants, Sensor Protocols for Information via Negotiation, Low-Energy Adaptive Clustering Hierarchy, Power-Efficient Gathering in Sensor Information Systems,	8

	Directed Diffusion, Geographical Routing.	
Unit III	**Transport Control Protocols for Wireless Sensor Networks** Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, CODA (Congestion Detection and Avoidance), ESRT (Event-to-Sink Reliable Transport), RMST (Reliable Multisegment Transport), PSFQ (Pump Slowly, Fetch Quickly), GARUDA, ATP (Ad Hoc Transport Protocol), Problems with Transport Control Protocols, Performance of Transport Control Protocols, Congestion, Packet Loss Recovery.	8
Unit IV	**Middleware for Wireless Sensor Networks** Introduction, Network Management Requirements, Traditional Network Management Models, Simple Network Management Protocol, Telecom Operation Map, Network Management Design Issues, Example of Management Architecture: MANNA, Other Issues Related to Network Management, Naming, Localization.	8
Unit V	**Performance and Traffic Management** WSN Design Issues, MAC Protocols, Routing Protocols, Transport Protocols, Performance Modeling of WSNs, Performance Metrics, Basic Models, Network Models. **Operating Systems for Wireless Sensor Networks** Operating System Design Issues, Examples of MANTIS, SenOS, MagnetOS	8

References: 1. Kazem Sohraby/wiley "Wireless Sensor Networks: Technology, Protocols, and Applications". 2. Zhao Feng Elsevier India "Wireless Sensor Networks". 3. Piotr Szczechowiak/ Lap Lambert "Security in Wireless Sensor Networks" Academic Publishing. 4. Raghavendra Sivalingam Znati/ Springer India "Wireless Sensor Networks". 5. Robert Faludi/ O'reilly "Building Wireless Sensor Networks".

Learning Outcome: 1. The students will learn the concepts of wireless sensor technology, MAC protocols and traffic management of wireless sensor networks.

Unit	Course Outcome	Description

I	CO1	To Understand Sensor Networks. Outline of WSN with its range of Applications, Identify the design Issues.
	CO2	Explain the Sensor node architecture, its Hardware and Software, Describing Sensor Taxonomy, Understand the WSN Operating Environment.
	CO3	To Understand Radio Technology Primer, Propagation & Propagation Impairments, Outline of Available Wireless Technologies.
II	CO4	Describe the Performance Requirements, Understand various protocols, MAC Protocols for WSNs.
	CO5	To Understand the Routing Protocols for Wireless Sensor Networks. Outline of Routing Challenges and Design Issues in WSN. Explain the Resource Constraints. Identify the WSN Routing Techniques.
III	CO6	Identify Transport Protocol Design Issues, Understand and Compare various Transport Control Protocols. Describe the problems with Transport Control Protocols, Congestion, Packet Loss Recovery.
IV	CO7	Outline of Network Management Requirements, Explain its Models, Design issues. Analyzing Management Architecture: MANNA and its issues.
V	CO8	To Understand Performance Modeling of WSNs. Analyzing Performance Metrics. Demonstrate the Basic Models and Network Models.
	CO9	List Operating System Design Issues. Describe Operating Systems for Wireless Sensor Networks with its Examples.

Course Code: RJSPIT2P2		
Course Name: Wireless Sensor Networks		
Lectures/ Hrs. : 20	**Total Marks :100**	**Credits : 02**

Course Objectives:
1. To Understand Wireless sensor network applications and its simulation with various protocols.
2. How to build the networks, using NS2 Simulator, write/ generate TCL scripts.

Practical List
1. Introduction of Wireless sensor network applications and its simulation.
2. Network Simulator installation of wireless sensor network.
3. Write TCL script for transmission between mobile nodes.
4. Write TCL script for sensor nodes with different parameters.
5. Generate tcl script for udp and CBR traffic in WSN nodes.
6. Generate tcl script for TCP and CBR traffic in WSN nodes.

7. Implementation of routing protocol in NS2 for AODV protocol.
8. Implementation of routing protocol in NS2 for DSR protocol.
9. Implementation of routing protocol in NS2 for TORA protocol.
    Study other wireless sensor network simulators (Mannasim. Contiki.)

Learning Outcome:
1. The students will be able to: build the networks, generate TCL script and implement the routing protocols.

Unit	Course Outcome	Description
	CO1	To Understand and Explain various Wireless sensor network applications with its Embedded components.
	CO2	Understand and Install Network Simulator NS2 wireless sensor network.
	CO3	Understand and Design a network by writing TCL script for transmission between mobile nodes.
	CO4	Understand different parameters affecting the network and Demonstrate using TCL script for sensor nodes with different parameters.
	CO5	Understand and Demonstrate use of UDP protocol and its effect on the network. Also Design a network by writing a tcl script for UDP for passing CBR traffic in between WSN nodes.
	CO6	Understand and Demonstrate use of TCP protocol and various traffic parameters effect on the network. Also Design a network by writing a tcl script for TCP and CBR traffic in WSN nodes.
	CO7	Understand AODV protocol. Using AODV protocol, Design a network by writing TCL script.
	CO8	Understand DSR protocol. Design a network by using DSR protocol by writing TCL script.
	CO9	Understand TORA protocol. Design a network by using TORA protocol by writing TCL script.

Course Code: RJSPIT203 Course Name: Big Data Analytics		
Lectures /Hrs. :	Total Marks :100	Credits: 04

40		

Course Objectives:

1. To introduce the big data technology, hadoop framework, data analysis of big data, data mining of big data and big data frameworks.

Unit	Description	No. of Lectures
Unit I	**INTRODUCTION TO BIG DATA** Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools.	8
Unit II	**HADOOP FRAMEWORK** Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN.	8
Unit III	**DATA ANALYSIS** Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.	8
Unit IV	**MINING DATA STREAMS** Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.	8
Unit V	**BIG DATA FRAMEWORKS** Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and	8

		File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries.	

References:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series, 208 .
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3. Learning R – A Step-by-step Function Guide to Data Analysis, Richard Cotton, O'Reilly Media, 2013.
4. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second Edition, 2007.
5. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
6. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 208 .
7. Sridhar Alla, "Big Data Analytics with Hadoop3", Packt, 2018.
8. Simon Walkowiak, "Big Data Analytics with R: Utilize R to uncover hidden patterns in your Big Data", Packt, 2016.

Learning Outcome:

The students will be able to:

1. Understand how to leverage the insights from big data analytics.
2. Analyze data by utilizing various statistical and data mining approaches.
3. Perform analytics on real-time streaming data.
4. Understand the various NoSql alternative database models.

Unit	Course Outcome	Description
	CO1	Discuss and Describe the Big Data concepts, Big Data Applications, Various Analytical Processes and Tools.
	CO2	Discuss, Install and Configure Hadoop Framework, MapReduce and Hadoop Yarn. Discuss and Implement the various MapReduce Algorithms as Well.
	CO3	Describe, Apply and Analyze various methods to Big Data.
	CO4	Perform Predictive Analysis using R/Python.

	CO5	Understand and Describe the Stream Data Model, NoSQL Models and its Architecture.
	CO6	Understand, Apply and Use various Big Data Frameworks and leverage the insights from Big Data Insights.

Course Code: RJSPIT2P3
Course Name: Big Data Analytics

Lectures /Hrs. : 20	Total Marks :50	Credits : 02

Course Objectives:
1. To introduce Map reduce, MongoDb database and HDFS with Hive.

Practical List
1. To understand the overall programming architecture using Map Reduce API.
2. Store the basic information about students such as roll no, name, date of birth and address of student using various collection types such as List, Set and Map.
3. Basic CRUD operations in MongoDB.
4. Retrieve various types of documents from students collection.
5. To find documents from Students collection.
6. Develop Map Reduce Work Application.
7. Creating the HDFS tables.
8. Loading HDFS tables in Hive and learn joining of tables in Hive.

Learning Outcome:
1. The students will be able to handle big data and query big data.

Unit	Course Outcome	Description
	CO1	Describe and Apply fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
	CO2	Execute basic CRUD Operations Using Mongo DB.
	CO3	Create and Execute the MapReduce Application.
	CO4	Perform various operations like Create, Load, and Join HDFS table using Hive.

	CO5	Describe and Apply Supervised and Unsupervised algorithms to Big Data.

<table>
<tr>
<td colspan="3">Course Code: RJSPIT204
Course Name: Virtualization</td>
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<tr>
<td>Lectures /Hrs. : 40</td>
<td>Total Marks :100</td>
<td>Credits: 04</td>
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<tr>
<td colspan="3">Course Objectives:

Understanding the basics of virtualization and vmware vSphere product suite.
Identify the need for Server Virtualization.
Describe the components and features of vSphere 6.0 and ESXi.
Describe how VMware's products help solve business and technical challenges with regard to Server Virtualization.

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<tr>
<td>Unit</td>
<td>Description</td>
<td>No. of Lectures</td>
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<tr>
<td>Unit I</td>
<td>Understanding Virtualization
Describing Virtualization, Microsoft Windows Drives Server Growth, Explaining Moore's Law, Understanding the Importance of Virtualization, Examining Today's Trends, Virtualization and Cloud Computing Understanding Virtualization, Software Operation, Virtualizing Servers Virtualizing Desktops Virtualizing Applications.
Understanding Hypervisors
Describing a Hypervisor, Exploring the History of Hypervisors, Understanding Type 1 Hypervisors, Understanding Type 2 Hypervisors, Understanding the Role of a Hypervisor, Holodecks and Traffic Cops, Resource Allocation, Comparing, Today's Hypervisors, ESX, Citrix Xen, Microsoft Hyper-V.
Understanding Virtual Machines
Describing a Virtual Machine, Examining CPUs in a Virtual Machine, Examining Memory in a Virtual Machine, Examining Network Resources in a Virtual Machine, Examining Storage in a Virtual Machine, Understanding How a Virtual, Machine Works, Working with Virtual Machines, Understanding Virtual Machine Clones, Understanding Templates, Understanding Snapshots,</td>
<td>8</td>
</tr>
</table>

	Understanding OVF, Understanding Containers.	
Unit II	**Introducing VMware vSphere** Exploring VMware vSphere 6.0, Why Choose vSphere? **Planning and Installing VMware ESXi** Planning a VMware vSphere Deployment, Deploying VMware ESXi, Performing, Post installation Configuration. **Installing and Configuring vCenter Server** Introducing vCenter Server, Choosing the Version of vCenter Serve, Planning and Designing a vCenter Server Deployment, installing vCenter Server and Its Components, installing vCenter Server in a Linked Mode Group, Deploying the, vCenter Server Virtual Appliance, exploring vCenter Server, Creating and, managing a vCenter Server Inventory, exploring vCenter Server's Management Features, Managing vCenter Server Settings, vSphere Web Client Administration.	8
Unit III	**vSphere Update Manager and the vCenter Support Tools** vSphere Update Manager, Installing vSphere Update Manager, Configuring vSphere Update Manager, Creating Baselines, Routine Updates, Upgrading Hosts with, vSphere Update Manager, Performing an Orchestrated Upgrade, Investigating Alternative Update Options, vCenter Support Tools. **Creating and Configuring Virtual Networks** Putting Together a Virtual Network, working with vSphere Standard Switches, working with vSphere Distributed Switches, Examining Third-Party Distributed Virtual Switches, Configuring Virtual Switch Security. **Creating and Configuring Storage Devices** Reviewing the Importance of Storage Design, Examining Shared Storage Fundamentals, Implementing vSphere Storage Fundamentals, Leveraging SAN and NAS Best Practices.	8
Unit IV	**Ensuring High Availability and Business Continuity** Understanding the Layers of High Availability, Clustering VMs, Implementing vSphere High Availability, Introducing vSphere SMP Fault Tolerance, Planning for Business Continuity. **Securing VMware vSphere** Overview of vSphere Security, Securing ESXi Hosts, securing vCenter Server, Securing Virtual Machines. **Creating and Managing Virtual Machines** Understanding Virtual Machines, creating a Virtual Machine, installing a Guest Operating System, Installing VMware Tools,	8

	Managing Virtual Machines, Modifying Virtual Machines. **Using Templates and vApps** Cloning VMs, Creating Templates and Deploying Virtual Machines, Using OVF Templates, Using Content Libraries, working with vApps, Importing Machines from Other Environments.	
Unit V	**Managing Resource Allocation** Reviewing Virtual Machine Resource Allocation, Working with Virtual Machine Memory, Managing Virtual Machine CPU Utilization, Using Resource Pools, Regulating Network I/O Utilization, Controlling Storage I/O Utilization. **Balancing Resource Utilization** Comparing Utilization with Allocation, exploring vMotion, ensuring vMotion Compatibility, Using Storage vMotion, combining vMotion with Storage vMotion, Introducing Cross vCenter vMotion, Exploring vSphere Distributed, Resource Scheduler, Working with Storage DRS. **Monitoring VMware vSphere Performance** Overview of Performance Monitoring, Using Alarms, Working with Performance Charts, Working with resxtop, Monitoring CPU Usage, Monitoring Memory Usage, Monitoring Network Usage, Monitoring Disk Usage. **Automating VMware vSphere** Why Use Automation? vSphere Automation Options, Automating with PowerCLI, using vCLI from vSphere Management Assistant, Using vSphere, Management Assistant for Automation with vCenter, ESXCLI and PowerCLI, Leveraging the Perl Toolkit with vSphere Management Assistant, Automating with vRealize Orchestrator.	8

References:

1. Mastering VMware vSphere 6.5: Leverage the power of vSphere for effective virtualization, administration, management and monitoring of data centers Andrea Mauro, Paolo Valsecchi, Karel Novak - Publisher: Packt Publishing.
2. Bill Ferguson, "vSphere 6 Foundations Exam Official Cert Guide (Exam #2V0-620): VMware Certified Professional 6 VMware Press", 1st Edition.
3. Nick Marshall, Scott Lowe (Foreword by) with Grant Orchard, Josh Atwell, "Mastering VMware vSphere 6", Publisher: Sybex 1st Edition (24 March 2015).
4. Matthew Portnoy, "Virtualization Essentials", 2nd Edition, Wiley India Pvt. Ltd.

Learning Outcome:

Student will be able to :
1. Implementing vmwareESXi server virtualization.
2. Managing vmwareESXi with vCentre server.

Unit	Course Outcome	Description
I	CO1	Understand and Describe the Concepts of Virtualization, Hypervisor, Virtual Machines.
II	CO2	Understand VMware vSphere 6.0.
	CO3	Describe, Install and Configure ESXi and vCenter Server.
III	CO4	Demonstrate the use of vSphere Update Manager and Create a vSphere Network.
	CO5	Allocate and Configure Storage Devices.
IV	CO6	Configure the Virtual servers and Virtual Machines and Manage Resources to ensure Business Continuity.
	CO7	Understand and Apply VMware vSphere Security.
	CO8	Understand, Create and Manage Virtual Machines and Use the Templates.
V	CO9	Describe, Configure and Monitor the resources.
	CO10	Monitor performance and Understand the Automation of vSphere.

Course Code: RJSPIT2P4 **Course Name: Virtualization**			
Lectures/ Hrs. : 20	**Total Marks :50**		**Credits : 02**
Course Objectives: 1. To configure and implement server Virtualization. 2. To manage server. 3. To implement VLAN.			
Practical List 1. Managing Hyper –V Environment with SCVVM 208			

2. Provisioning Self-service with App Controller
3. Managing Private cloud with App Controller
4. Using Data Protection Manager for Backup and Recovery
5. Using Operations manager for real-time monitoring
6. Using Advisor for proactive monitoring
7. Using Service Manager to Standardize
8. Using Orchestrator for automation
9. Implementing Windows Azure Pack
10. Using Configuration Manager 208 for managing and maintaining

Learning Outcome:

1. The students will be able to handle Hyper-V, private cloud with App Controller, Windows Azure.

Unit	Course Outcome	Description
	CO1	Implement and Manage Hyper-V.
	CO2	Understand and Implement private cloud with App Controller.
	CO3	Understand, Install and Apply Data protection manager, Operations manager, Advisor, Service Manager, Orchestrator for server virtualization.
	CO4	Understand and Implement Windows Azure pack and Configuration Manager for managing and maintaining.

Scheme of Examination

Internal Evaluation (40 Marks)

1. Internal Examination 40 marks various modes with different weightage (Presentation, seminar, MCQs, Quiz etc.)

2. One External (Semester End Examination) of 60 marks. Duration 2 ½ hours.

3. One Practical at the end of Semester consisting of 50 marks.

4. Minimum marks for passing Semester End Theory and Practical Exam is 40 %. Separate passing for Internal and Semester End examination.

5. For any KT examinations, there shall be ODD-ODD/EVEN-EVEN pattern followed.

6. A candidate will be allowed to appear for the practical examinations if he/she submits a certified journal or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course as per the minimum requirements.

7. In case of loss of journal, a candidate must produce a certificate from the Head of the department /Institute that the practical for the academic year were completed by the student. However, such a candidate will be allowed to appear for the practical examination but the marks allotted for the journal will not be granted.

8. HOD's decision, in consultation with the Principal, shall remain final and abiding to all.

Evaluation and Assessment

1. The internal assessment marks shall be awarded as follows:
   A. 30 marks (Any one of the following):
      a. Written Test
         or
      b. SWAYAM NPTEL (Advanced Course) of minimum 20 hours and certification examination completed
         or
      c. Valid International Certifications (Prometric, Pearson, Certiport, Coursera, Udemy, edx and the like).
         or
      d. One certification mark shall be awarded one course only. For four courses, the students will have to complete four certifications.
   B. 10 Marks
      The marks given out of 40 for publishing the research paper should be divided into four course and should awarded out of 10 in each of the four courses.
2. Semester End Examination – 60 marks
   Question paper covering all units
3. Evaluation of Practical 200 marks (50 marks for each practical)

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