

Semester-III

Branch: M.Sc.(C.S.)	Semester-III
Subject Code: PG3.1	Lecture: 04 Credit: 04
Subject Title	BIG DATA ANALYTICS

Modules	Sr. No.	Topic and Details	No. of lectures assigned	Marks Weightage
UNIT-I	1	<p>INTRODUCTIONTOBIGDATAANDHADOOP Types of Digital Data, Introduction to BigData, BigData Analytics, History of Hadoop, Apache Hadoop, Analyzing Datawith Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and BigSheets.</p> <p>HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with FlumeandScoopandHadooparchives,HadoopI/O:Compression,Serialization,AvroandFile-BasedDatastructures</p>	15	25
UNIT-II	2	<p>MapReduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling,ShuffleandSort,TaskExecution,MapReduceTypesandFormats,MapReduceFeatures</p>	10	25
UNIT-III	3	<p>Hadoop EcoSystem Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, HiveMetastore,ComparisonwithTraditionalDatabases,HiveQL,Tables,QueryingDataandUserDefinedFunctions.Hbase:HBasics,Concepts,Clients,Example,HbaseVersus RDBMS. Big SQL :Introduction</p>	15	25
UNIT-IV	4	<p>Data Analytics with R Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with Big R.</p>	10	25

Reference Books

1. Tom White “Hadoop: The Definitive Guide” Third Editon,O’reily Media,2012.
2. Seema Acharya, Subhasini Chellappan,"Big Data Analytics" Wiley2015.References
3. Michael Berthold, David J.Hand,"IntelligentDataAnalysis”,Springer,2007.
4. JayLiebowitz,“BigDataandBusinessAnalytics”AuerbachPublications,CRCpress(2013)
5. Tom Plunkett, Mark Hornick,“Using R to Unlock the Value of Big Data: BigData Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013),Oraclepress.
6. Anand Rajaraman and Jefrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
7. Bill Franks, “Taming the BigData Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”,John Wiley & sons,2012.

8. Glen J. Myat, “Making Sense of Data”, John Wiley & Sons, 2007
9. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.
10. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
11. Arvind Sathi, “Big Data Analytics: Disruptive Technologies for Changing the Game”, MC Press, 2012
12. Paul Zikopoulos, Dirk DeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corgan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.

Branch: M.Sc.(C.S.)	Semester-III
Subject Code: PG3.2	Lecture: 04 Credit: 04
Subject Title	Machine Learning

COURSE OBJECTIVES:

1. Able to analyze the efficiency of algorithm.
2. Understand the features of machine learning to apply on real world problems.
3. To learn the concept of how to learn patterns and concepts from data.
4. To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
5. Explore supervised and unsupervised learning paradigms of machine learning.

COURSE OUTCOMES:

After completion of course, students would be able to:

1. Extract features that can be used for a particular machine learning approach in various applications.
2. To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
3. To mathematically analyze various machine learning approaches and paradigms.

Modules	Sr. No.	Topic and Details	No of Lectures Assigned	Marks Weight age %
UNIT-I	1	Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross- validation. Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning. Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis.	9	15
UNIT-II	2	Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity	9	15
UNIT-III	3	Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions	9	15

		Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves Case Study of Polynomial Curve Fitting.		
UNIT-IV	4	LOGIC BASED AND ALGEBRAIC MODELS Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Distance based clustering algorithms - K-means and K-medoids, Hierarchical clustering. Rule Based Models: Rule learning for subgroup discovery, Association rules mining – Apriori Algorithm, Confidence and Support parameters. Tree Based Models: Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy, Best Split	9	15
UNIT-V	5	TRENDS IN MACHINE LEARNING : Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties Deep Learning: The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons .	9	15

Text Book:

1. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

Reference Books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009
3. David Barber, Bayesian Reasoning and Machine Learning (Cambridge University Press). Online version available here.
4. Tom Mitchell. Machine Learning (McGraw Hill) , First Edition
5. Richard O. Duda, Peter E. Hart, David G. Stork. Pattern Classification (John Wiley & Sons)
6. Ethern Alpaydin, Introduction to Machine Learning, MIT Press, 3rd Edition.

Branch: M.Sc.(C.S.)	SEMESTER-III
Subject Code: PG3.3	Lecture:02 Credit: 02
Subject Title	DATA SCIENCE

COURSE OBJECTIVE

1. Provide student with the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
3. Produce Python code to statistically analyze a dataset.
4. Critically evaluate data visualizations based on their design and use for communicating stories from data.

COURSE OUTCOME

1. Explain how data is collected, managed and stored for data science
2. Understand the key concepts in data science, including the real-world applications and the tool kit used by data scientists
3. Implement data collection and management scripts using MongoDB.

Modules	Sr. No.	Topic and Details	No. of Lectures Assigned	Marks Weight age%
UNIT-I	1	Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.	5	10
	2	Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using Multiple data sources.	7	11
UNIT-II	3	Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT,	7	11
	4	Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.	7	11
UNIT-III	5	Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings,	5	10

		Visual encodings.		
	6	Applications of Data Science, Technologies for visualization.	7	11
UNIT-IV	7	Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science	7	11

References:

1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O’Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets.v2.1,Cambridge University Press.

Branch: M.Sc.(C.S.)	SEMESTER-III
Subject Code: PG3.4	Practical:02 Credit:02
Subject Title	BIG DATA ANALYTICS LAB

COURSE OBJECTIVES:

1. Optimize business decisions and create competitive advantage with Big Data analytics.
2. Imparting the architectural concepts of Hadoop and introducing map reduce paradigm.
3. Introducing Java concepts required for developing map reduce programs.
4. Derive business benefit from unstructured data.
5. Introduce programming tools PIG & HIVE in Hadoop ecosystem.
6. Developing Big Data applications for streaming data using Apache Spark.

COURSE OUTCOMES:

1. Preparing for data summarization, query, and analysis.
2. Applying data modelling techniques to large data sets.
3. Creating applications for Big Data analytics.
4. Building a complete business data analytic solution.

SAMPLE EXERCISES:

1. (i) Perform setting up and Installing Hadoop in its two operating modes:
 - Pseudo distributed,
 - Fully distributed.
 (ii) Use web based tools to monitor your Hadoop setup.
2. (i) Implement the following file management tasks in Hadoop:
 - Adding files and directories
 - Retrieving files
 - Deleting files
 ii) Benchmark and stress test an Apache Hadoop cluster

3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
 - Find the number of occurrences of each word appearing in the input file(s)
 - Performing a MapReduce Job for word search count (look for specific keywords in a file)
4. Stop word elimination problem:
 - Input:
 - A large textual file containing one sentence per line
 - A small file containing a set of stop words (One stop word per line)
 - Output:
 - A textual file containing the same sentences of the large input file without the words appearing in the small file.
5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at:<https://github.com/tomwhite/hadoop-book/tree/master/input/ncdc/all>.
 - Find average, max and min temperature for each year in NCDC data set?
 - Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.
6. Purchases.txt Dataset
 - Instead of breaking the sales down by store, give us a sales breakdown by product category across all of our stores
 - What is the value of total sales for the following categories?
 - Toys
 - Consumer Electronics
 - Find the monetary value for the highest individual sale for each separate store
 - What are the values for the following stores?
 - Reno
 - Toledo
 - Chandler
 - Find the total sales value across all the stores, and the total number of sales.
7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
8. Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available at: Project Gutenberg)
9. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
10. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.
11. Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.
 - Write a single Spark application that:
 - Transposes the original Amazon food dataset, obtaining a PairRDD of the type:
 - `<user_id> → <list of the product_ids reviewed by user_id>`
 - Counts the frequencies of all the pairs of products reviewed together;
 - Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

Branch: M.Sc.(C.S.)	Semester-III
Subject Code: PG3.5	Practical: 02 Credit: 02
Subject Title	Machine Learning LAB

COURSE OBJECTIVES:

1. Understand the features of machine learning to apply on real world problems.
2. To extract patterns from data
3. To design and implement various machine learning algorithms and techniques using standard datasets.

COURSE OUTCOMES:

After completion of course, students would be able to:

1. Effectively use the various machine learning tools.
2. Understand and implement the procedures for machine learning algorithms.
3. Design Python programs for various machine learning algorithms.
4. Apply appropriate datasets to the Machine Learning algorithms.
5. Analyze the graphical outcomes of learning algorithms with specific datasets.

SAMPLE EXERCISES:

1. Introduction to Machine Learning Tools.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
4. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
5. Write a program to implement k-Nearest Neighbor algorithm to classify a standard data set. Print both correct and wrong predictions.
6. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
7. Develop machine learning method for classifying i) the incoming mails. ii) how people rate the movies, books, etc.

Elective-III

Branch: MSc-DS	Semester-III
Subject Code: PG3.6.1	Lecture: 03 Credit: 03
Subject Title	BLOCK CHAIN

Prerequisite:

1. Expertise in Programming, Basic Knowledge Of Computer Security, Cryptography, Networking, Concurrent Or Parallel Programming Would Help A Student To Understand The Topics.

COURSE OBJECTIVES:

By the end of the course, students will be able to

1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work and to securely interact with them.
2. Design, build, and deploy smart contracts and distributed applications.

COURSE OUTCOMES:

1. Explain design principles of Bitcoin and Ethereum.
2. Explain Nakamoto consensus.
3. Explain the Simplified Payment Verification protocol.
4. List and describe differences between proof-of-work and proof-of-stake consensus.
5. Interact with a blockchain system by sending and reading transactions.
6. Design, build, and deploy a distributed application.
7. Evaluate security, privacy, and efficiency of a given blockchain system.

Modules	Sr. No.	Topic and Details	No of Lectures Assigned
UNIT-I	1	Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. • Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.	12
UNIT-II	2	Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.	12
UNIT-III	3	Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.	12
UNIT-IV	4	Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart	12

		Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.	
	5	Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Cryptocurrency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.	
UNIT-V		Hyperledger as a protocol :The reference architecture Requirements and design goals of Hyperledger Fabric: The modular approach Privacy and confidentiality, Scalability, Deterministic transactions Identity, Auditability Interoperability Portability Rich data queries Fabric Hyperledger Fabric Membership services Blockchain services Consensus services Distributed ledger ,The peer to peer protocol Ledger storage Chaincode services ,Components of the fabric	
		Scalability and Other Challenges: Scalability Network plane ,Consensus plane, Storage plane View plane ,Block size increase ,Block interval reduction Invertible Bloom, Lookup Tables Sharding State channels Private blockchain, Proof of Stake Sidechains Subchains Tree chains (trees) Block propagation Bitcoin-NG, Plasma ,Privacy Indistinguishability Obfuscation Homomorphic encryption ,Zero-Knowledge Proofs State channels Secure multiparty computation Usage of hardware to provide confidentiality CoinJoin Confidential transactions, MimbleWimble Security Smart contract security Formal verification and analysis Oyente tool	12

Text Book:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books:

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
3. DR. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,” Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts.
5. “Mastering Blockchain”: Imran Bashir

Branch: M.Sc.(C.S.)	Semester-III
Subject Code: PG3.6.2	Lecture: 04 Credit: 04
Subject Title	GIS AND REMOTE SENSING

COURSE OBJECTIVE:

1. To introduce the fundamentals and components of Geographic Information System.
2. To provide details of spatial data structures and input, management and output processes.

COURSE OUTCOME:

1. The basic concepts and components of GIS.
2. The techniques used for storage of spatial data and data compression.
3. The practices used for input, management and output of spatial data.

Concepts of spatial data quality and data standards.

Modules	Sr. No.	Topic Details	No. of Lectures Assigned
UNIT-I	1	Fundamentals of GIS: Defining GIS, components of GIS, spatial data, spatial data-maps, characteristics, spatial data modeling, attribute data management-database data model, GIS applications and developments in database.	15
UNIT-II	2	Input-Output and Data Analysis in GIS: Data input and editing– methods, editing, integration, Data analysis-measurements, queries, reclassification, buffering, map overlay, interpolation, analysis of surfaces, network analysis, spatial analysis, Analytical modeling in GIS-physical, environment and human processes, output from GIS –maps, non-cartographic output, spatial multimedia, decision support.	15
UNIT-III	3	Issues in GIS: Development of computer methods for spatial data, Issues in GIS- data quality and errors, sources of errors, human and organizational issues, GIS project design and management–problem identification, designing a data model, project management, Implementation, evaluation, the future of GIS, Internet resources of GIS.	15
UNIT-IV	4	Remote Sensing: Principles of remote sensing, remote sensing system-classification, Imaging, characteristics, extraction of information from images–metric and thematic, Integration of RS and GIS.	15

	5	Global Positioning Systems (GPS): Introduction to GPS, Accuracy of GPS, Differential GPS, Applications of GPS, Integration of GIS and GPS.	
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Reference Books:

1. An Introduction to Geographical Information Systems by Heywood, Cornelius and Carver(Person Education Asia2000)
2. Concepts and techniques of Geographic Information Systems by C. P. Lo and Albert Yeung(PHI, NewDelhi)
3. Fundamentals of Geographic information Systems 2nd Edition by Michael N. Demers (JohnWiley& Sons (ASIA) PteLtd)
4. ArcGIS Developer’s Guide for Visual Basic Applications by Razvi (Onword Press,2002)

Branch: M.Sc.(C.S.)	Semester-III
Subject Code: PG3.6.3	Lecture: 03 Credit: 03
Subject Title	SOFTWARE TESTING

Modules	Sr. No.	Topic Details	No. of Lectures Assigned
UNIT-I	1	Software Testing Terminology and Methodology Software Testing Terminology, Software Testing Life Cycle, Writing a Policy for Software Testing, Economics of Testing, Testing – An organizational Issue, Management Support for Software Testing, Fig. of Software Testing Methodology, Risk associated with not meeting customer needs, Developing Test Strategy	15
	2	Overview of Software Testing Process Advantages of Following a Process, The Cost of Computer Testing, The Seven-Step Software Testing Process	
	3	Verification and Validation Verification and Validation (V&V) Activities, Verification, Verification of Requirements, Verification of High –level Design, Verification of Low –level Design, How to Verify Code? ,Validation	
UNIT-II	4	Static Testing Inspections, Structured Walkthroughs, Technical Reviews	15
	5	Validation Activities Unit Validation Testing, Integration Testing, Function Testing, System Testing , Acceptance Testing Regression Testing Progressive vs. Regressive Testing, Regression Testing Produces Quality Software, Regression Testability, Objectives of Regression Testing, When is Regression Testing Done? , Regression Testing Types, Defining Regression Test Problem, Regression Testing Techniques	
UNIT-III	6	Test Management Test Organization, Structure of Testing Group, Test Planning, Detailed Test Design and Test Specifications	15

	7	Software Metrics Need for Software Management, Definition of Software Metrics, Classification of Software Metrics, Entities to be Measured, Size Metrics	
	8	Testing Metrics for Monitoring and Controlling the Testing Process Measurement Objectives for Testing, Attributes and Corresponding Metrics in Software Testing, Attributes, Estimation Models for Estimating Testing Efforts (include only topic Halstead Metrics), Test Point Analysis (TPA) – introduction only	
UNIT-IV	9	Testing Process Maturity Models Need for Test Process Maturity, Measurement and Improvement of a Test Process, Test Process Maturity Models	15
	10	Automation and Testing Tools Need for Automation, Categorization of Testing Tools, Selection of Testing Tools, Cost Incurred in Testing Tools, Guidelines for Automated Testing, Overview of Some Commercial Testing Tools Testing Object Oriented Software Object-Oriented Testing	
	11	Using Agile Methods to Improve Software Testing The importance of Agility, Building an Agile Testing Process, Agility Inhibitors, Is Improvement Necessary, Compressing Time, Challenges, Solutions , Measuring Readiness , The Seven-Step Process 4.5 Test Plan	

Text books:

1. Software Testing Principles and Practices - By Naresh Chauhan, Oxford
2. Effective Methods of Software Testing (3rd Edition) - By William E Perry Wiley, India
3. Software Testing principles and practices- By Srinivasan Desikan, Gopalaswamy Ramesh, Pearson Ed.
4. Software testing (2nd Edition) – By Ron Patton, Pearson Education
5. Effective Software Testing 50 specific ways to improve your testing- By Elfriede Dustin, Pearson Edu.

Branch: M.Sc.(C.S.)	Semester-III
Subject Code: PG3.6.4	Lecture: 04 Credit: 04
Subject Title	Robotic Process Automation

Unit	Topics	No. of Lectures
I	<p>Robotic Process Automation Foundations What is RPA, Flavors of RPA, History of RPA, What can RPA do, Components of RPA, The Benefits of RPA, The Downsides of RPA, RPA Compared to BPO, BPM, BPA, What is the Difference Between AI and RPA, RPA Tools and Platforms, Consumer Willingness for Automation, The Workforce of the Future</p> <p>About UiPath What is UiPath, UiPath Studio, UiPath Robot, UiPath Orchestrator, UiPath – an integrated view</p> <p>About Automation Anywhere What is Automation Anywhere, Enterprise Control Room, IQ Bot</p>	15

II	<p>Downloading and Installing UiPath Studio</p> <p>Record and Play Learning UiPath Studio, Task Recorder, Step by step examples using the recorder</p> <p>Sequence, Flowchart, and Control Flow Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step by step example using Sequence, Flowchart and Control Flow, Log Message</p> <p>Data Manipulation Variables and scope, Collections, Arguments – purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa</p>	15
III	<p>Taking Control of the Controls Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of OCR available, Avoiding typical failure points</p> <p>Tame that Application with Plugins and Extensions Terminal plugin, SAP automation, Java plugin, Citrix automation, Mail plugin, PDF plugin, Web integration, Excel and Word plugins, Credential management, Extensions – Java, Chrome, Firefox and Silverlight</p> <p>Handling User Events and Assistant Bots What are assistant bots, Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event</p> <p>Exception Handling, Debugging and Logging Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting</p>	15
IV	<p>Managing and Maintaining the Code Project organization, Nesting workflows, Reusability of workflows, Commenting techniques, State Machine, When to use Flowcharts, State Machines or Sequences, Using config files and examples of a config file, Integrating a TFS Server</p> <p>Deploying and Maintaining the Bot Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to Control bots, Using Orchestration server to deploy bots, License management, Publishing and managing updates</p> <p>Case Study Project (Build real-world solutions using UiPath)</p>	15
Total Lectures		60

References:

1. Alok Mani Tripathi, “Learning Robotic Process Automation”, Packt Publishing, 2018
2. Tom Taulli, “The Robotic Process Automation Handbook – A Guide to Implementing RPA Systems”, Apress, 2020
3. Jonathan Sireci, “The Practitioner’s Guide to RPA”, Farchair Solutions 2020
4. Pascal Bornet, Ian Barkin, Jochen Wirtz, “Intelligent Automation – Welcome to the World of HYPERAUTOMATION”, 2021

Branch: M.Sc.(C.S.)	SEMESTER-III
Subject Code: PG3.7	Credit: 04
Subject Title	RP / OJT