S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

Syllabus for M.Sc

Program: M.Sc (Information Technology)

Program Code: Information Technology (RPSIT)

(Credit Based Semester and Grading System for academic year 2021–2022)

Program outcomes for Masters in Science (M.Sc)

PO	**Description** **A student completing Master's Degree in Information Technology program will be able to:**
PO 1	Demonstrate in depth understanding in the relevant science discipline. Recall, explain, extrapolate and organize conceptual scientific knowledge for execution and application and also to evaluate its relevance.
PO 2	Critically evaluate, analyze and comprehend a scientific problem. Think creatively, experiment and generate a solution independently, check and validate it and modify if necessary.
PO 3	Access, evaluate, understand and compare digital information from various sources and apply it for scientific knowledge acquisition as well as scientific data analysis and presentation.
PO 4	Articulate scientific ideas, put forth a hypothesis, design and execute testing tools and draw relevant inferences. Communicate the research work in appropriate scientific language.
PO 5	Demonstrate initiative, competence and tenacity at the workplace. Successfully plan and execute tasks independently as well as with team members. Effectively communicate and present complex information accurately and appropriately to different groups.
PO 6	Use an objective, unbiased and non-manipulative approach in collection and interpretation of scientific data and avoid plagiarism and violation of Intellectual Property Rights. Appreciate and be sensitive to environmental and sustainability issues and understand its scientific significance and global relevance
PO 7	Translate academic research into innovation and creatively design scientific solutions to problems. Exemplify project plans, use management skills, and lead a team for planning and execution of a task.
PO 8	Understand cross disciplinary relevance of scientific developments and relearn and reskill to adapt to technological advancements.

PROGRAM SPECIFIC OUTCOMES

PSO	Description **A student completing Master's Degree in Science program in the subject of Information Technology will be able to:**
PSO 1	Achieve expertise in various subjects from the broad area of Information technology.
PSO 2	Design the solution to real world problems and issues using various software and hardware state of the art tools & softwares.
PSO 3	Analyze and compare the existing solutions and tools available to the problems and generate new solutions or tools.
PSO 4	Use the techniques, skills and modern computing tools to emerge as a freelancer and entrepreneur in the field.
PSO 5	Identify the changing computational domains and adapt the new age technologies and computing domain.
PSO 6	Become a responsible citizen totally aware of environmental issues and develop solutions saving the environment.
PSO 7	Assimilate professional ethics, managerial and soft skills to emerge as a leader to manage diverse projects in industry
PSO 8	Apply domain expertise to pursue research in Computer science and Information Technology discipline.

PROGRAM OUTLINE

M.Sc (Information Technology)							
SEMESTER – I (THEORY)					**SEMESTER – I (PRACTICALS)**		
Year	Sem	Course code	Course title	Credits	Course code	Course title	Credits
Part I	I	RPSIT101	Data Science	4	RPSITP101	Data Science	2
Part I	I	RPSIT102	Microservices Architecture	4	RPSITP102	Microservices Architecture	2
Part I	I	RPSIT103	Full Stack Web Development - I	4	RPSITP103	Full Stack Web Development - I	2
Part I	I	RPSIT104	Advanced IoT	4	RPSITP104	Advanced IoT	2

M.Sc (Information Technology)							
SEMESTER – II (THEORY)					**SEMESTER – II (PRACTICALS)**		
YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS	COURSE CODE	COURSE TITLE	CREDITS
M.Sc IT	II	RPSIT201	Blockchain Technology	4	RPSITP201	Blockchain Technology	2

M.Sc IT	II	RPSIT202	Big Data Analytics	4	RPSITP202	Big Data Analytics	2
M.Sc IT	II	RPSIT203	Machine Learning	4	RPSITP203	Machine Learning	2
M.Sc IT	II	RPSIT204	Full Stack Web Development - II	4	RPSITP204	Full Stack Web Development - II	2

M.Sc (Information Technology)							
SEMESTER – III (THEORY)					**SEMESTER – III(PRACTICALS)**		
YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS	COURSE CODE	COURSE TITLE	CREDITS
M.Sc IT	III	RPSIT301	Cloud Computing	4	RPSITP301	Cloud Computing	2
M.Sc IT1s1a	III	RPSIT302	Digital Forensics	4	RPSITP302	Digital Forensics	2
M.Sc IT	III	RPSIT303	UX/UI Designing	4	RPSITP303	UX/UI Designing	2
M.Sc IT	III	-	-	-	RPSITP304	Project	6

M.Sc (Information Technology)							
SEMESTER IV							
SEMESTER – IV (THEORY)					SEMESTER – IV (PRACTICALS)		
YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS	PRACTICAL COURSE	CREDITS	TOTAL CREDITS
M.Sc IT	IV	RPSIT401	Penetration Testing	4	RPSITP401	2	6
M.Sc IT	IV	-	Internship (500-600 Hours)	-	RPSITP402	18	18

SEMESTER I
Course Code: RPSIT101
Course Title: DATA SCIENCE
Academic year 2020-21

Course Outcomes:

Course Outcomes	Description
CO 1	Develop Analytical solution to Real world data science Problem
CO 2	Apply statistical and mathematical techniques to explore data
CO 3	Compare and Implement various supervised and unsupervised Learning algorithms for specific use case.
CO 4	Evaluate results of Analytics and suggest Solutions
CO 5	Articulate techniques for handling Time series and Semi-structured data

COURSE CODE RPSIT101	COURSE NAME DATA SCIENCE	CREDITS 4 LECTURE
I	**Introduction to Data Science**: What is Data? Different kinds of data, Data Science Process or lifecycle. **Data scientist**: Role and Profile **Pre-requisites for Data science**: statistics:Measures,Probability, Hypothesis and Inference ,Linear Algebra: Vectors and Matrices, Calculus:Gradient Descent Strategy	15 L
II	**Exploratory Data Analysis (EDA):** Measures of central tendency and dispersion, Bar plot, Scatter Plot, Line graph, histogram, Box plots, stem-leaf diagram, multi-dimensional modeling **Supervised Learning:** Random Forests, Regression,KNN,Application of Artificial neural networks ,Optimization with Genetic Algorithms	15 L

III	**Unsupervised Learning:** Clustering- Advanced hierarchical methods, Model based methods, Grid based method, Constraint based method, density based methods **Association rules:** Frequent Pattern, Apriori, Frequent pattern tree, pattern evaluation, Multidimensional ,multi-level , quantitative associations, Constraint based Pattern generation, Associative Classification and Clustering, Applications	15 L
IV	**Ensemble methods**: Increasing the Accuracy, Model Selection and evaluation. **Advanced Analytical Theory and Methods** **Semi-structured systems:** Semi-structured data Model, management and querying of data. **Time Series Analysis:** Overview of Time Series Analysis, ARIMA Model, Additional Methods. **Case Studies:** Fraud detection, Social network Analysis,Causality,Epidemology.	15 L

COURSE CODE RPSITP101	COURSE NAME PRACTICAL OF RPSIT101 (DATA SCIENCE)	CREDITS 2
	1. Data Cleaning and Pre Processing 2. Exploratory Data Analysis 3. Random Forests 4. DBSCAN 5. Artificial Neural network 6. Genetic Algorithms 7. Association 8. Model validation 9. Semi-structured data analysis 10. Time series Design and implementation of minimum two case studies based on the domain of the subject.	

Main References:
1. Doing Data Science, Rachel Schutt and Cathy O'Neil, O'Reilly,2013
2. Data Science From Scratch, Joel Grus, O'Reilly,2015
3. J. Han and M. Kamber, " Data Mining: Concepts and Techniques", Second Edition, Elsevier, Reprinted2008
4. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services
5. Machine Learning, Tom M. Mitchell
6. Practical Statistics for Data Scientist Peter Bruce and Andrew Bruce, O'Reilly,2017

Additional References:
1. Hands-On Programming with R, Garrett Grolemund,1st Edition, 2014
2. An Introduction to Statistical Learning, James, G., Witten, D., Hastie, T., Tibshirani, R.,Springer,2015
3. Machine Learning, 1/e by Subramanian Chandramouli, Amit Kumar Das Saikat Dutt

Course Code: **RPSIT102**
Course Title: **MICOSERVICES ARCHITECTURE**
Academic Year: 2021-22

Course Outcomes:

Course Outcomes	Description
CO 1	Understanding and implementing microservices
CO 2	Reconstitute a monolithic system into microservices
CO 3	Developing microservices on FOSS platforms
CO 4	Securing Microservices and deploying them.

Course Code RPSIT102	Microservices Architecture	Credits 4 Lectures

UNIT I	Understanding Microservices: Origins of Service-Oriented Architecture, The monolithic approach, The microservice approach, Microservice benefits, Separation of concerns, Smaller projects, Scaling and deployment, Microservices pitfalls, Illogical splitting, Data storing and sharing, Compatibility issues, Testing, Implementing microservices with Python, The WSGI standard, Greenlet and Gevent, Twisted and Tornado, asyncio, Language performances. Discovering Flask How Flask handles requests, Routing, Variables and converters, the url_for function, Request, Response, Flask built-in features, The session object, Globals, Signals, Extensions and middlewares, Templates, Configuration, Blueprints, Error handling and debugging, Custom error handler, The debug mode, A microservice skeleton.	15 L
UNIT II	Coding, Testing, and Documenting -Different kinds of tests, Unit tests, Functional tests, Integration tests, Load tests, End-to-end tests, Using WebTest, Using pytest and Tox, Developer documentation, Continuous Integration, Travis-CI, ReadTheDocs. Designing Runnerly, The Runnerly application, Monolithic design, Model, View and Template, Background tasks, Strava token, Authentication and authorization, Putting together the monolithic design, Splitting the monolith, Data Service, Using Open API 2.0,	15 L
UNIT III	Interacting with Other Services, Synchronous calls, Using Session in a Flask app, Connection pooling, HTTP cache headers, Improving data transfer, GZIP compression, Binary payloads, Putting it together, Asynchronous calls, Task queues, Topic queues, Publish/subscribe, RPC over AMQP, Putting it together, Testing, Mocking synchronous calls, Mocking asynchronous calls, Mocking Celery, Mocking other asynchronous calls Monitoring Your Services, Centralizing logs, Setting up Graylog, Sending logs to Graylog, Adding extra fields, Performance metrics, System metrics, Code metrics, Web server metrics	15 L
UNIT IV	Securing Your Services, The OAuth2 protocol, Token-based authentication, The JWT standard, PyJWT, X.509 certificate-based authentication, The TokenDealer microservice, The POST/oauth/token implementation, Using TokenDealer. Bringing It All Together, building a ReactJS dashboard, The JSX syntax, React components, ReactJS and Flask, Using Bower, npm, and Babel, Cross-origin resource sharing, Authentication and authorization, Interacting with Data Service, Getting the Strava token, JavaScript authentication.	15 L

Course Code RPSITP102	Course Name Practical Of RPSIT102 (Microservices Architecture)	Credits 2
	1. Create simple microservice to create TODo app 2. Create a feedback form with backend database connectivity 3. Create microservices for booking app 4. Create microservice to demonstrate use of Runnerly application 5. Create a microservice for chatbot and secure the service. 6. Demonstrate microservices using ReactJS and Flask 7. Demonstrate the working of Strava Token using ReatJS	

Main References:
1. Python microservices Development Tarek Ziade Packt

Additional References:
1. Kubernetes Microservices with Docker, Deepak Vohra, Apress
2. Microservice Architecture, Irakli Nadareishvali, Ronnie Mitra, Matt McLarty & Mike Amundsen, O'Reilly

Course Code: **RPSIT103**
Course Title: **FULL STACK WEB DEVELOPMENT - I**
Academic Year: 2021-22

Course Outcomes:

Course Outcomes	Description
CO 1	Identify and define the need of Angular.js in Web Development.
CO 2	Implement MVC pattern of efficient and quick application development.
CO 3	Develop secure cloud based applications.
CO 4	Work with Modern Database technology like MongoDB.
CO 5	Design responsive and interactive web sites.

CO 6	Job ready and accept the MEAN Stack Developer profile.

Course Code RPSIT103	Course Title - FULL STACK WEB DEVELOPMENT - I	Credits 4 Lectures
I	**Introduction to Angular.js:** Getting Ready, Your First AngularJS App, Putting AngularJS in Context, HTML and Bootstrap CSS Primer, JavaScript Primer, Introduction to MVC, Filters and Modules, SportsStore: A Real Application, Navigation and Checkout , Orders and Administration. **Working with Anuglar.js:** The Anatomy of an AngularJS App, Using Binding and Template Directives, Using Element and Event Directives, Working with Forms, Using Controllers and Scopes, Using Filters, Creating Custom Directives, Creating Complex Directives, Advanced Directive Features.	15 L
II	**Angular.js Web Services:** Working with Modules and Services, Services and Server Communication , Services for Global Objects, Errors, and Expressions, Services for Ajax and Promises, Services for REST, Services for Views & Organizing Views, Services for Animation and Touch, Services for Provision and Injection, Unit Testing, Deployment Considerations. Building a data model with MongoDB and Mongoose, Writing a REST API: Exposing the MongoDB database to the application, Consuming a REST API: Using an API from inside Express, Adding Angular components to an Express application, Building a single-page application with Angular: Foundations, Building an SPA with Angular: The next level, Authenticating users, managing sessions, and securing APIs	15 L
III	**Working with Express.JS Framework:** Introduction, Quickstart, The Interface, Tips & Tricks, Examples, ExpressWorks, Building a Web server with Express, The basics of Node.js, Foundations of Express, Middleware, Routing, Building APIs, Views and templates: Pug and EJS, Persisting your data with MongoDB, Testing Express applications, Security, Deployment: assets and Heroku, Best practice.	15 L

IV	**Introduction to CodeIgniter Framework:** Welcome to the MVC World, Agile Methodologies and Approaches, A 10,000-Foot View of CodeIgniter, Creating the Main Web Site, Building a Shopping Cart, Creating a Dashboard, Improving the Dashboard, Last-Minute Upgrades, Security and Performance, Launch.	15 L

Course Code RPSITP103	Course Name PRACTICAL OF RPSIT103 (FULL STACK WEB DEVELOPMENT - I)	Cred its 2
1	Designing a login page using captcha with help of database.	
2	Designing home page based on some case study.	
3	Implementing a shopping cart for some case study.	
4	Designing responsive photo gallery taking some case study	
5	Designing a data entry form using all the controls studied.	
6	Design and implement web pages with its various features on various case studies like: • Online shopping portal • E-school portal • Online learning platform etc... Students should be able to implement a new idea after doing all the Make use of various technologies like MongoDB, ExpressJS, NodeJS and AngularJS.	

Main References:
- Pro Angular JS, Adam Freeman, Apress.
- Beginning Angular JS, Andrew Grant, Apress.
- Express.js Guide, The Comprehensive Book on Express.js, Azat Mardan
- Express in Action - Writing, building, and testing Node.js applications, EVAN M. HAHN, Manning
- Professional CodeIgniter®, Thomas Myer, Wrox Publication
- Practical MongoDB Architecting, Developing, and Administering MongoDB, Shakuntala Gupta Edward, Navin Sabharwal, Apress.
- The Definitive Guide to MongoDB - A complete guide to dealing with Big Data using MongoDB, David Hows, Eelco Plugge, Peter Membrey & Tim Hawkins, Apress.

Additional References:
- Getting MEAN with Mongo, Express, Angular, and Node by SIMON HOLMES, Manning
- https://www.tutorialsteacher.com/angularjs/angularjs-tutorials
- https://www.w3schools.com/angular/
- https://docs.angularjs.org/tutorial
- https://www.tutorialspoint.com/angularjs/index.htm
- The Little MongoDB, Kari Seguin
- Practical CodeIgniter 3 From the trenches advice and techniques for making the most out of CodeIgniter, Lonnie Ezell
- CodeIgniter for Rapid PHP Application Development, David Upton, PACKT Publishing
- Next Generation Databases NoSQL, NewSQL, and Big Data, Guy Harrison, Apress

Course Code: **RPSIT104**
Course Title: **ADVANCED IoT**
Academic Year: 2021-22

Course Outcomes:

Course Outcomes	Description
CO 1	Identify and Define Industrial Internet of Things.
CO 2	Design the prototype and give solutions for the real world problems.
CO 3	Develop smart applications with the help of smart devices.
CO 4	Demonstrate the implementation of IoT based applications in Cloud.
CO 5	Propose and apply automation in industry.

COURSE CODE RPSIT104	COURSE NAME ADVANCED IoT	CREDITS 4 LECTURES
UNIT I	**IoT Ecosystems Concepts and Architecture:** Internet of Things An Overview, Open Source Semantic Web Infrastructure for Managing IoT Resources in the Cloud, Device/Cloud Collaboration Framework for Intelligence Applications, Fog Computing: Principles, Architectures and Applications, Programming Frameworks For Internet Of Things, Security And Privacy In The Internet Of Things, Cloud-Based Smart-Facilities Management.	15 L
UNIT II	**Industrial Internet of Things:** Introduction to the Industrial Internet, Industrial Internet Use-Cases, The Technical and Business Innovators of the Industrial Internet, IIoT Reference Architecture, Designing Industrial Internet Systems, Examining the Access Network Technology and Protocols, Examining the Middleware Transport Protocols.	15 L
UNIT III	**Software's, Protocols and Technologies:** Middleware Software Patterns, Software Design Concepts, Middleware Industrial Internet of Things Platforms, IIoT WAN Technologies and Protocols, Securing the Industrial Internet, Introducing Industry 4.0, Getting From Here to There: A Roadmap.	15 L
UNIT IV	**Edge Computing & IoT Applications:** Defining IOt Analytics & Challenges, IoT Analytics for Cloud, Creating an AWS Cloud Analytics Environment, Collecting All that Data - Strategies & Techniques, **IoT Applications:** Smart Metering/Advanced Metering Infrastructure, e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking (Following and Monitoring Mobile Objects), Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications, Smart Factories.	15 L

COURSE CODE RPSITP104	COURSE NAME PRACTICAL OF RPSIT104 (ADVANCED IoT)	CREDITS 2
1	Interfacing Sensors (Gas,Water,Fire,Touch etc). Relay Board and Communication with telegram and Display status on 16x2 LCD ie M2M Communication	
2	Interfacing Temperature and Humidity sensor with Cloud and Sending Tweet if temperature and Humidity are beyond set range	
3	Python Flask Server Trigger a set of led Gpios on the pi via a Python Flask web server	
4	MQTT connecting Pis Setup a Mosquito MQTT server and client and write a Python script to communicate data between Pi's And MQTT GYRO Interface with an Accelerometer Gyro Mpu6050 on the i2c bus and send sensor values over the internet via mqtt.	
5	Design Intruder using PIR Sensor and Pi Camera which send Email when Someone is on Door	
6	Design App to Communicate with Device connected to RPi and Display Status of Sensor on App	
7	Using NodeMCU Design Sensor Node, Collect information using Raspberry Pi and Display on Cloud	
8	Voice Control of Devices using Blynk, IFTTT and Webhooks	
9	Working with IoT cloud platforms - IBM Watson, Google IoT, AWS IoT etc	
10	Exploring IoT Simulation Environment	

Main References:
1. Internet of Things Principles and Paradigm, Rajkumar Buyya, Amir Vahid Dastjerdi, Morgan Kaufman
2. Industry 4.0 - The Industrial Internet Of Things, Alasdair Gilchrist, Apress
3. Building The Internet of Things with IPv6 and MIPv6, Daniel Minoli, Wiley

Additional References:
- Interconnecting Smart Objects with IP The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kaufmann Publishers
- Getting Started with Raspberry Pi Zero, Richard Grimmett, Packt
- Getting Started with the Internet of Things, Cuno Pfister, O'Reilly

SEMESTER II
Course Code: **RPSIT201**
Course Title: **BLOCKCHAIN TECHNOLOGY**
Academic Year: 2021-22

Course Outcome	Description
CO 1	To understand Blockchain technology and its application
CO 2	To Gain knowledge about bitcoin technology
CO 3	To develop Etherium application using solidity
CO 4	To know working of private blockchain using Hyperledger Fabric
CO5	To study different blockchain use cases

COURSE CODE RPSIT201	COURSE NAME BLOCKCHAIN TECHNOLOGY	CREDITS 4 LECTURE
UNIT I	**Introduction to Blockchain :**Centralised Database, Addresses, Transaction Distributed Databases, Blockchain: An Information Technology, Trust: The Byzantine Generals Problem, Satoshi Nakamoto's Blockchain Breakthrough, Types of Blockchain	15 L
UNIT II	**Bitcoin technology**: Cryptology, Bitcoin Addresses, Transactions:Transaction scripts, multisignature transaction ,transaction signature, hash function, timestamp, Proof of work, Double spend and other attacks, Transaction spanning, merkle tree, Wallet, Mining, Selfish mining ,alternative coins	15 L
UNIT III	**Etherium:** Concept, notion of decentralization, Ethereum mining, forking, and block architecture, Ethereum wallets and client interfaces ,Comparison to bitcoin, Smart contracts, Slashing Transactions Costs, Characteristics of smart contract, Smart contract example, types of smart contract, Construct smart contract with solidity, Accessing contracts and transaction with solidity **Hyperledger Fabric**: Introduction, Features, Architecture, Requirements, Components of fabric, Working of fabric	15 L
UNIT IV	**Blockchain Use cases:** Business Use Cases, Technology Use Cases, Legal and Governance Use Cases, Private block chain Use cases	15 L

COURSE CODE RPSITP201	COURSE NAME PRACTICAL OF RPSIT201 (BLOCKCHAIN TECHNOLOGY)	CREDITS 2
1	Linked list Implementation.	
2	Cryptography Fundamentals	
3	Simple blockchain implementation	

4	Block chain implementation with database	
5	Smart contract with token/coin.	
6	Smart Contract to solve/optimize a problem using Ethereum	
7	create a DApp, with Ethereum	
8	Enterprise Block chain using hyperledger fabric	
9	Blockchain case Study	

References:

1**.**   Understanding Bitcoin , PEDRO FRANCO,Wiley
2.   A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara Paul R. Allen
3.   Ethereum Smart Contract Development, Mayukh Mukhopadhyay,packt
4.   Blockchain A Beginners Guide,BlockchainHub

Additional References:
- Mastering Etherium, Andreas M. Antonopoulos,O'relly
- Mastering Bitcoin by Andreas M. Antonopoulos,O'relly
- Mastering Blockchain,ImranBashir,packt
- https://solidity.readthedocs.io/en/v0.6.2/
- Bitcoin whitepaper
- Blockchain For Dummies,Tiana Laurence

Course Code: **RPSIT202**
Course Title:**BIG DATA ANALYTICS**
Academic Year: 2021-22

Course Outcomes	Description
CO 1	Judge the applicability for Big data solution to Use case
CO 2	Interpret Big data Ecosystem and lifecycle
CO 3	Create customized solution using big data technologies to solve real world problems

CO 4	Implement techniques and concepts to handle unstructured data
CO 5	Develop Programs with Map Reduce PAradigm.

COURSE CODE RPSIT202	COURSE NAME BIG DATA ANALYTICS	CREDITS 4 LECTURE
UNIT I	**INTRODUCTION TO BIG DATA** **Big Data - From the Business Perspective:** Characteristics of Big Data, The 5 Vs of Data, Data in the Warehouse and Data in Hadoop, Importance of Big Data, When to Consider a Big Data Solution **Big Data Use Cases:** Patterns for Big Data Deployment, IT for IT Log Analytics, The Fraud Detection Pattern, The Social Media Pattern, The Call Centers, Risk: Patterns for Modeling and Management, Big Data and the Energy Sector **BIG DATA ANALYTICS FUNDAMENTALS** **Introduction to Big Data Analytics:** Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics **Data Analytics Life Cycle:** Data Analytics Lifecycle Overview, Discovery, Preparation, Model Planning, Model Building, Communicate Results, Operationalize, Case Study: Global Innovation Network and Analysis (GINA).	15 L
UNIT II	**Unstructured data:** Basics, Limitations of RDBMS to store unstructured data, Nosql databases:Features, Types, case studies, Natural Language Processing for Text, Introduction to data lake, Data lake Applications and uses	15 L
UNIT III	**INTRODUCTION TO MAP REDUCE** The map tasks, Grouping by key, The reduce tasks, Combiners, Details of MapReduce Execution, Coping with node failures. Algorithms Using MapReduce: Matrix-Vector Multiplication, Computing Selections and Projections, Union, Intersection, and Difference, Natural Join, sorting, Role of Map reduce.	15 L

| UNIT IV | **BIG DATA TECHNOLOGIES**
Fundamentals of Hadoop: Hadoop Ecosystem, Data, Data Storage and Analysis, Querying All Data, Comparison with Other Systems, Moving data in and out of Hadoop
The Hadoop Distributed File System: The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop Filesystems, The Java Interface, Data Flow.
Hadoop Plugins- Pig fundamentals, working with Hive , Introduction to Spark. | 15 L |

COURSE CODE RPSITP202	COURSE NAME PRACTICAL OF RPSIT202 (BIG DATA ANALYTICS)	CREDITS 2
	1. Nosql : key- value pair 2. NoSql:column-store 3. NLP 4. Map reduce for Maximum 5. Map reduce for Semi-join 6. Mapreduce for sorting 7. Moving data in and out of hadoop 8. Hadoop plugins Design and implementation of minimum two case studies based on the domain of the subject.	

References:
1. Understanding Big data , Chris Eaton, Dirk deroos et al. , McGraw Hill, 2012.
2. Hadoop The Definitive Guide, Tom White, O'Reilly,3rd edition.
3. Hadoop in Practice , Alex Holmes ,Manning Publications Co.
4. Natural Language processing with Python" Analyzing Text with Natural Language Toolkit. - By Steven Bird, Ewan Klein, Edward Loper, O'Reilly Media
5. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services,2015.
6. Big Data Analytics with R and Hadoop, Vignesh Prajapati, PACKT Publishing,2013.
7. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012.
8. Mastering Apache Spark, Mike Frampton, PACKT Publication

Additional References:
1. Professional Hadoop Solutions, Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, WROX
2. http://www.bigdatauniversity.com/
3. EMC Material/Courseware: https://education.etnc.com/

Course Code: **RPSIT203**
Course Title: **MACHINE LEARNING**
Academic Year: 2021-22

Course Outcomes	Description
CO 1	Develop an appreciation for what is involved in learning from data.
CO 2	Understand a wide variety of learning algorithms.
CO 3	Understand how to apply a variety of learning algorithms to data.
CO 4	Understand how to perform evaluation of learning algorithms and model selection.

COURSE CODE RPSIT203	COURSE NAME MACHINE LEARNING	CREDITS 4 LECTURE
UNIT I	**Inference in Probabilistic Models:** Probabilistic Reasoning, Basic Graph Concepts, Belief Networks, Graphical Models, Efficient Inference in Trees. **Learning in Probabilistic Models:** Statistics for Machine Learning, Learning as Inference, Naive Bayes,1 Learning with Hidden Variables, Bayesian Model Selection.	15 L
UNIT II	**Machine Learning:** Machine Learning Concepts, Nearest Neighbor Classification, Unsupervised Linear Dimension Reduction, Supervised Linear Dimension Reduction, Bayesian Linear Models.	15 L
UNIT III	Dynamical Models: Discrete-State Markov Models, Continuous-state Markov Models, Switching Linear Dynamical Systems, Distributed Computation, Approximate Inference.	15 L
UNIT IV	Deep Learning: Deep forward Networks, Regularization of Deep Learning, Optimization of Train Deep Models, Convolution Networks, Sequence Modeling: Recurrent and Recursive Nets	15 L

COURSE CODE RPSITP203	COURSE NAME PRACTICAL OF RPSIT203 (MACHINE LEARNING)	CREDITS 2
1	Apply Bayesian learning to Gene Regulatory Network.	
2	Show how to apply Bayesian network and machine learning for Biomonitoring systems.	
3	Implement classification for books in library using Machine Learning and Bayesian methods	
4	Develop a semantic searching system to generate more relevant results using Machine Learning.	
5	For a given image/s perform image cleaning and auto enhancement using ML techniques.	
6	Create a BN to infer different types of biological network from Bayesian structure learning	
7	Using Deep Learning for spam filter	
8	Develop and information retrieval system using Deep Learning.	

References:
1. Bayesian Reasoning and Machine Learning, David Barber
2. Deep Learning Ian Goodfellow, Yoshua Bengio, Aaron Courville MIT Press

Course Code: **RPSIT204**
Course Title: **FULL STACK WEB DEVELOPMENT - I**I
Academic Year: 2021-22

Course Outcomes:

Course Outcomes	Description
CO 1	Identify and define the need of Node.js in Web Development.
CO 2	Implement MVC pattern of efficient and quick application development.
CO 3	Develop secure cloud based applications.
CO 4	Work with Modern Database technology like MongoDB.
CO 5	Design responsive and interactive web sites.
CO 6	Job ready and accept the MERN Stack Developer profile.

COURSE CODE RPSIT204	COURSE NAME FULL STACK WEB DEVELOPMENT - II	CREDITS 4 LECTURE
UNIT I	**Introduction to Node.JS:** Setting Up & Understanding Node.js Development, Core Node.js, Node.js Packages, Events and Streams, Getting Started with HTTP, Introducing Express to Create Node.js Web Apps, Persisting Data with MongoDB and Mongoskin, Front-End Basics, Simplifying Callbacks.	15 L

UNIT II	**Building Applications with Node.JS:** Using Sessions and OAuth to Authorize and Authenticate, Users in Node.js Apps, Boosting Your Node.js Data with the Mongoose ORM Library, Building Node.js REST API Servers with Express.js and Hapi, Real-Time Apps with WebSocket, Socket.IO, and DerbyJS, Getting Node.js Apps Production Ready, Deploying Node.js Apps, Debugging & Testing, Deploying-Publishing and Scalability of NOde.JS Apps, Modules and contributing to Open Source	15 L
UNIT III	Django: Introduction to DJango, View & URL Confs, Templates, Models, Com, Deploying Django, Integrating with Legacy Database and Applications.	15 L
UNIT IV	**Introduction to React.JS:** Beginner's Guide to React.JS, Form Validation, Saving Data Using React.JS, Game Creation using React.JS.	15 L

COURSE CODE RPSITP204	COURSE TITLE PRACTICAL OF RPSIT204 (FULL STACK WEB DEVELOPMENT - II)	CREDITS 2
	Design and implement web pages with its various features on various case studies like: ● Online shopping portal ● E-school portal ● Online learning platform etc... Students should be able to implement a new idea after doing all the Make use of various technologies like MongoDB, ExpressJS, NodeJS and ReactJS.	

Main References:
1. Beginning Node.JS, Basarat Ali Khan, Apress.
2. Practical Node.JS Building Real-world Scalable Web Apps, Azat Mardan. Apress.
3. MERN Quickstart Guide - Build web applications with MongoDB, Express.js, React, and Node, Eddy Wilson Iriarte Koroliova, Packt.
4. Express.JS Guide - The Comprehensive Book on Express.JS, Azat Mardan, Leanpub.
5. The Complete Beginner's Guide to React, Kristen Dyrr.

Additional References:
1. Web Development with Node & Express, Ethan Brown, O'Reilly.
2. The Express Handbook, Flavico Copes
3. Node.JS Notes for Professionals
4. https://www.w3schools.com/nodejs/
5. https://www.tutorialspoint.com/nodejs/index.htm
6. https://www.javatpoint.com/nodejs-tutorial
7. https://www.tutorialspoint.com/reactjs/index.htm
8. https://reactjs.org/tutorial/tutorial.html
9. https://www.w3schools.com/whatis/whatis_react.asp
10. https://www.tutorialspoint.com/expressjs/index.htm
11. https://www.javatpoint.com/expressjs-tutorial
12. https://expressjs.com/

SEMESTER - III

Course Code: **RPSIT301**
Course Title: **CLOUD COMPUTING**
Academic Year: 2021-22

Course Outcomes	Description
CO 1	Understand the Cloud Computing, Parallel Computing & Virtualization concepts
CO 2	Discuss the Cloud Architecture and its Implementation

CO 3	Demonstrate Cloud Programming and various Software Platforms and Environment
CO 4	Understand Mobile Computing and its importance
CO 5	Learn and Understand various Security & Privacy concepts in Cloud

COURSE CODE RPSIT301	COURSE NAME CLOUD COMPUTING	CREDITS 4 LECTURES
I	**Distributed System Models and Enabling Technologies:** Scalable Computing Service over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency Computer Clusters for scalable parallel computing: Clustering for massive parallelism **Virtual machines and Virtualization of clusters and Data centers:** Implementation levels of virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory & I/O Devices, Virtual Cluster Resource Management, Virtualization for Data Center Automation.	15 L
II	**Cloud Platform Architecture over Virtualized Data Centers:** Cloud Computing & Service Models, Data Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and AZURE, Inter-cloud Resource Management, Cloud Security and Trust Management. **Cloud Programming and Software Environments:** Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.	15 L

III	**Cloud Computing for Mobility:** Mobile Computing, Mobile Cloud Computing, Offloading in Mobile Cloud Computing, Green Mobile Cloud Computing, Resource Allocation in Mobile Cloud Computing, Sensor Mobile Cloud Computing, Mobile Social Cloud Computing.	15 L
IV	**Security & Applications of Mobile Cloud Computing:** Privacy and Security in Mobile Cloud Computing, Trust in Mobile Cloud Computing, Vehicular Mobile Cloud Computing, Business Aspects of Mobile Cloud Computing, Application of Mobile Cloud Computing, Future Research Scope of Mobile Cloud Computing	15 L

COURSE CODE RPSITP301	COURSE NAME PRACTICAL OF RPSIT301 (CLOUD COMPUTING)	CREDITS 2
	1. Create virtual networks of windows 7 systems using VMWare Technologies. 2. Create a Windows based client-server system using Windows 2012 Hyper-V. 3. Create a Linux based client-server system using Citrix Xen Server 4. Implement server clusters using Windows 2012 Hyper-V. 5. Working with a Cloud Management Software(OpenNebula/Eucalyptus) 6. Create a small website application using Google App Engine 7. Create a small website application using Windows Azure 8. Implement MapReduce and Hadoop 9. Using cloud database for storage. (Google/AWS etc)	

References:

1. Kai Hwang, Jack Dongarra, Geoffrey Fox: Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, MK Publishers, 2012.
2. MOBILE CLOUD COMPUTING - Architectures, Algorithms and Applications, Debashis De

Additional Reference:

1. Michael Miller, Cloud Computing: Web-Based Applications that change the Way you work and collaborate Online, Pearson Publication, 2012.
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Fill, 2010.

Course Code: **RPSIT302**
Course Title: **DIGITAL FORENSIC**
Academic Year: 2021-22

Course Outcomes	Description
CO 1	Understand Digital Forensics Process
CO 2	Study different types of evidences and procedure to maintain integrity
CO 3	Apply evidence acquisition techniques
CO 4	Gain Knowledge about different domains of Digital forensics
CO 5	Explore digital forensics software

COURSE CODE RPSIT302	COURSE NAME DIGITAL FORENSIC	CREDITS 4 LECTURES

I	**Computer Forensics**: Computer Forensics and Investigation Processes, Understanding Computing Investigations, The Investigator's Office and Laboratory, Data Acquisitions **Data Recovery:** Data Recovery and Backup, Role of Data Recovery, Hiding and Recovering Hidden Data. Evidence Collection: Need to Collect the Evidence, Types of Evidences, The Rules of Evidence, Collection Steps, Computer Image Verification and Authentication: Special Needs of Evidence Authentication. Identification of Data: Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices	15L
II	**Network Forensics Fundamentals:** Types of digital evidence, Challenges to network evidence, Network forensics methodology, Sources of Network Based Evidence, case study **Network Evidence Acquisition and analysis:** Physical Interception, Traffic Acquisition Software, Active Acquisition, Protocol Analysis, Packet Analysis, Flow Analysis, Higher-Layer Traffic analysis. Statistical Flow Analysis, Collection and Aggregation, Analysis. case study	15L
III	**Wireless Network Forensics:** The IEEE Layer 2 Protocol Series, Wireless Access Point, Wireless Traffic Capture and Analysis, Common Attacks, Case study **Cloud forensics:** Need of cloud forensics, usage of forensics, Dimensions of forensics, Challenges in cloud forensics, opportunities in cloud forensics, Evidence Collection in the Cloud , , Admissibility of Cloud Evidence, case study	15L

IV	**Mobile forensics:** Crime and mobile phone,Mobile evidence,Forensics Procedure, Data Preservation and Isolation from the Network , Identifi cation of the Phone , Examination of the SIM Card and the Memory of the Phone,finding report,Mobile forensics tools,case study **Sim Card analysis**: Location Information File and Broadcast Control Channel File,SMS storage file, External Memory Dump	15L

COURSE CODE RPSITP302	COURSE NAME PRACTICAL OF RPSIT302 (**DIGITAL FORENSICS**)	CREDITS 2
1.	File System Analysis	
2.	Windows forensics tools	
3.	Data acquisition tools	
4.	Forensics Investigation	
5	Use of stegnography tools	
6.	Network Traffic capturing and analysis tools	
7.	Email Forensics tools	
8.	Mobile forensics tools	

9.	Password cracking tools	

Main References:

1. Guide to Computer Forensics and Investigations Bell Nelson, Amelia Phillips, Christopher Steuart, 4th Edition, Cengage Learning.
2. Computer Forensics Computer Crime Scene Investigation, John R. Vacca, Second Edition, 2005.
3. Network Forensics, Sherri Davidoff, Jonathan HAM, Prentice Hall, 2012.
4. Mobile Phone Security and Forensic: A Practical Approach, Second Edition, IosifI. Androulidkis, Springer, 2012
5. Digital Forensics for Network, Internet, and Cloud Computing_ A Forensic Evidence Guide for Moving Targets and Data,Clint P. Garrison

Additional Reference:

1.   The Basics of Digital Forensics_ The Primer for Getting Started in Digital Forensics, John Sammons

Course Code: **RPSIT303**
Course Title: **UX / UI DESIGNING**
Academic Year: 2021-22

Course Outcomes	Description
CO 1	Understand what UX/UI Designing is and the importance of user-centered design.
CO 2	Understand how the sensory, cognitive and physical capabilities or users help in the designing of interactive products.
CO 3	Understand the process of UX/UI design that include prototyping, evaluation and implementation.

COURSE CODE RPSIT303	COURSE NAME UX / UI DESIGNING	CREDITS 4 LECTURES

I	**Introduction and Elements of UX Designing:** Introduction to UX Designing, User Experience and Why It Matters, Meet the Elements, The Strategy Plane, The Scope Plane, The Structure Plane, The Skeleton Plane, The Surface Plane.	15 L
II	**UX Designing Process: The Wheel:** A Lifecycle Template, Contextual Inquiry: Eliciting Work Activity Data, Contextual Analysis: Consolidating and Interpreting Work Activity Data, Extracting Interaction Design Requirements, Constructing Design-Informing Models, Design Thinking, Ideation, and Sketching, Mental Models and Conceptual Design, Design Production, UX Goals, Metrics, and Targets, Prototyping.	15 L
III	**User Experience Research Techniques:** Research Planning, Competitive Research, Universal Tools: Recruiting and Interviewing, Focus Groups, More Than Words: Object-Based Techniques, Field Visits: Learning from Observation, Diary Studies, Usability Tests, Surveys, Global and Cross-Cultural Research, Others' Hard Work: Published Information and Consultants, Analyzing Qualitative Data, Automatically Gathered Information: Usage Data and Customer Feedback.	15 L
IV	**Introduction to UI Designing:** A Design Process for Digital Products, Understanding the Problem: Design Research, Modeling Users: Personas and Goals, Setting the Vision: Scenarios and Design Requirements, Designing the Product: Framework and Refinement, A Basis for Good Product Behavior, Digital Etiquette, Designing for the Desktop, Designing for Mobile and Other Devices, Designing for the Web, Design Details: Controls and Dialogs.	15 L

COURSE CODE RPSITP303	COURSE NAME PRACTICAL OF RPSIT303 (**UX/UI DESIGNING**)	CREDITS 2

	Designing UX/UI for various domains as given below: ● Interface for online shopping website. ● e learning web site ● Video/ Audio on demand web site ● ATM interface ● Automatic vending machine for Drinks ● Route finder ● Students' Kiosk for institute's information ● Web site for buying Car ● Week end holidays ● Pass port application tracking system ● Zoo information kiosk ● Museum Information Center ● Help desk for Hotel ● Patients information storage ● Catering Service (on-line chef) ● Marriage burro ● Placement agency ● Event management	
	Technologies - JavaScript, JQuery, BootStrap, HTML 5, CSS3, Image Editing Tools (Photoshop, CorelDraw, Illustrator) etc.	

Main References:
1. The Elements Of User Experience - User Centered Design For The Web And Beyond , Jesse James Garrett.
2. The UX Book - Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson, Pardha S. Pyla, Morgan Kaufmann.
3. Observing the User Experience - A Practitioner's Guide to User Research, Elizabeth Goodman, Mike Kuniavsky, Andrea Moed - Morgan Kaufmann.
4. The Essentials of Interaction Design, Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel with Jason Csizmadi, and Doug LeMoine, 4th Edition, Wiley.

Additional References:
1. Interaction Design Beyond Human–Computer Interaction, Preece, Sharp & Rogers, 4th Edition, Wiley.
2. Designing with the Mind in Mind - Simple Guide to Understanding User Interface Design Guidelines, Jeff Johnson, 2nd Edition, Morgan Kaufmann.
3. Designing Interfaces, Jenifer Tidwell, 2nd Edition, O'Reilly.

Course Code: **RPSITP304**
Course Title: **PROJECT**
Academic Year: 2021-22

Course Outcomes	Description
CO 1	Enhance problem solving skills
CO 2	Undertake research based projects.
CO 3	Demonstrate the use of tools/technologies they learn for implementing their ideas.
CO 4	Provide solutions to the real world problems using technology
CO 5	Implementation of programming skills.

COURSE CODE RPSITP304	COURSE NAME PROJECT	CREDITS 6

Course Objective:
- To make students use their knowledge in solving real world problems.
- To encourage students to take up some research-based project.
- To encourage students to use the tools/technologies they learn for implementing their ideas.

The syllabus proposes project implementation as part of the semester–IV. The student is expected to give a presentation of the project proposed and get verified and sanctioned by the project guide. In addition, experimental set up, analysis of results, comparison with results of related works, conclusion and future prospects will be part of the project implementation. A student is expected to make a project implementation report and appear for a project viva. He or she needs to spend around 200-250 hours on the project implementation for which the student will be awarder 6 credits.

SEMESTER - IV

Course Code: **RPSIT401**
Course Title: **PENETRATION TESTING**
Academic Year: 2021-22

Course Outcomes	Description
CO 1	Identify the core concepts related to computer software and hardware.
CO 2	Apply various ways to find the vulnerabilities and solutions to them.
CO 3	Analyze the legal issues and IT Laws laid down in the Cyber Security.
CO 4	Exploit and find the vulnerabilities using various tools.
CO 5	Develop an excellent understanding of current cyber security issues and ways that user, administrator, and programmer errors can lead to exploitable insecurities

COURSE CODE RPSIT401	COURSE NAME PENETRATION TESTING	CREDITS 4 LECTURES
I	Introduction to Ethical Hacking, System Fundamentals, Cryptography, Footprinting, Scanning, Enumeration	15 L
II	System Hacking, Malware, Sniffers, Social Engineering, Denial of Service, Session Hijacking	15 L\
III	Web Servers & Applications, SQL Injection, Hacking Wi-Fi & Bluetooth, Mobile Devices, Evasion, Cloud Technologies & Security, Physical Security	15 L
IV	Indian Cyber & Data Protection Law, Protection of Personal Data & EU Principles, Cyberspace Regulations & Role of United Nations.	15 L

COURSE CODE RPSITP401	COURSE NAME PRACTICAL OF RPSIT401 (ETHICAL HACKING)	CREDITS 2
	1. Using Footprinting, Reconnaissance & Social Engineering tools 2. Using Network Scanning & Enumeration tools 3. Using System Hacking tools 4. Using Trojans, Backdoors, Viruses & Worms tools 5. Using tools for sniffing 6. Using tools for Web Hacking (webservers, session hijacking, sql injections) 7. Using tools for wireless hacking 8. Using tools for evading IDS, Firewalls 9. Using Cryptanalysis.	

Text Books:
1. Ethical Hacking Study Guide, Sean-Philip Oriyano, Wiley Publishing
2. Hacking Exposed Network Security Secrets & Solutions, Stuart McClure, Joel Scambray
3. The Indian Cyber Law, Suresh T. Vishwanathan, Bharat Law House, New Delhi

Course Code: **RPSITP402**
Course Title: **INTERNSHIP**
Academic Year: 2021-22

Course Outcomes	Description
CO 1	Introduce the students to the real world work environment.
CO 2	Exposure to new and upcoming trends and technologies in the IT Industry.
CO 3	Help students to understand the needs of the IT Industry.
CO 4	Overall development of students.
CO 5	Enhance Team Building capacities, cooperation and coordination among themselves, communications skills and many more.

COURSE CODE RPSITP402	COURSE NAME INTERNSHIP (**Approx.** 600-650 **hrs)**	CREDITS 18

Course Objective:
- To introduce students to the work environment of industry.
- To gain and acquire the knowledge pertaining to real world problems.

The syllabus proposes an internship for about 600-650 hours to be done by a student. It is expected that a student chooses an IT or IT-related industry and formally works as a full time intern during the period. The student should give a presentation of the internship subject as the part of internship evaluation with proper documentation of the attendance and the type of work he or she has done in the chosen organization. Proper certification (as per the guidelines given) by the person, to whom the student was reporting, with the Organization's seal should be attached as part of the documentation. Students will be awarded 14 credits for the entire internship along with the final presentation in front of the examiners.

MSc Part I (Sem I & II) EVALUATION SCHEME

Owing to the pandemic situation prevailing in 2020 and continuing in 2021, the external examinations (Semester End) may be conducted online as per the instructions/circulars received from the University of Mumbai and Maharashtra State notifications from time to time. The conventional mode of external examination will commence again only after the declaration of normalcy by the Government authorities.

External Examination- 60%- 60 Marks
Semester End Theory Examination: (Deviation from the usual modality)

THEORY

Internal Exam - 40 Marks

1. **20 Marks -- MCQ Test:**
   Test will be taken based on any of the unit/units as informed by the faculty in-charge.
2. **20 Marks -**

    Develop Mini project in group(max four) and presentation of the same. / Online Course.

Note: Students have to acquire at least 40% marks in each paper individually.

External Examination - 60 Marks Duration 2½ Hrs

- **Pandemic changes**
  - MCQ

Theory Question Paper Pattern:-

All Questions are Compulsory		
Questions	**Based On**	**Marks**
Q1	Unit I	12
Q2	Unit II	12
Q3	Unit III	12
Q4	Unit IV	12
Q5	MIX	12

- All questions are compulsory with internal choice within the questions.
- **Each Question will have 3 sub-questions carrying 6 marks each, out of which student has to answer any 2.**

Note: Students have to acquire at least 40% marks in each paper individually.

PRACTICAL

Internal Exam - 20 Marks

1. **Innovative Practical -- 10 Marks**
   1. It can be clubbed with mini project as an additional application.
   2. Give a separate application based on the theory paper.

Regularity -- 10 Marks
   1. Timely submission of practical's on the Google classroom.
   2. Attendance should be 75%.
   3. Submission of e-journal on time.

Note: Students have to acquire at least 40% marks in each paper individually.

External Examination - 30 Marks Practical Question -
- 1 or 2 questions can be asked in the practical exam for each paper.
- External will be called for evaluating the same.

Note:
1. **Students who have submitted their e-Journal and certified are only allowed to appear for the exam.**
2. **Students have to acquire at least 40% marks in each paper individually.**

- **Pandemic changes**

    o MCQ, Viva, Written submission.

MSc Part II (Sem III & IV) EVALUATION SCHEME

THEORY

Internal Exam - 40 Marks

1. **20 Marks -- MCQ Test:**

   Test will be taken based on any of the unit/units as informed by the faculty in-charge.

1. **20 Marks –**

    Assignments based on syllabus or any other topic in demand based on syllabus.

Note: Students have to acquire at least 40% marks in each paper individually.

External Examination- 60%- 60 Marks

Semester End Theory Examination: (Deviation from the usual modality)

External Examination - 60 Marks Duration 2½ Hrs

- **Pandemic changes**
  - MCQ

Theory Question Paper Pattern:-

All Questions are Compulsory		
Questions	Based On	Marks
Q1	Unit I	12
Q2	Unit II	12
Q3	Unit III	12
Q4	Unit IV	12
Q5	MIX	12

-

- **Each Question will have 3 sub-questions carrying 6 marks each, out of which student has to answer any 2.**

Note: Students have to acquire at least 40% marks in each paper individually.

PRACTICAL

Internal Exam - 20 Marks

1. **Innovative Practical -- 10 Marks**
   1. It can be clubbed with assignment.
   2. Research paper review to be done for an application.

2. **Regularity -- 10 Marks**
   1. Timely submission of practical's on the Google classroom.
   2. Attendance should be 75%.
   3. Submission of e-journal on time.

Note: Students have to acquire at least 40% marks in each paper individually.

External Examination - 30 Marks Practical Question -
- 1 or 2 questions can be asked in the practical exam for each paper.
- External will be called for evaluating the same.

- **Pandemic changes**

  o MCQ, Viva, Written submission.

Note:

1. **Students who have submitted their e-Journal and certified are only allowed to appear for the exam.**
2. **Students have to acquire at least 40% marks in each paper individually.**

PROJECT EVALUATION - 150 Marks

Internal evaluation - 60 Marks

- Abstract submission & literature Survey / sample data collection - 10 Marks
- Technology Implementation - 10 marks
- Mid-Term Presentation - 20 Marks
- Project Documentation- 20 marks

External evaluation - 90 Marks

- Project Quality - 20 Marks.

- Project Implementation - 40 Marks.
- Presentation - 30 Marks.

A Student should submit project implementation report with following details:

1. **Title:** Title of the project.
2. **Implementation details:** A description of how the project has been implemented. It shall be of 2 to 4 pages.
3. **Experimental set up and results:** A detailed explanation on how experiments were conducted, what software used and the results obtained. Details like screen shots, tables and graphs can come here. It shall be of 6 to 10 pages.
4. **Analysis of the results:** A description on what the results means and how they have been arrived at. Different performing measures or statistical tools used etc may be part of this. It shall be of 4 to 6 pages.
5. **Conclusion:** A conclusion of the project performed in terms of its outcome (May be half a page).
6. **Future enhancement:** A small description on what enhancement can be done when more time and resources are available (May be half a page).
7. **Program code:** The program code may be given as appendix.

Note:
1. **Students have to acquire at least 40% marks in project evaluation.**
2. **Internal evaluation will be done by the Project guide allotted.**
3. **Timely submission on google classroom as per requirement is must, regularity will be determined based on that.**
4. **Attendance should be 75%.**

INTERNSHIP EVALUATION - 450 Marks

Internal evaluation - 180 Marks

Following are the guidelines for evaluation:

1. Job description : 20 Marks
2. Technical knowledge/skills : 40 Marks
3. Innovation & creativity : 40 Marks
4. Adherence to Schedule (weekly activity report) : 20 Marks
5. Soft Skills (Communication, Team work, Resource Management, Leadership qualities) : 40 Marks
6. Discipline & behavior : 20 Marks

External evaluation - 270 Marks (50% by employer & 50% by external examiner)

On the basis of the detailed internship report submitted by the student duly signed by the employer and the internal faculty. A presentation is expected from the student for sharing his / her learning experience and work done at the internship.

Following are the guidelines for evaluation:

1. Internship Report : 30 Marks
2. Innovation and creativity : 50 Marks
3. Experience based learning : 50 Marks
4. Viva : 20 Marks
5. Internship Genuineness : 20 Marks
6. Soft Skills : 30 Marks
7. Suitability & Clarity of material presented : 30 Marks
8. Quality of oral presentation : 40 Marks

Note: - Students need to find Internship by themselves. It's their responsibility.

Following things are expected to be completed by the student for the final evaluation.

1) The syllabus proposes an internship for about 600 hours to be done by a student.
2) It is expected that a student chooses an IT or IT-related industry and formally works as a full time intern during the period.
3) Evaluation will be done based on the feedback given by the employers about the student.
4) The student should subject oneself with an internship evaluation with proper documentation of the attendance and the type of work he or she has done in the chosen organization.

Following are the guidelines laid for the same

1) Internship joining Letter with proper job description.
2) Weekly Report in Excel format to be shown every week to Internal In-charge
   ● Start date
   ● End date
   ● Task Assigned
   ● Task completed
   ● Outcome / Learning's
3) Internship completion Letter with proper hours & task completed.

4) Employer Feedback Form is prepared to assess based on the following:
   ● Skills/ Knowledge
   ● Self-Management
   ● Dependability
   ● Attitude
   ● Relationships
5) Internship report :
   ● Organization Overview
   ● Description (Role, Activities, Technology Used, Live project link or screenshots)

- SWOT Analysis
- Introspection (knowledge acquired, Skills learned, challenging task performed)
- Employers Feedback.

6) Proper certification by the person, to whom the student was reporting, with Organization's seal should be attached as part of the documentation.

Note: - Students need to find Internship by themselves. It's their responsibility

PASSING CRITERIA 40%: - Students must acquire a minimum of 40% marks in each course individually (Theory, Practical, Project & Internship).