

Resolution No: AB/II (20-21).2.RPS7

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 2020–2021)**

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

SEMESTER III and IV Syllabus is for students belonging to 2019-2021 M.Sc. batch
Students joining in 2020-21 will have the revised syllabus.

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	Embedded Systems	4	RPSITP301	Embedded Systems	2
M.Sc IT	III	RPSIT302	Big Data Analytics	4	RPSITP302	Big Data Analytics	2
M.Sc IT	III	RPSIT303 A	Ethical Hacking	4	RPSITP303 A	Ethical Hacking	2
M.Sc IT	III	RPSIT303 B	Artificial Neural Networks	4	RPSITP303 B	Artificial Neural Networks	2
M.Sc IT	III	RPSIT304 A	Digital Forensics	4	RPSITP304 A	Digital Forensics	2
M.Sc IT	III	RPSIT304 B	Machine Learning	4	RPSITP304 B	Machine Learning	2

M.Sc (Information Technology)								
SEMESTER IV								
YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS	PRACTICAL COURSE	CREDITS	TOTAL CREDITS	
M.Sc IT	IV	RPSIT401	Information Security Management	4	RPSITP401	2	6	
M.Sc IT	IV	RPSITP402	Project					4
M.Sc IT	IV	RPSITP403	Internship (Approx 400 - 500 Hrs)					14

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.	15 L

	Time Series Analysis: Overview of Time Series Analysis, ARIMA Model, Additional Methods. Case Studies: Fraud detection, Social network Analysis, Causality, Epidemiology.	
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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, Reprinted 2008
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 Golemund, 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: 2020-21

Course Outcomes:

Course Outcomes	Description
CO 1	Describe the Microservices Architecture.
CO 2	Demonstrate various technological implementation for Microservices.
CO 3	Develop efficient and scalable applications in the cloud.
CO 4	Identify the need and usage of Microservices in various products.

Course Code RPSIT102	Microservices Architecture	Credits 4 Lectures
UNIT I	Introduction to Microservices: Microservices - The Evolutionary Architect, How to Model Services, Integration, Splitting the Monolith, Designing Microservice System, Establishing the Foundation.	15 L
UNIT II	Development & Testing: Inter-Service Communication, Developing Services, Data Management, Microservice Governance, Integrating Microservices.	15 L
UNIT III	Building Microservices with ASP.Net Core: ASP.Net Core Primer, Building a Microservice with ASP.Net Core, Backing Services, Creating a Data Service, Event Sourcing and CQRS.	15 L
UNIT IV	Building Microservices with ASP.Net Core: Building an ASP.Net Core Web Application, Service Discovery, Configuring Microservices Ecosystem, Securing Applications and Microservices, Building Real-Time Apps and services.	15 L

Course Code RPSITP102	Course Name Practical Of RPSIT102 (Microservices Architecture)	Credits 2
	Design and implement microservices based on various case studies like: <ul style="list-style-type: none"> • Online e-commerce platform • Educational services • Hospital services • Railway reservation • Airline reservation • Examination system 	

Main References:

1. Building Microservices - Designing Fine-grained Systems, Sam Newman, O'Reilly
2. Building Microservices with ASP.NET Core, Kevin Hoffmann, O'Reilly
3. Microservice Architecture, Irakli Nadareishvili, Ronnie Mitra, Matt McLarty & Mike Amundsen, O'Reilly
4. Microservices for the Enterprise Designing, Developing, and Deploying, Kasun Indrasiri, Prabath Siriwardena, Apress

5. PHP Microservices, Carlos Pérez Sánchez, Pablo Solar Vilariño, PACKT Publication
6. Pro PHP MVC, Chris Pit, Apress
Additional References:
1. Kubernetes Microservices with Docker, Deepak Vohra, Apress

Course Code: RPSIT103
 Course Title: FULL STACK WEB DEVELOPMENT - I
 Academic Year: 2020-21

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
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Course Code RPSITP103	Course Name PRACTICAL OF RPSIT103 (FULL STACK WEB DEVELOPMENT - I)	Credits 2
1	Designing a login page using captcha with help of database.	
2	Designing home page based on some case study.	
3	Implementing 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	<p>Design and implement web pages with its various features on various case studies like:</p> <ul style="list-style-type: none"> • Online shopping portal • E-school portal • Online learning platform etc... <p>Students should be able to implement a new idea after doing all the Make use of various technologies like MongoDB, ExpressJS, NodeJS and AngularJS.</p>	

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: 2020-21

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: 2020-21

Course Outcome	Description
CO 1	To understand Blockchain technology and its application
CO 2	To Gain knowledge about bitcoin technology
CO 3	To develop Ethereum 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 Ethereum, Andreas M. Antonopoulos, O'reilly
- Mastering Bitcoin by Andreas M. Antonopoulos, O'reilly
- Mastering Blockchain, Imran Bashir, packt
- <https://solidity.readthedocs.io/en/v0.6.2/>
- Bitcoin whitepaper
- Blockchain For Dummies, Tiana Laurence

Course Code: RPSIT202
 Course Title: BLOCKCHAIN TECHNOLOGY
 Academic Year: 2020-21

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	15 L

	<p>The Hadoop Distributed File System: The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop Filesystems, The Java Interface, Data Flow.</p> <p>Hadoop Plugins- Pig fundamentals, working with Hive , Introduction to Spark.</p>	
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COURSE CODE RPSITP202	COURSE NAME PRACTICAL OF RPSIT202 (BIG DATA ANALYTICS)	CREDITS 2
	<ol style="list-style-type: none"> 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 <p>Design and implementation of minimum two case studies based on the domain of the subject.</p>	

References:

1. Understanding Big data , Chris Eaton, Dirk deeroos 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: 2020-21

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.	
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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 - II

Academic Year: 2020-21

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 Mongoose, 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: <ul style="list-style-type: none"> • 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 and IV Syllabus is for students belonging to
2019-2021 M.Sc. batch
Students joining in 2020-21 will have the revised syllabus.**

SEMESTER III

Course Code: RPSIT301
Course Title: EMBEDDED SYSTEMS
Academic Year: 2020-21

Course Outcomes	Description
CO 1	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO 2	Become aware of the architecture of the embedded system processor and its programming aspects (assembly Level)
CO 3	Become aware of interrupts, hyper threading and software optimization.
CO 4	Design real time embedded systems using the concepts of RTOS.
CO 5	Analyze various examples of embedded systems based on ARMprocessors.

COURSE CODE RPSIT301	COURSE NAME EMBEDDED SYSTEMS	CREDITS 4 LECTURE
UNIT I	Introduction What is an Embedded System, Embedded System Vs, General Computing System. The Typical Embedded System Core of Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware. Characteristic and quality attributes of Embedded System Characteristics of an Embedded System, Quality Attributes of Embedded System.	12 L
UNIT II	Memories and Memory Subsystem Introduction, Classifying Memory, A general Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, A SRAM Design, A DRAM Design, The DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Design a cache system, Dynamic Memory Allocation, Testing Memories.	12 L
UNIT III	Hardware Software Co-design and Program Modeling Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language (UML), Hardware Software Trade-offs.	12 L

	<p>Embedded Hardware design and development Analog Electronic Components, Digital Electronic Components, Electronic design Automation (EDA) Tools, The PCB Layout design.</p> <p>Embedded Firmware design and development Embedded Firmware Design Approaches, Embedded Firmware Development Languages</p> <p>Real Time Operating System(RTOS) Operating System Basics, Types of Operating Systems, Device Drivers, How to choose an RTOS</p> <p>Embedded product development life cycle What is EDLC, Why EDLC? Objectives of EDLC, Different Phases of EDLC.</p>	
UNIT IV	<p>Programming Concept and Embedded Programming in C/C++ and Java Software programming in Assembly Language (ALP) and in High-level Language 'C', C program Elements: Header and Source Files and Pre-processor Directives, Program Elements: Macros and Functions, Program Elements: Types, Data Structures, Modifiers, Statements, Loops and Pointers, Object-Oriented Programming, Embedded Programming in C++, Embedded Programming in Java.</p>	12 L
UNIT V	<p>Trends in the Embedded Industry Processor trends in Embedded System, Embedded OS Trends, Development Language Trends, Introduction of PIC Family of Microcontrollers, Introduction of ARM Family of Microcontrollers, Introduction of AVR Family of Microcontrollers.</p>	12 L

COURSE CODE RPSITP301	COURSE NAME PRACTICAL OF RPSITP301 (EMBEDDED SYSTEMS)	CREDITS 2
	<ol style="list-style-type: none"> 1. Design a elevator simulator 2. Design a traffic signal simulator 3. Design a calculator 4. Convert a Digital Signal to Analog and vice versa 5. Develop an application to demonstrate serial communication between to devices 6. Develop an application to demonstrate parallel communication between to devices 7. Develop an application to demonstrate working with memory module. 8. Design a simple game. 	

References:

1. Introduction to embedded systems Shibu K. V 2nd Edition Tata McGraw-Hill
2. Embedded Systems Architecture, Programming and Design Raj Kamal 2nd Edition Tata McGraw-Hill
3. Embedded Systems: A Contemporary Design Tool. James K. Peckol 1st Edition Wiley Edition

Course Code: RPSIT302
 Course Title: BIG DATA ANALYTICS
 Academic Year: 2020-21

Course Outcomes	Description
CO 1	Judge the applicability for Big data solution to Use case
CO 2	Create customized solution using big data technologies to solve real world problems
CO 3	Develop Programs with Map Reduce PARadigm.

COURSE CODE RPSIT302	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	12 L
UNIT II	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).	12 L
UNIT III	ADVANCE ANALYTICAL METHODS Advanced Analytical Theory and Methods-Time Series Analysis: Overview of Time Series Analysis, ARIMA Model, Additional Methods. Advanced Analytical Theory and Methods-Text Analysis: Text Analysis Steps, Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insight. Shingling of Documents: Finding Similar Items, Applications of Near-Neighbor Search, Jaccard similarity of sets, Similarity of documents, Collaborative filtering as a similar-sets problem, Documents, k-Shingles, Choosing the Shingle Size, Hashing Shingles, Shingles built from Words. Similarity-Preserving Summaries of Sets, Locality-Sensitive hashing for documents. The Theory of Locality-Sensitive functions. Methods for high degrees of similarity	12 L
UNIT IV	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.	

	Extensions to MapReduce: Workflow Systems, Recursive extensions to MapReduce.	
UNIT V	BIG DATA TECHNOLOGIES Fundamentals of Hadoop: Data, Data Storage and Analysis, Querying All Data, Comparison with Other Systems. The Hadoop Distributed File System: The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop Filesystems, The Java Interface, Data Flow. Integrating R and Hadoop: Architecture, Samples and function reference of RHIPE and RHADOOP, Data Analytics Problems: Exploring web pages categorization, Computing the frequency of stock market Change, Predicting the sale price of blue book for bulldozers – case study.	

COURSE CODE RPSITP302	COURSE NAME PRACTICAL OF RPSITP302(BIG DATA ANALYTICS)	CREDITS 2
	<ol style="list-style-type: none"> 1. Generate time series model and interpret the result for a given data set. 2. Categorize documents by topics 3. Perform sentiment analysis on twitter. 4. Write a program for measuring similarity among documents and detecting passages which have been reused 5. Write a program to construct different types of k-shingles for given document. 6. Write a map reduce program to find out what are the top 5 categories with maximum number of videos uploaded on youtube 7. Write a map reduce program to find the top 10 rated videos on youtube 8. Write a map reduce program to analyse image and video. 9. Write a map-reduce program: <ol style="list-style-type: none"> i. to find matrix-vector multiplication; ii. to compute selections and projections; 2. (iii) to find union, intersection, difference, natural Join for a given dataset. 3. Write a mapreduce program to find Find highest temperature for each year in weather data set 	

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. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, 2015.
4. Big Data Analytics with R and Hadoop, Vignesh Prajapati, PACKT Publishing, 2013.
5. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012.

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: RPSIT303A
 Course Title: ETHICAL HACKING
 Academic Year: 2020-21

Course Outcomes:

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 RPSIT303A	COURSE NAME ETHICAL HACKING	CREDITS 4 LECTURE
UNIT I	Introduction to Ethical Hacking, Footprinting and Reconnaissance - Social Engineering,, Scanning Networks, Enumeration	12 L
UNIT II	System Hacking, Trojans and Backdoors, Viruses and Worms, Sniffing, Denial of Service,	12 L
UNIT III	Hacking Webservers& Web Applications, Session Hijacking, SQL Injection	12 L
UNIT IV	Hacking Wireless Networks, Hacking Mobile Platforms, Evading IDS, Firewalls, Buffer Overflows, Cryptography, Penetration Testing	12 L
UNIT V	Cyber Laws& IT Act Understanding Computers, Internet & Cyber Laws, Conceptual Framework of E-Commerce, Cyber crime and criminal justice, Patents & Copyright, Introduction to IPR.	12 L

COURSE CODE RPSITP303A	COURSE NAME PRACTICAL OF RPSITP303A (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.

References:
1. Ethical Hacking Review Guide, Kimberly Graves, Wiley Publishing
2. Ethical Hacking Ankit Fadia, 2nd Edition, Macmillan India Ltd, 2006
3. Insider Computer Fraud, Kenneth C.Brancik, 2008,Auerbach Publications Taylor & Francis Group
4. Cyber Law Simplified, Vivek Sood, TMH
5. Cyber Laws and IT Protection, Harish Chander, PHI Learning,2012

Course Code: RPSIT303B
 Course Title: ARTIFICIAL NEURAL NETWORKS
 Academic Year: 2020-21

Course Outcomes	Description
CO 1	Create artificial neural networks using understanding of its architecture
CO 2	Work with LMS and perceptrons to solve complex problems.
CO 3	Identify the and develop supervised and unsupervised systems

COURSE CODE RPSIT303B	COURSE NAME ARTIFICIAL NEURAL NETWORKS	CREDITS 4 LECTURE
I	The Brain Metaphor, Basics of Neuroscience, Artificial Neurons, Neural Networks and Architectures	12 L
II	Geometry of Binary Threshold Neurons and Their Networks, Supervised Learning I: Perceptrons and LMS, Supervised Learning II: Backpropagation and Beyond	12 L
III	Neural Networks: A Statistical Pattern Recognition Perspective, Statistical Learning Theory, Support Vector Machines and Radial Basis Function Networks	12 L
IV	Dynamical Systems Review, Attractor Neural Networks, Adaptive Resonance Theory	12 L
V	Towards the Self-organizing Feature Map, Fuzzy Sets and Fuzzy Systems, Evolutionary Algorithms	12 L

COURSE CODE RPSITP303B	COURSE NAME PRACTICAL OF RPSITP303B (ARTIFICIAL NEURAL NETWORKS)	CREDITS 2
	At least 8 practicals based on above syllabus must be covered.	

References:

1. Neural Networks, A Classroom Approach, Satish Kumar, 2nd Edition, McGraw Hill
2. Artificial Neural Networks, Robert Schalkoff, McGraw Hill
3. Introduction to Neural Networks using MATLAB, S Sivanandam, S Sumathi, McGraw Hill

Course Code: RPSIT304A
 Course Title: DIGITAL FORENSICS
 Academic Year: 2020-21

Course Outcomes	Description
CO 1	Understand the core concepts related to digital forensics and its application
CO 2	Study different steps in digital forensics process
CO 3	Understand Network and Mobile Forensics Concepts
CO 4	Gain information about lawsuit in digital forensics
CO 5	Explore various tools for investigating a real time case in the cyberspace.

COURSE CODE RPSIT 304A	COURSE NAME DIGITAL FORENSICS	CREDITS 4 LECTURE
I	Introduction: Computer Forensics and Investigation Processes, Understanding Computing Investigations, The Investigator's Office and Laboratory, Data Acquisitions.	12 L
II	Processing: Crime and Incident Scenes, Working with Windows and DOS Systems, Current Computer Forensics Tools.	12 L
III	Evidence Analysis: Macintosh and Linux Boot Processes and File Systems, Computer Forensics Analysis, Recovering Graphics Files.	12 L
IV	Forensics Types: Virtual Machines, Network Forensics, and Live Acquisitions, E-mail Investigations, Cell Phone and Mobile Device Forensics	12 L
V	Ethics: Report Writing for High-Tech Investigations, Expert Testimony in High-Tech Investigations, Ethics and High-Tech Investigations.	12 L

COURSE CODE RPSITP304A	COURSE NAME PRACTICAL OF RPSITP304A (DIGITAL FORENSICS)	CREDITS 2
	<ol style="list-style-type: none"> 1. File System Analysis using The Sleuth Kit 2. Using Windows forensics tools 3. Using Data acquisition tools 4. Using file recovery tools 5. Using Forensic Toolkit (FTK) 6. Forensic Investigation using EnCase 7. Using Steganography tools 	

	8. Using Password Cracking tools 9. Using Log Capturing and Analysis tools 10. Using Traffic capturing and Analysis tools 11. Using Wireless forensics tools 12. Using Web attack detection tools 13. Using Email forensics tools 14. Using Mobile Forensics software tools 15. Writing report using FTK	
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References:

1. Guide to Computer Forensics and Investigations Bell Nelson, Amelia Phillips, Christopher Steuart, 4th Edition, Cengage Learning
2. Computer Forensics A Pocket Guide, Nathan Clarke, I.T Governance Publishing
3. Computer Forensics: Computer Crime Scene Investigation, John R. Vacca, 2nd Edition, Charles River Media.

Course Code: RPSIT304B
 Course Title: MACHINE LEARNING
 Academic Year: 2020-21

Course Outcomes	Description
CO 1	Solve fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
CO 2	Identify the strengths and weaknesses of many popular machine learning approaches.
CO 3	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and unsupervised learning.
CO 4	Be able to design and implement various machine learning algorithms in a range of real-world applications.
CO 5	Work on independent study and research in various real life problems using Artificial Intelligence.

COURSE CODE	COURSE NAME	CREDITS
RPSIT304B	MACHINE LEARNING	4 LECTURE
UNIT I	Introduction: Well-posed Learning Problems, Designing a learning system, Perspective and Issues in Machine Learning. Concept Learning and the General-to-Specific Ordering: A Concept learning task, Concept learning as search, Find-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate-Elimination, Candidate elimination learning Algorithm.	12 L

UNIT II	<p>Decision Tree Learning: Decision tree Representation, Appropriate Problems for decision tree learning, the basic decision tree learning Algorithm, Hypothesis spaces search in decision tree learning, Inductive Bias in Decision tree learning, Issues in Decision tree learning.</p> <p>Artificial Neural Network: Neural Network Representations, Appropriate problems for Neural Network learning, Perceptron. Multilayer Neural Network and the Back propagation algorithm.</p>	12 L
UNIT III	<p>Bayesian Learning: Bayes theorem and concept learning, Maximum likelihood and least square error hypothesis, Maximum Likelihood hypothesis for predicting probabilities, Minimum description length principle, Bayes optimal classifier. Gibbs algorithm, Naive Bayes classifier. Bayes Belief Network. The EM Algorithm.</p> <p>Instance Based Learning: K-Nearest Neighbor learning, Locally Weighted Regression, Radial Basis Function, Case-based Reasoning.</p> <p>Learning Sets of Rules: Sequential Covering Algorithms, Learning Rule sets, learning First Order Rules, Induction as inverted deduction, Inverting Resolution.</p>	12 L
UNIT IV	<p>Genetic Algorithms: Introduction to Genetic Algorithms, Hypothesis space search, Genetic programming, Models of evolution and learning, parallelizing genetic algorithms.</p> <p>Analytical Learning: Learning with Perfect domain theories: Prolog-EBG, Explanation-based learning of search control knowledge.</p>	12 L
UNIT V	<p>Combining inductive and analytical learning: Inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis, using prior knowledge to alter the search objective, using prior knowledge to Augment Search Operators</p> <p>Reinforcement learning: The learning task, Q learning, Non-Deterministic Rewards and actions, Temporal Difference learning, Generalizing from examples, Relationship to dynamic programming</p>	12 L

COURSE CODE	COURSE NAME	CREDITS
RPSITP304B	PRACTICAL OF RPSITP304B (MACHINE LEARNING)	2
	<ol style="list-style-type: none"> 1. Implement decision tree algorithm 2. Implement back propagation algorithms for a multi-layer neural network 3. Implement Gibbs algorithm 4. Implement Baye's belief network 5. Implement Naive Bayes classifier. 6. Implement EM algorithm 7. Implement k nearest neighbor algorithm 8. Implement radial basis function network 9. Implement Q learning 	

Text book:

- Machine Learning, Tom Mitchell, McGraw Hill, 1997.
- Introduction to machine learning Nils J. Nilsson, 1997.

Reference:

- David Barber's Bayesian Reasoning and Machine Learning
- Kevin Murphy's Machine learning: a Probabilistic Perspective
- Hastie, Tibshirani, and Friedman's The Elements of Statistical Learning
- Bishop's Pattern Recognition and Machine Learning
- Mitchell's Machine Learning

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SEMESTER IV

Course Code: RPSIT401

Course Title: INFORMATION SECURITY MANAGEMENT

Academic year 2020-21

Course Outcomes:

Course Outcomes	Description
CO1	To have an understanding of the key themes and principles of information security management and be able to apply these principles in designing solutions to managing security risks effectively
CO 2	To understand how to apply the principles of information security management in a variety of contexts;
CO 3	To have an appreciation of the interrelationship between the various elements of information security management and its role in protecting organizations.

COURSE CODE RPSIT401	COURSE NAME INFORMATION SECURITY MANAGEMENT	CREDITS 4 LECTURE
UNIT I	Security Risk Assessment and Management: Introduction to Security Risk Management. Reactive and proactive approaches to risk management. Risk assessment, quantitative and qualitative approaches and asset classification - Security Assurance Approaches: Introduction to OCTAVE and COBIT approaches.	12 L
UNIT II	Security Management of IT Systems: Network security management. Firewalls, IDS and IPS configuration management. Web and wireless security management. General server configuration guidelines and maintenance. Information Security Management Information classification. Access control models, role-based and lattice models. Mandatory and discretionary access controls. Linux and Windows case studies. Technical controls, for authentication and confidentiality. Password management and key management for users. Case study: Kerberos.	12 L
UNIT III	Key Management in Organizations: Public-key Infrastructure. PKI Applications, secure email case study(S/ MIME or PGP). Issues in public-key certificate issue and lifecycle management - Management of IT Security Infrastructure; Computer security log management, malware handling and vulnerability management programs. Specifying and enforcing security policies.	12 L
UNIT IV	Auditing and Business continuity Planning: Introduction to information security audit and principles of audit. Business continuity planning and disaster recovery. Case study: 9/11 tragedy. Backup and recovery techniques for applications and storage	12 L

UNIT V	Computer forensics: techniques and tools. Audit Tools: NISSUS and NMAP. Information Security Standards and Compliance: Overview of ISO 17799 Standard. Legal and Ethical issues	12 L
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COURSE CODE	COURSE NAME	CREDITS
RPSITP401	PRACTICAL OF RPSITP401 (INFORMATION SECURITY MANAGEMENT)	2
	1. Working with Sniffers for monitoring network communication (Ethereal) 2. Using open SSL for web server - browser communication 3. Using GNU PGP 4. Performance evaluation of various cryptographic algorithms 5. Using IP TABLES on Linux and setting the filtering rules 6. Configuring S/MIME for e-mail communication 7. Understanding the buffer overflow and format string attacks 8. Using NMAP for ports monitoring 9. Implementation of proxy based security protocols in C or C++ with features like confidentiality, integrity and authentication 10. Socket programming 11. Exposure to Client Server concept using TCP/IP, blowfish, Pretty Good Privacy.	

References:
1. IT Security and Risk Management(Main reference) Slay, J. and Koronios, A.,2006 Wiley 2. Incident Response and Computer Forensics. Chris Prorise and Kevin Mandia,2003. McGraw-Hill 3. Information Systems Security-Security Management, Metrics, Frameworks and Best Practices, Nina Godbole, Wiley, 2009 4. Information Security Policies, Procedures, and Standards: Guidelines for Effective Information Security Management (Paperback), 1st edition, Auerbach, 2001.

COURSE CODE	COURSE NAME	CREDITS
RPSIT402	RPSIT402 PROJECT	4

Course Objective:
<ul style="list-style-type: none"> 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.
<p>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</p>

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 awarded 6 credits.

COURSE CODE	COURSE NAME	CREDITS
RPSIT403	RPSIT403 INTERNSHIP (Approx 200-300 hrs)	14
Course Objective: <ul style="list-style-type: none"> 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 500-600 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 Organization's seal should be attached as part of the documentation. Student 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

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 –

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

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	From All Units	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.

1. 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.

MSc Part II (Sem III & IV) EVALUATION SCHEME

THEORYInternal 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 Marks Duration 2½ HrsTheory 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	Unit V	12

- All questions shall be 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.

PRACTICALInternal 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.

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
2. Internship completion Letter with proper hours & task completed.

1. Employer Feedback Form is prepared to assess based on the following:

- Skills/ Knowledge
- Self-Management
- Dependability
- Attitude
- Relationships

1. 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.

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

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