

Resolution No. AC//I/(23-24).3.RPS7

S. P. Mandali's
Ramnarain Ruia Autonomous College
(Affiliated to University of Mumbai)



Syllabus for MSc Information Technology

Program: M.Sc.

Program Code: RPSIT

(As per the guidelines of NEP2020-Academic year 2023-24)



GRADUATE ATTRIBUTE

S. P. Mandali's Ramnarain Ruia Autonomous College has adopted the Outcome Based Education model to make its science graduates globally competent and capable of advancing in their careers. The Bachelors Program in Science also encourages students to reflect on the broader purpose of their education.

GA	GA Description A student completing Master's Degree in Science program will be able to:
GA 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.
GA 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.
GA 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.
GA 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.
GA 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.
GA 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
GA 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.
GA 8	Understand cross disciplinary relevance of scientific developments and relearn and reskill to adapt to technological advancements.



PROGRAM OUTCOMES

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



PROGRAM OUTLINE

YEA R	SEM	COURSE CODE	Type of Course	COURSE TITLE	CREDIT S
M.Sc. I	I	RPSIT.O501	Discipline Specific Core I	Data Science	3
		RPSITP.O501	Practical DSC I	Practical of Data Science	1
		RPSIT.O502	Discipline Specific Core II	Microservices Architecture	3
		RPSITP.O502	Practical DSC II	Practical of Microservices Architecture	1
		RPSIT.O503	Discipline Specific Core III	Blockchain Technology	3
		RPSITP.O503	Practical DSC III	Practical of Blockchain Technology	1
		RPSIT.O504	Discipline Specific Core IV	Professional Ethics	2
		RPSRMIT.O50 5	RM	Research Methodology	4
		RPSIT.O506	Discipline Specific Elective	Full Stack Fundamentals	3
		RPSITP.O506	Practical on DSE	Practical of Full Stack Fundamentals	1



YEA R	SEM	COURSE CODE	Type of Course	COURSE TITLE	CREDIT S
	II	RPSIT.E511	Discipline Specific Core I	Digital Forensics	3
		RPSITP.E511	Practical DSC I	Practical of Digital Forensics	1
		RPSIT.E 512	Discipline Specific Core II	Big Data Analytics	3
		RPSITP.E512	Practical DSC II	Practical of Big Data Analytics	1
		RPSIT.E 513	Discipline Specific Core III	Machine Learning	3
		RPSITP.E513	Practical DSC III	Practical of Machine Learning	1
		RPSIT.E514	Discipline Specific Core IV	Entrepreneurship Development	2
		RPSIT.E515	On job Training / Field Project	Project	4
		RPSIT.E516	Discipline Specific Elective	Advanced Full Stack	3
		RPSITP.E516	Practical of DSE	Practical of Advanced Full Stack	1



Course Code: RPSIT.O501
Course Title: DATA SCIENCE
Academic year 2023-24

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 RPSIT.O501	DATA SCIENCE	CREDITS 3 / 45 HOURS
I	<p>Introduction to Data Science: What is Data? Different kinds of data, Data Science Process or lifecycle.</p> <p>Data scientist: Role and Profile</p> <p>Pre-requisites for Data science: statistics: Measures, Probability, Hypothesis and Inference ,Linear Algebra: Vectors and Matrices, Calculus: Gradient Descent Strategy</p> <p>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</p>	15 Hrs
II	<p>Supervised Learning: Random Forests, Regression,KNN,Application of Artificial neural networks ,Optimization with Genetic Algorithms</p> <p>Unsupervised Learning: Clustering- Advanced hierarchical methods, Model based methods, Grid based method, Constraint based method, density based methods</p>	15 Hrs



III	<p>Association rules: Frequent Pattern, Apriori, Frequent pattern tree, pattern evaluation, Multidimensional ,multi-level , quantitative associations, Constraint based Pattern generation, Associative Classification and Clustering, Applications</p> <p>Ensemble methods: Increasing the Accuracy, Model Selection and evaluation.</p> <p>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.</p>	15 Hrs
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COURSE CODE RPSITP.O501	COURSE NAME PRACTICAL OF DATA SCIENCE	CREDITS 1 / 15 HOURS
	<ol style="list-style-type: none"> 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. Data Visualization 10. Semi-structured data analysis 11. Time series <p>Design and implement minimum two case studies based on the subject domain.</p>	

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: RPSIT.O502
Course Title: MICROSERVICES ARCHITECTURE
Academic Year: 2022-23

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 RPSIT.O50 2	Microservices Architecture	Credits 3 / 45 Hours
UNIT I	Microservices: What Are Microservices? Technology Heterogeneity, Resilience, Scaling, Ease of Deployment, Organizational Alignment, Composability, Optimizing for Replaceability, What About Service-Oriented Architecture?, Other Decompositional Techniques, Shared Libraries, Modules, The Evolutionary Architect: Inaccurate Comparisons, An Evolutionary Vision for the Architect, Zoning, A Principled Approach, Strategic Goals, Principles, Combining Principles and Practices, A Real-World Example, The Required Standard, Monitoring, Interfaces, Architectural Safety, Governance Through Code, Exemplars, Tailored Service Template, Technical Debt, Exception Handling, Governance and Leading from the Center, Building a Team	15 Hrs
UNIT II	Technology Choices, Complexities of Asynchronous Architectures, Services as State Machines, Reactive Extensions , DRY and the Perils of Code Reuse in a	15 Hrs



	<p>Microservice World, Client Libraries, Access by Reference, Versioning, Defer It for as Long as Possible, Catch Breaking Changes Early, Use Semantic Versioning, Coexist Different Endpoints, Use Multiple Concurrent Service Versions, User Interfaces, Toward Digital, Constraints, API Composition, UI Fragment Composition, Backends for Frontends, A Hybrid Approach, Integrating with Third-Party Software , Lack of Control, Customization, Integration Spaghetti, On Your Own Terms, The Strangler Pattern</p>	
UNIT III	<p>Decomposing Monolithic Systems: The Reasons to Split the Monolith, Security, Tangled Dependencies, Getting to Grips with the Problem, Examples, Refactoring Databases, Staging the Break, Transactional Boundaries, Distributed Transactions, Reporting, The Reporting Database, Data Retrieval via Service Calls, Data Pumps, Alternative Destinations, Event Data Pump, Backup Data Pump, Cost of Change, Understanding Root Cause Deployment: A Brief Introduction to Continuous Integration, Mapping Continuous Integration to Microservices, Build Pipelines and Continuous Delivery, And the Inevitable Exceptions, Platform-Specific Artifacts, Operating System Artifacts, Custom Images, Images as Artifacts, Immutable Servers, Environments, Service Configuration, Service-to-Host Mapping, Multiple Services Per Host, Application Containers, Single Service Per Host, Platform as a Service, Automation, Two Case Studies on the Power of Automation, From Physical to Virtual, Traditional Virtualization, Vagrant, Linux Containers, Docker, A Deployment Interface, Environment</p>	15 Hrs

Course Code RPSITP.O502	Practical Of Microservices Architecture	Credits 1 / 15 Hours
	<ol style="list-style-type: none"> 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	
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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: RPSIT.O503

Course Title: BLOCKCHAIN TECHNOLOGY

Academic year 2023-24

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
	After Completing this course student will be able to:
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

DETAILED SYLLABUS

Course Code RPSIT.O503	Cyber and Information Security	Credits 3 / 45 Hours
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I	<p>Introduction to Blockchain technology</p> <p>History of blockchain, Properties of blockchain, Centralization vs Decentralization, Consensus, Satoshi Nakamoto's Blockchain Breakthrough, Types of blockchain, Blockchain forking, Structure of block</p> <p>Public blockchain: Bitcoin</p> <p>Overview, Cryptographic keys, Transactions, Blockchain Mining, Bitcoin network, Wallets, Bitcoin payments, Innovation in Bitcoin, Advanced protocols, Bitcoin investment</p>	15 Hrs
II	<p>Public blockchain: Ethereum</p> <p>Overview, Ethereum network, Components of the Ethereum ecosystem, The Ethereum Virtual Machine (EVM), Application</p> <p>Smart Contracts</p> <p>Solidity Programming –Contracts, Creating Contracts, Visibility and Getters, Function Modifiers, Constant State Variables, Functions, Inheritance, Abstract Contracts, Interfaces, Libraries</p>	15 Hrs
III	<p>Private blockchain: Hyperledger Fabric</p> <p>Introduction, Features, Architecture, Requirements, Components of fabric, Working of fabric</p> <p>Blockchain Use cases: Business Use Cases, Technology Use Cases, Legal and Governance Use Cases, Private blockchain Use cases</p>	15 Hrs

References:

- Understanding Bitcoin, PEDRO Ransomville
- A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara Paul R. Allen
- Ethereum Smart Contract Development, Mayukh Mukhopadhyay, packt 4.
Blockchain A Beginners Guide, Blockchain Hub
- Josh Thompson, „Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming“, Create Space Independent Publishing Platform, First Edition - 2017.
- <https://solidity.readthedocs.io/en/v0.6.2/>
- <https://bitcoin.org/bitcoin.pdf>



Course Code RPSITP.O503	Practical of Blockchain Technology	Credit 1 / 15 Hours
1	Double link list implementation	
2	Cryptography Basics	
3	Single block generation	
4	Multiple block generation	
5	Block mining	
6	Basic smart contracts	
7	Advanced smart contract-I	
8	Advanced smart contract-II	

COURSE CODE – RPSIT.O504
COURSE TITLE – PROFESSIONAL ETHICS
ACADEMIC YEAR 2023-24

COURSE OUTCOMES	DESCRIPTION
	On completion of this course students will be able to
CO1	Define what is ethics and identify the principles of ethics.
CO2	Describe and discuss the theory behind ethics and its importance.
CO3	Demonstrate ethical behaviour in his/her profession.
CO4	Analyze the responsibilities and rights of professionals and manage the risks associated.
CO5	Justify the need of ethical codes and importance of ethical audits.
CO6	Apply human values and ethics in day-to-day life.

Course Code RPSIT.O50 4	PROFESSIONAL ETHICS	Credits 2 / 30 Hours
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I	<p>Basic Ethics - Introduction, Terminology, Contextual Aspects, Personal Ethics, Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts on Ethics, Value Education, Dimensions of Ethics, Setting Goals in Life.</p> <p>Profession and Professionalism - Introduction, Profession, Professional, Professionalism Professional Associations, Roles of a Professional, Professional Risks, Professional Accountability, Professional Success, Ethics and Profession, Image of a Profession.</p> <p>Ethical Theories - Basic Ethical Principles, Moral Development Theories Classification of Ethical Theories, Some Basic Theories, Moral Issues.</p> <p>Ethics in Engineering Profession – Engineering Profession, Technology and Society, Engineering as Social Experimentation, Engineering Professionals, Engineering Ethics, Roles of Engineers.</p> <p>Contemporary Matters/Issues in Ethics – Ethical issues in IT, Context of It Ethical issues, IT Professional Ethics, Three Codes of Ethics, Management Conflicts, Privacy & Security.</p> <p>Engineer’s Responsibility for Safety – Safety and Risk, Assessment of Risk, Safety in Engineering, Risk and, Engineers’ Responsibility for Safety, Designing for Safety, Risk–Benefit Analysis, Risk Costs and Management, Principles of Risk Management, Severity and Probability of Risk.</p>	15 Hrs
II	<p>Responsibility & Rights of Professionals - Rights and Responsibilities, Professional Responsibilities, Professional Rights.</p> <p>Global Issues – Current Scenario, Business Ethics, Corporate Social Responsibility, Environmental Ethics, Computer Ethics, Media Ethics, War Ethics, Bioethics, Research Ethics, Intellectual Property Rights, Professionals and Ethics.</p> <p>Ethical Codes - Need for Ethical Codes, Sample Codes, Codes from Other Professions, Corporate Codes, Development of Codes, Implementation of Codes, Limitations of Codes.</p> <p>Ethics Audit - Need for Ethics Audit, Ethics Profile of Organizations, Consideration for Ethics Audit, Ethics</p>	15 Hrs



	<p>Standards and Benchmarking, Procedure for Ethics Audit, Ethics Audit Report – Examples, Ethics Indices.</p> <p>Human Values & Attitudes – Terminology, Domains of Learning, Human Values, Value System, Degeneration of Values, Acquiring Values, Attitudes, Values, Attitudes, and Professionals.</p> <p>Ethical Living - Needs of Life, Some Thoughts on Life, Ethical Living, Setting Goals in Life, Ethical Living for Professionals.</p>	
<p>References:</p> <ul style="list-style-type: none"> • Professional Ethics - Includes Human Values, R. Subramanian, Oxford University Press, 2nd edition • Contemporary Issues in Ethics and Information Technology, Robert A. Schultz, IRM Press 		

Course Code – RPSRMIT.O505
Course Title – Research Methodology
Academic Year 2023-24

Course Outcomes	DESCRIPTION On completion of this course students will be able to
CO1	Define research, formulate problems and describe the research process and research methods.
CO2	Understand and apply basic research methods including research design, data analysis and interpretation.
CO3	Develop and implement the techniques of data collection, analysis of data and interpretation.
CO4	Understand ethical issues in research, write research report, research paper and publish the paper.



Course Code RPSRMIT.O505	RESEARCH METHODOLOGY	Credits 4 / 60 Hours
I	<p>About Research</p> <p><u>Foundations of Research:</u> Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process.</p> <p><u>Research Design:</u> Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.</p> <p><u>Qualitative and Quantitative Research:</u> Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.</p>	15 Hrs
II	<p>Statistical Concepts & methods</p> <p><u>Measurement:</u> Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.</p> <p><u>Sampling:</u> Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.</p> <p><u>Data Analysis:</u> Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.</p> <p><u>Problem Identification & Formulation</u> – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis – Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.</p>	15 Hrs



III	<p>Preparation of Dissemination of Research</p> <p><u>Interpretation of Data and Paper Writing</u> – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.</p> <p>Use of Encyclopaedia, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.</p> <p>Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.</p>	15 Hrs
IV	<p>Publication</p> <p><u>Technical Writing:</u> Writing a Research Proposal, what is a Scientific Paper? Ethics in Scientific Publishing.</p> <p><u>Preparing the Text:</u> How to Prepare the Title, how to List the Authors and Addresses, how to Prepare the Abstract, how to Write the Introduction, how to Write the Materials and Methods Section, how to Write the Results, how to Write the Discussion, how to State the Acknowledgments, how to Cite the References.</p> <p><u>Preparing the Tables and Figures:</u> How to Design Effective Tables, how to Prepare Effective Graphs, how to Prepare Effective Photographs.</p> <p><u>Publishing the Paper:</u> Rights and Permissions, How to Submit the Manuscript, How and When to Use Abbreviations, How to Write a thesis, Outcome of Research, Ethical issues in research</p> <p>How to measure the impact of Research Publications?</p>	15 Hrs
<p>References:</p> <ul style="list-style-type: none"> ● Research Methodology – Methods & Techniques, C. R. Kothari, Gaurav Garg, New Age International Publishers, 3rd Edition ● Researching Information Systems & Computing, Briony Oates, Sage Publications 		



Course Code: RPSIT.O506
Course Title: FULL STACK FUNDAMENTALS
Academic Year: 2023-24

Course Outcomes:

Course Outcomes	Description
CO 1	Identify and define the need of Angular.js in Web Development.
CO 2	Implement MVC / MVT pattern of efficient and quick application development.
CO 3	Develop secure cloud based applications.
CO 4	Work with React & create applications to combine with Angular.
CO 5	Design responsive and interactive web sites using Reactjs.
CO 6	Getting ready to accept the MEAN / MERN Stack Developer profile.



Course Code RPSIT.O506	FULL STACK FUNDAMENTALS	Credits 3 / 45 Hours
I	<p>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.</p> <p>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.</p>	15 Hrs
II	<p>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, Building a single-page application with Angular: Foundations, Building an SPA with Angular: The next level, Authenticating users, managing sessions, and securing APIs.</p>	15 Hrs
III	<p>Introduction to React.JS: Beginner's Guide to React.JS, Form Validation, Saving Data Using React.JS, Game Creation using React.JS.</p>	15 Hrs

Course Code RPSITP.O506	PRACTICAL OF FULL STACK FUNDAMENTALS	Credits 1 / 15 Hours
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: <ul style="list-style-type: none"> • Online shopping portal 	



	<ul style="list-style-type: none"> ● E-school portal ● Online learning platform etc... <p>Students should be able to implement a new idea after doing all the</p> <p>Make use of various technologies like MongoDB, ExpressJS, NodeJS and AngularJS.</p>	
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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



SEMESTER II

Course Code: RPSIT.E511
Course Title: DIGITAL FORENSICS
Academic Year: 2023-24

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION After Completing this course student will be able to:
CO 1	Understand Digital Forensics Process
CO 2	Study different types of evidences and procedure to maintain integrity
CO 4	Apply evidence acquisition techniques
CO 5	Analyze challenges of Digital forensics process

DETAILED SYLLABUS

Course Code RPSIT.E511	DIGITAL FORENSICS	Credits 3 / 45 Hours
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	15 L
II	Network Forensics	15 L



	Types of digital evidence, Challenges to network evidence, Network forensics methodology, Sources of Network Based Evidence 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	
III	Cloud Forensics Solidity Programming –Contracts, Creating Contracts, Visibility and Getters, Function Modifiers, Constant State Variables, Functions, Inheritance, Abstract Contracts, Interfaces, Libraries. Mobile forensics Mobile attacks, Mobile forensics process, possible evidences, sources of evidences, security mechanism	15 L

References:

- Guide to Computer Forensics and Investigations Bell Nelson, Amelia Phillips, Christopher Steuart, 4th Edition, Cengage Learning.
- Computer Forensics Computer Crime Scene Investigation, John R. Vacca, Second Edition, 2005.
- Network Forensics, Sherri Davidoff, Jonathan HAM, Prentice Hall, 2012.
- Mobile Phone Security and Forensic: A Practical Approach, Second Edition, Iosifl. Andreoulakis, Springer, 2012
- The Basics of Digital Forensics_ The Primer for Getting Started in Digital Forensics, John Sammons

Course Code RPSITP.E511	PRACTICAL OF DIGITAL FORENSICS	Credit 1 / 15 Hours
1.	Image acquisition	
2.	Case examination	
3.	Network forensics	
4.	Email forensics	
5.	Browser Forensics	
6.	Steganography tools	
7.	Password cracking tools	
8.	Process monitoring tools	



Course Code: RPSIT.E512
Course Title: Big Data Analytics
Academic Year: 2023-24

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 customised 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 RPSIT.E512	BIG DATA ANALYTICS	CREDITS 3/ 45 Hours
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UNIT I	<p>INTRODUCTION TO BIG DATA</p> <p>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</p> <p>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</p> <p>BIG DATA ANALYTICS FUNDAMENTALS</p> <p>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</p> <p>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).</p>	15 Hrs
UNIT II	<p>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</p>	15 Hrs
UNIT III	<p>INTRODUCTION TO MAP REDUCE</p> <p>The map tasks, Grouping by key, The reduce tasks, Combiners, Details of MapReduce Execution, Coping with node failures.</p> <p>Algorithms Using MapReduce: Matrix-Vector Multiplication, Computing Selections and Projections, Union, Intersection, and Difference, Natural Join, sorting, Role of Map reduce.</p> <p>BIG DATA TECHNOLOGIES</p> <p>Fundamentals of Hadoop: Hadoop Ecosystem, Data, Data Storage and Analysis, Querying All Data, Comparison with Other Systems, Moving data in and out of Hadoop</p> <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>	15 Hrs



COURSE CODE RPSITP.E512	PRACTICAL OF BIG DATA ANALYTICS	CREDITS 1 / 15 Hours
	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: RPSIT.E513
Course Title: MACHINE LEARNING
Academic Year: 2023-24

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.
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COURSE CODE RPSIT.E513	MACHINE LEARNING	CREDITS 3/ 45 Hours
UNIT I	Application of Machine Learning, Learning and Generalization, Probability distribution, Product Rule of Probability, Rules of Probability, Classification: Naïve Bayes for text classification, Support vector machines, K-nearest neighbor, Clustering: Which Clustering Algorithm to Use?, Discovering Holes and Data Regions, Learning from Labeled and Unlabeled Examples, learning from Positive and Unlabeled Examples	15 Hrs
UNIT II	Reinforcement Learning, Learning through Awards, Model-Free Reinforcement Learning Model, Q-Learning, Neural Networks and Reinforcement Learning (RPROP), Gradient Descent Reinforcement Learning, Connectionist Q-Learning, State-action-reward-state-action Algorithm (SARSA), Monte Carlo	15 Hrs
UNIT III	Deep Learning: Deep forward Networks: Gradient-Based Learning, Hidden Unit, Back-Propagation and Other Differentiation Algorithms. Regularization of Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations	15 Hrs

COURSE CODE RPSITP.E513	PRACTICAL OF MACHINE LEARNING	CREDITS 1/ 15 Hours
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
3. Web Data Exploring Hyperlinks, Contents, and Usage Data Second Edition by Bing Liu Springer

Course Code: RPSIT.E514**Course Title: ENTREPRENEURSHIP DEVELOPMENT****Academic Year: 2023-24****Course Outcomes:**

Course Outcomes	Description
CO 1	To develop Entrepreneurial Mindset among young brains
CO 2	To encourage students to become self-employed
CO 3	To make student aware about the role of Entrepreneur in the growth of economy and nation
CO 4	To introduce the various start-up support systems that are available for Entrepreneurs in India
CO 5	To motivate students to take up Entrepreneurship as new life-skill
CO 6	To make students capable to converting ideas into sustainable business opportunities



CO 7	To foster technology-based innovation into successful business
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COURSE CODE RPSIT.E514	COURSE NAME ENTREPRENEURSHIP DEVELOPMENT	CREDITS 2 / 30 HOURS
UNIT I	The Entrepreneurial Mind-Set, Generating And Exploiting New Entries, Creativity And The Business Idea, The Business Plan: Creating And Starting The Venture, The Marketing Plan, Sources Of Capital, Introduction to Entrepreneurial Finance	15 Hrs
UNIT II	New Venture Development and Sources of Financing, The Financial Environment and Small Businesses, Venture Capital Finance, Microfinance Intervention, Understanding and Analysing Financial Statements, Working Capital Management Legal Issues for the Entrepreneur, IPR, Patenting, Trademark, Copyright, Agreements, Licensing	15 HRs

Practicals / Exercises

- Case Studies in various areas.

Main References:

- Entrepreneurship, Robert D. Hisrich, Michael Peters, Dean Shepherd
- Entrepreneurial Finance for MSMEs_ A Managerial Approach for Developing Markets
- Handbook on Entrepreneurship Development, BS Rathore and JS Saini, Aapga Publications Panchkula

Additional References:

- Entrepreneurship: Strategies and Resources, Marc J Dollinger, Pearson
- Shaping Entrepreneurial Mindsets - Innovation and Entrepreneurship in Leadership Development, Jordi Canals
- Entrepreneurship: Creating and Leading an Entrepreneurial Organization, Arya Kumar, Pearson
- Women Entrepreneurs: Opportunities, Performance, Problems, SK Dhameja, Deep and Deep Publications, Jaipur
- Entrepreneurship Development in India, CB Gupta and NP Srinivisan, Sultan Chand and Sons, New Delhi
- Entrepreneurial Development, SS Khanka, S Chand and Co. Ltd, New Delhi
- Entrepreneurship Development Small Business Enterprises, Poornima M Charantimath, Pearson
- Global Trends in Entrepreneurship, SK Dhameja, Abhishek Publications Chandigarh
- Entrepreneurship in Knowledge Economy, BS Rathore, DD Sharma, SK Dhameja, Abhishek Publications Chandigarh



- Women and Rural Entrepreneurship in India, DD Sharma, SK Dhameja, Abhishek Publications Chandigarh
- Entrepreneurship and Small Business, JS Saini, SK Dhameja, Rawat Publications Jaipur
- Start and Run A Business From Home_ How to turn your hobby or interest into a business (Small Business Start-Ups), Paul Power

Ramnarain Ruia Autonomous College



Course Code: RPSIT.E515
Course Title: PROJECT
Academic Year: 2023-24

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 RPSIT.E515	Field Project	CREDITS 4 / 60 Hours
<p>Course Objective:</p> <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 projects. ● To encourage students to use the tools/technologies they learn for implementing their ideas. 		
<p>The student is expected to give a presentation of the project proposed and get verified and sanctioned by the project guide. In addition, experimental setup, 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.</p>		



Course Code: RPSIT.E516
Course Title: ADVANCED FULL STACK
Academic Year: 2023-24

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 MEAN / MERN Stack Developer profile.

COURSE CODE RPSIT.E516	ADVANCED FULL STACK	CREDITS 3/ 45 HOURS
UNIT I	<p>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 Simplifying Callbacks.</p> <p>Building Applications with Node.JS: Using token based Authorize and Authenticate, Real-Time Apps with WebSocket, Socket.IO, (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)</p>	15 Hrs
UNIT II	<p>Working with Express.JS Framework: Introduction, Quickstart, The Interface, Tips & Tricks, Examples, Building a Web server with Express, Foundations of Express, Middleware, Routing, Building APIs, (Views and templates: Pug and EJS,)</p>	15 Hrs
UNIT III	<p>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</p>	15 Hrs



	inside Express Persisting your data with MongoDB, Testing Express applications, Security, Best practice.	
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COURSE CODE RPSITP.E516	COURSE TITLE PRACTICAL OF ADVANCED FULL STACK	Credits 1/ 15 Hours
	<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 ReactJS.</p>	

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/>



MODALITY OF ASSESSMENT-DSC/DSE (FOR 3 CREDITS)

Theory Examination Pattern:

A) Internal Assessment (40%) - 30 Marks

Sr No	Evaluation type	Marks
1	Class Test	20
2	Class Test/ Project / Assignment / Presentation	10
	TOTAL	30

B) External Examination (Semester End 60%) - 45 Marks

Semester End Theory Examination:

1. Duration – The duration for these examinations shall be of **two hours**.
2. Theory question paper pattern:

Paper Pattern:

Questions	Options	Marks	Questions Based on
1	3 questions of 5 M each from 4 Questions	15	Unit I
2	3 questions of 5 M each from 4 Questions	15	Unit II
3	3 questions of 5 M each from 4 Questions	15	Unit III
	TOTAL	45	

Practical Examination Pattern:

A) External Assessment Semester End - 50 Marks

Sr No	Evaluation type	Marks
1	Practical Implementation for the given question	40
2	Attendance, Punctuality and Lab discipline/Practice	10
	TOTAL	50



MODALITY OF ASSESSMENT-DSC/DSE (FOR 2 CREDITS)

Theory Examination Pattern:

A) External Examination - 50 Marks

Semester End Theory Examination:

1. Duration – The duration for these examinations shall be of **two hours**.
2. Theory question paper pattern:

Paper Pattern:

Questions	Options	Marks	Questions Based on
1	5 questions of 5 M each from 6 Questions OR 7/8 marks questions with option to any one	25	Unit I
2	5 questions of 5 M each from 6 Questions OR 7/8 marks questions with option to any one	25	Unit II
	TOTAL	50	



MODALITY OF ASSESSMENT – RESEARCH METHODOLOGY

Theory Examination Pattern:

A) Internal Assessment (40%) - 40 Marks

Sr No	Evaluation type	Marks
1	Class Test	20
2	Scientific Writing assignment (Abstract /Research Article), Research Review/ Research Proposal Writing	20
	TOTAL	40

B) External Examination (60%) - 60 Marks

Semester End Theory Examination:

1. Duration – The duration for these examinations shall be of **two Hours**.
2. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
1	3 questions of 5 M each from 4 Questions OR 7/8 marks questions with option to any one	15	Unit I
2	3 questions of 5 M each from 4 Questions OR 7/8 marks questions with option to any one	15	Unit II
3	3 questions of 5 M each from 4 Questions OR 7/8 marks questions with option to any one	15	Unit III
4	3 questions of 5 M each from 4 Questions OR 7/8 marks questions with option to any one	15	Unit IV
	TOTAL		

MODALITY OF ASSESSMENT – PROJECT



A) Internal Assessment (40%) - 40 Marks

Sr No	Evaluation type	Marks
1	Abstract submission & literature Survey / Sample Data Collection	10
2	Technology Implementation	10
3	Adherence to the project schedule	10
4	Project Documentation	10
	TOTAL	40

B) External Assessment (60%) - 60 Marks

Sr No	Evaluation type	Marks
1	Project Quality	20
2	Project Implementation	20
3	Final Presentation	20
	TOTAL	60

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 & Output:** 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%.