Resolution No.: AB/I (20-21).2. RPS6

S.P. Mandali's

RAMNARAIN RUIA AUTONOMOUS COLLEGE

(Affiliated to University of Mumbai)

RUIA COLLEGE
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Syllabus for: M.Sc. Computer Science

Program: M.Sc.

Course Code: Computer Science (RPSCS)

(Choice Based Credit System for academic year 2020-21)

PROGRAM OUTCOMES

PO	PO Description **A student completing master's degree in Computer Science program will be able to:**
PO 1	Demonstrate an in-depth understanding of 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	Develop keen interest in the emerging technologies in the industry.
PSO 2	Analyze, innovate, and solve real-life case studies using technology.
PSO 3	Work in teams with various disciplines; working on an interdisciplinary project.
PSO 4	Understand work culture in the industry and attain skills to become a successful entrepreneur.
PSO 5	Develop a skillset analyze, describe, and innovate various methodologies to solve a given problem
PSO 6	Understand the philosophy of the subject to apply to various fields of research.
PSO 7	Work inan industrial environment under expert supervision and develop expertise in various technologies
PSO 8	Effective utilization of available resources to overcome challenging tasks.

PROGRAM OUTLINE

M.Sc (Computer Science) Part I							
SEMESTER – I (THEORY)					**SEMESTER – I (PRACTICALS)**		
YEAR	**SEM**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**
Part I	**I**	RPSCS101	Analysis of Algorithm	04	RPSCSP101	Analysis of Algorithm	02
Part I	**I**	RPSCS102	Advanced-Data Modelling	04	RPSCSP102	Advanced Data Modelling	02
Part I	**I**	RPSCS103	Natural Language Processing	04	RPSCSP103	Natural Language Processing	02
Part I	**I**	RPSCS104	Blockchain	04	RPSCSP104	BlockChain	02

M.Sc (Computer Science) Part I							
SEMESTER – II (THEORY)					**SEMESTER – II (PRACTICALS)**		
YEAR	**SEM**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**
Part I	**II**	RPSCS201	Machine Learning	04	RPSCSP201	Machine Learning	02
Part I	**II**	RPSCS202	Cyber & information Security	04	RPSCSP202	Cyber & information Security	02
Part I	**II**	RPSCS203	Wireless and Mobile Networks	04	RPSCSP203	Wireless and Mobile Networks	02
Part I	**II**	RPSCS204	Advanced Mining Techniques	04	RPSCSP204	Advanced Mining Techniques	02

Note: The following syllabus of SEM III and IV is for students belonging to 2019-2021 M.Sc. batch. Students joining in 2020-21 will have a revised syllabus.

M.Sc (Computer Science) Part II							
SEMESTER – III (THEORY)					SEMESTER – III (PRACTICALS)		
YEAR	**SEM**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**
Part II	**III**	RPSCS301	Social Network Analysis	04	RPSCSP301	Social Network Analysis	02
Part II	**III**	RPSCS302A	Elective I - Cyber and Information Security- II (Cyber Forensics)	04	RPSCSP302A	Elective I - Cyber and Information Security- II (Cyber Forensics)	02
Part II	**III**	RPSCS302B	Elective II - Business Intelligence and Big Data Analytics - II(Mining Massive Data sets)	04	RPSCSP302B	Elective II - Business Intelligence and Big Data Analytics - II(Mining Massive Data sets)	02
Part II	**III**	------	-----	----	RPSCSP304	Project	06

M.Sc (Computer Science) Part II							
SEMESTER – IV (THEORY)					**SEMESTER – IV (PRACTICALS)**		
YEAR	**SEM**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**
Part II	**IV**	RPSCS401	Simulation and Modeling	04	RPSCSP401	Simulation and Modeling	02
Part II	**IV**	RPSCS402A	Elective II - Cyber and Information Security- II (Cryptography and Crypt Analysis)	04	RPSCSP402A	Elective II - Cyber and Information Security- II (Cryptography and Crypt Analysis)	02
Part II	**IV**	RPSCS402B	Elective III - Business Intelligence and Big Data Analytics - III (Intelligent Data Analysis)Massive Data sets)	04	RPSCSP402B	Elective III - Business Intelligence and Big Data Analytics -III (Intelligent Data Analysis)Massive Data sets)	02
Part II	**IV**	-------	-------	------	RPSCSP403	Internship	12

Course Code: RPSCS101

Course Title: ANALYSIS OF ALGORITHMS

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	Description
CO 1	Understanding Algorithmic complexity and analyzing the same
CO 2	Developing an understanding of various techniques and methods to design algorithms
CO 3	Skill to make the algorithm and solve real-world problems
CO 4	Developing algorithms to solve real-life problems.
CO 5	Analysis of traditional algorithms and apply to various problems.
CO 6	Find applications to algorithms in real-time case studies

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE / WEEK
RPSCS101	**RPSCS101: Analysis of Algorithms**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Introduction:** The Role of Algorithms in Computing, Algorithms as a technology, Insertion sort, Analyzing algorithms, Designing algorithms, Growth of Functions, Asymptotic notation, Standard notations and common functions, Divide-and-Conquer, The maximum-subarray problem, Strassen's algorithm for matrix multiplication, The substitution method for solving recurrences, The recursion-tree method for solving recurrences, The master method for solving recurrences, Proof of the master theorem. Probabilistic Analysis and Randomized Algorithms: The hiring problem, Indicator		15 L

	random variables, Randomized algorithms, Probabilistic analysis and further uses of indicator random variables	
II	**Sorting and Order Statistics:** Introduction, Heapsort, Heaps, Maintaining the heap property, Building a heap, The heapsort algorithm, Priority queues, Quicksort, Description of quicksort, Performance of quicksort, A randomized version of quicksort, Analysis of quicksort, Sorting in Linear Time, Lower bounds for sorting, Counting sort, Radix sort, Bucket sort, Medians and Order Statistics, Minimum and maximum, Selection in expected linear time, Selection in worst-case linear time.	15 L
III	Dynamic Programming, Rod cutting, Matrix-chain multiplication, Elements of dynamic programming, Longest common subsequence, Optimal binary search trees, Greedy Algorithms, An activity-selection problem, Elements of the greedy strategy, Huffman codes, Matroids and greedy methods, A task-scheduling problem as a matroid, Amortized Analysis, Aggregate analysis, The accounting method, The potential method, Dynamic tables	15 L
IV	**String Matching:** The naive string-matching algorithm, The Rabin-Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm **NP-Completeness:** Polynomial-time, Polynomial-time verification, NP-completeness and reducibility, NP-completeness proofs, NP-complete problems, Approximation Algorithms, The vertex-cover problem, The travelling-salesman problem, The set-covering problem, Randomization and linear programming, The subset-sum problem	15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE / WEEK
RPSCSP101	**RPSCSP101: PRACTICAL OF Analysis of Algorithms**	2	4
1	Demonstrate Strassen Matrix Multiplication.		
2	Solve the Hiring Problem with an appropriate algorithm		
3	Demonstrate various sorting algorithm and compute the efficiency of each		
4	Demonstrate dynamic programming with Rod Cutting problem.		
5.	Demonstrate the Long Subsequence problem and its solution using recursion.		

6	Demonstrate the Huffman Codes and its application.		
7.	Implement The Knuth-Morris-Pratt algorithm		
8.	Demonstrate the travelling Sales man's problem		

Text book:

1. Introduction to Algorithms Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein

References:

1. Analysis and Design of Algorithms: A Beginner's Approach by Rajesh K. Shukla

2. Design and Analysis of Algorithms: A Contemporary Perspective by Sandeep Sen

Course Code: RPSCS102

Course Title: Advanced Data Modelling

Academic year 2020-21

COURSE OUTCOMES:

Course Outcomes	Description
CO 1	Interpret different Data modelling Techniques for handling a variety of data.
CO 2	Evaluate and Apply appropriate NoSQL database for a specific use case.
CO 3	Analyze spatial data,relationships and metrics.
CO 4	Design and implement applications for semi-structured data.

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE / WEEK
RPSCS102	**RPSCS102: Advanced Data Modelling**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Spatial data modelling:** spatial data types, Raster, vector representation, topological spatial relationships, indexing, Geographical information systems: Data management, processing, referencing and analysis, visualization		15 L
II	**Semi-structured data modeling:** Semi-structured data model, Hierarchical data model, DTD, XML documents and schema, XML documents and databases, XML querying		15 L
III	**Nosql:** Features, Managing different data types, consistency methods, Distributed scenario, Partitioning, Query model, Storage layout, Enterprise application Evaluating Nosql: Technical, Business, issues		15 L
IV	NoSQL data stores: features and use cases of key-value, Big Table, document database, hybrid NoSQL, search engines.		15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE / WEEK
RPSCSP102	**RPSCSP102: Advanced Data Modelling**	**2**	**4**
	Real-world Case studies based on the following single category of databases or a combination of multiple databases 1. Semi-structured data 2. Spatial data 3. GIS 4. Nosql: Columnar data store 5. NoSQL: Key-value datastore 6. NoSQL: Graph datastore 7. NoSQL: Document datastore 8. NoSQL: Search engine		

Text book:

1. NoSQL for Dummies by Adam Fowler published by Willey

2. NoSQL and SQL Data modelling By Ted Hills

3. Fundamentals of database systems Navathe

4. Principles of GIS, otto Huisman, Rolf A

Course Code: RPSCS103

Course Title: Natural Language Processing

Academic year 2020-21

COURSE OUTCOMES:

Course Outcome	Description
CO 1	To learn how to apply basic algorithms & design and implement applications based on natural language processing
CO 2	Implement a rule-based system to tackle morphology/syntax of a language
CO 3	To design an innovative application system that uses NLP components
CO 4	Be able to design, implement and test algorithms for NLP problems
CO5	Be able to apply NLP techniques to design real-world NLP applications

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE / WEEK
RPSCS103	**RPSCS103: Natural Language Processing**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Introduction:** Knowledge In Speech And Language processing, Ambiguity, History of NLP. **Words Analysis:** Regular expression, Regular Languages and FSA, Words & Transducers, Morphology, Words & sentence Tokenization, Human Morphological processing, N-Grams, Evaluating N-grams, Parts of speech tagging (POST), Hidden Markov Model (HMM).		15 L
II	**Speech:** Phonetics, Speech sound & phonetic transcription, Articulatory phonetics, Speech Synthesis, Automatic Speech recognition, Computational phonology.		15 L
III	**Syntax:** Formal Grammars of English, Parsing with context-free grammars, Statistical Parsing, Language and complexity, Features and unification		15 L
IV	**Semantics & applications:** Representing Meaning, Computational semantic, lexical-semantic, Computational lexical-semantic, Information Extraction, Machine translation.		15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSCSP103	**RPSCSP103: PRACTICAL OF Natural Language Processing**	**2**	**4**
1.	Preprocessing of text: Word Analysis (Tokenization, Filtration, Script Validation)		
2.	Preprocessing of text: Word Generation (word frequency, Stop Word Removal, Stemming)		
3.	Morphological Analysis		
4.	N-gram model		
5.	POS tagging: HMM		

6.	POS tagging: Viterbi Decoding		
7.	Building POS Tagger		
8.	Chunking		
9.	Building Chunker / Name Entity Extraction		
10.	Case Study based on Application		

Text book:

1. Speech and Language Processing - By Daniel Jurafsky, James H. Martin – 2nd Edition, Prentice-Hall, 2008/2009.
2. Foundations of Statistical Natural Language Processing - By Christopher D. Manning and HinrichSchutze - The MIT Press(1999), Cambridge, Massachusetts, London, England.
3. Natural Language Processing with Python" Analyzing Text with Natural Language Toolkit. -By Steven Bird, Ewan Klein, Edward Loper,O'Reilly Media

References:

- Natural Language Processing: A Paninian Perspective ByAkshar Bharati, Vineet Chaitanya, Rajeev Sangal.
- Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, First Edition, OReilly Media, 2009.

Course Code: RPSCS104

Course Title: Blockchain

Academic year 2020-21

COURSE OUTCOMES:

Course Outcome	Description
CO 1	Explain blockchain technology as a security mechanism
CO 2	Explore blockchain types and implementation
CO 3	Construct and deploy Smart contracts using Ethereum
CO 4	Implement decentralized applications using blockchain in real-time applications.
CO 5	Describe Private Blockchain using Hyperledger Fabric

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCS104	**RPSCS104: Blockchain**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Introduction to blockchain:**Web3 - The Decentralized Web Distributed system, History of blockchain, Need of blockchainSatoshi Nakamoto's Blockchain Breakthrough, Basics of blockchain, Block structure, Features, Types of blockchain, Application of blockchain, Consensus in blockchain, Benefits, limitation and challenges of blockchain, Decentralization: Methods of decentralization, Roles to decentralization, Smart contracts, Decentralized organization		15 L
II	**Public blockchain:** Basics of Bitcoin, transactions, blockchain, Mining, Wallet types, Bitcoin network, Bitcoin limitations, Ethereum blockchain, elements of Ethereum blockchain, Block structure, Mining and consensus, Construction of smart contract by solidity, Alternative coins, Bitcoins, namecoin, Peercoin		15 L
III	**Private blockchain:** Hyperledger GreenHouse**,** Introduction to Hyledger Fabric, Features**,** Architecture, Requirements, Components of fabric, Working of fabric,Hyperledger SAWTOOTH, Hyperledger BESU Hyperledger INDY, Hyperleger BURROW		15 L
IV	**Blockchain Use cases:** Business Use Cases, Technology Use Cases, Legal and Governance Use Cases, Private blockchain Use cases		15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSCSP104	**PRACTICAL OF RPSCSP104 Block chain**	**2**	**4**
1	Double Linked list Implementation		
2	Hashing algorithms		
3	Cryptography Fundamentals		

4	Simple blockchain implementation		
5	Blockchain with MongoDB		
6	Ethereum Smart contract development		
7	Ethereum Dapp		
8	Hyper ledger Fabric		
9	Blockchain Case Study		

Text book:

1. Mastering Blockchain, Imran Bashir,packt
2. A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara Paul R. Allen

References:

1. 1.https://bitcoin.org/bitcoin.pdf
2. 2.Mastering Bitcoin by Andreas M. Antonopoulos, O'Reilly
3. 3.Mastering Etherium, Andreas M. Antonopoulos, O'Reilly
4. 4.€https://solidity.readthedocs.io/en/v0.6.2/ (for solidity documentation
5. 5.https://www.hyperledger.org/
6. https://www.leewayhertz.com/blockchain-platforms-for-top-blockchain-companies

MODALITY OF ASSESSMENT

Theory exam total marks: 100 Marks

Theory Examination Pattern:

Internal Exam - 40 Marks

1. **20 Marks -- MCQ Test:**
   Test will be taken based on any of the unit/units as informed by the faculty in-charge.
2. **20 Marks –**
   Develop Mini project in group(max four) and presentation of the same. / Online Course.

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

External Examination - 60 Marks Duration 2½ Hrs

Theory Question Paper Pattern:-

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

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

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

PRACTICAL

Internal Exam - 20 Marks

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

Regularity -- 10 Marks

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

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

External Examination - 30 Marks Practical Question -

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

Note:

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

Overall Examination & Marks Distribution Pattern

Semester I

Course	**101, 102, 103, 104**		
	Internal	**External**	**Grand Total**
Theory	**40**	**60**	**400 (4Papers)**
Practicals	**20**	**30**	**200 (3 Papers)**
Individual Semester Total			**600**

Course Code: RPSCS201

Course Title: Machine Learning

Academic year 2020-21

COURSE OUTCOMES:

Course Outcome	Description
CO 1	Understanding Artificial Intelligence, neural networks and its applications in real-life problems
CO 2	Working with evolutionary strategies like genetic algorithms and another evolutionary programming to solve various case studies
CO 3	To solve the Fuzzy logic problem using various strategies and apply the same.
CO 4	Understand deep learning problems and apply machine learning techniques to solve the same.

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE / WEEK
RPSCS201	**RPSCS201: Machine Learning**	**4**	**4**
I	**Artificial Neural Networks** The Artificial Neuron, Supervised Learning Neural Networks, Unsupervised Learning Neural Networks, Radial Basis Function Networks, Reinforcement Learning, Performance Issues.		15 L
II	**Evolutionary Computation** Introduction to Evolutionary Computation, Genetic Algorithms, Genetic Programming, Evolutionary Programming, Evolution Strategies, Differential Evolution, Cultural Algorithms, Co-evolution.Computational Swarm Intelligence: Particle Swarm Optimization(PSO) - Basic Particle Swarm Optimization, Social Network Structures, Basic Variations and parameters, Single-Solution PSO.		15
III	**Advanced Topics and applications**. Ant Algorithms- Ant Colony Optimization Meta-Heuristic, Cemetery Organization and Brood Care, Division of Labor, Advanced Topics		15 L

	and applications. Artificial Immune systems, Fuzzy Systems and Rough Set Natural Immune System, Artificial Immune Models, Fuzzy Sets, Fuzzy Logic and Reasoning, Fuzzy Controllers, Rough Sets.	
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	**COURSE NAME**	**CREDITS**	**LECTURE /WEEK**
RPSCSP201	**RPSCSP201: PRACTICAL for Machine Learning**	**2**	**4**
1.	Implement a feed-forward neural network for the given data.		
2.	Implement a Self Organizing Map neural network.		
3.	Implement a Radial Basis Function neural network with gradient descent.		
4.	Implement a basic genetic algorithm with selection, mutation and crossover as genetic operators.		
5.	Implement an evolution strategy algorithm.		
6.	Implement a general differential evolution algorithm.		
7.	Implement a simple Ant colony optimization algorithm.		
8.	Demonstrate Convolution networks using a deep learning model.		

Text Book:

1. Computational Intelligence- An Introduction (Second Edition): AndriesP.Engelbrecht, John Wiley & Sons Publications (2007).
2. Deep Learning Ian Goodfellow, YoshuaBengio, Aaron Courville MIT Press

Reference:

1. Computational Intelligence And Feature Selection: Rough And FuzzyApproaches, Richard Jensen Qiang Shen, IEEE Press Series On ComputationalIntelligence, A John Wiley & Sons, Inc., Publication, 2008.
2. Computational Intelligence And Pattern Analysis In Biological Informatics,(Editors). Ujjwal
3. Maulik, Sanghamitra Bandyopadhyay, Jason T. L.Wang, JohnWiley& Sons, Inc, 2010.
4. Neural Networks for Applied Sciences and Engineering: From Fundamentals to Complex Pattern Recognition 1st Edition, Sandhya Samarasinghe, Auerbach Publications, 2006.
5. Introduction to Evolutionary Computing (Natural Computing Series) 2nd ed, A.E. Eiben, James E Smith, Springer; 2015.
6. Swarm Intelligence, 1st Edition, Russell C. Eberhart, Yuhui Shi, James Kennedy, Morgan Kaufmann,2001
7. Artificial Immune System: Applications in Computer Security, Ying Tan, Wiley-IEEE Computer
8. Society, 2016.
9. Computational Intelligence and Feature Selection: Rough and Fuzzy Approaches 1st Edition, Richard Jensen, Qiang Shen, Wiley-IEEE Press, 2008

Course Code: RPSCS202

Course Title: Cyber and Information security

Academic year 2020-21

COURSE OUTCOMES:

Course Outcome	Description
CO 1	Explain security mechanisms to secure data
CO 2	Analyze vulnerabilities in Network and cloud platform and find Its secure solution
CO 3	Identify possible attacks on IOT and its countermeasures

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSCS202	**Cyber and Information security**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Server Security** Server vulnerabilities, Threats and environment, Basic server security steps, Server security principle, Server security planning, Securing server operating system, Windows security, Unix security, Securing server database system, Securing server software, Maintaining the security of the server, virtual machines, Secure application design, Developing secure software		15 L
II	**Network Security** Secure Network Design, Network device security, Firewalls, Virtual private networks, Wireless network security, IDPS, VOIP and PBX security, SET, Detection and response to attacks, Risk analysis and management, Network security case scenario		15L
III	**Cloud Security** Cloud Computing Software Security Fundamentals, Cloud Computing Risk Issues, Cloud Computing SecurityChallenges, Cloud Computing SecurityArchitecture, Cloud Computing Life Cycle Issues, cloud security case scenario		15 L
IV	**IOT Security:** Threats AND ATTACKS, Computational Security for the IoT, Privacy-Preserving Time, Series Data Aggregation for the Internet of Things, Trust and authentication, Secure Path Generation, Scheme for Real-Time Green Internet of Things, Security Protocols for IoT Access Networks		15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSCSP202	**PRACTICAL OF RPSCSP202 Cyber & Information Security**	**2**	**4**
1.	Secure Communication		
2.	Secure programming implementation		
3.	Server Security		
4.	Database Security		
5.	cloud database security		
6.	cloud server Security		
7.	Using Docker for deployment to Secure Application code		
8.	Network monitoring tool		

Text book:

1. The Complete Reference: Information Security, Mark Rhodes-Ousley, McGraw-Hill 2nd Edition,2013
2. Cloud Security - A Comprehensive Guide to Secure Cloud Computing, Ronald L.Krutz, Russell Dean Vines, Wiley Publishing, Inc., 2010.
3. Security and Privacy in Internet of Things (IoT), Fei Hu, CRC press

References:

1. Guide to General Server Security, Recommendations of the National Institute Of Standards and Technology, Karen Scarfone Wayne Jansen Miles Tracy
2. Cloud Security and Privacy, Tim mather, Subra Kumaraswamy
3. Securing Cloud and Mobility A Practitioner's Guide, Ian Lim. Coleen CoolidgePaul Hourani
4. Security in Computing 4th edition, Charles P. Pfleeger, Charles P.Pfleeger, Shari Lawrence Pfleeger, Prentice Hall; 4th edition (2006)

Course Code: RPSCS203

Course Title: Wireless and Mobile Networks

Academic year 2020-21

COURSE OUTCOMES:

Course Outcome	Description
CO 1	Understanding Wireless Networking Systems
CO 2	Working with Mobile Technologies and innovations in the same.
CO 3	Using wireless networking for developing applications and projects
CO 4	Detailed understanding of various mobile communication technologies along with wireless systems.

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCS203	**RPSCS203: Wireless and Mobile Networks**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	Introduction to Telephone Systems, Telephones, Control Functions, telephone Traffic, Switching, Wireless information Networks, Information Transmission, State Diagram of Telephone Network, Modems, Mobile Communication, Need, Requirements, History, Properties of Wireless Medium. Introduction to Cellular Mobile Communication, Cellular Structure, Frequency Reuse, System Architecture, Traffic and Switching Techniques. Mobile Communication Standards: Generation of Wireless networks, Standard Organizations.		15 L
II	Global Systems for Mobile Communication (GSM), GSM Architecture, AMPS, DAMPS, Cordless Telephony, PACS, Third Generation Wireless Standards. Mobility Management: Handoff Techniques, Handoff Detection and Assignment, Types of Handoff, Radio Link transfer, Roaming Management. Frequency Management, Cellular System Spectrum, Adaptive Channel allocation, Frequency Division, Spectrum Utilization, channel reservation for handoff calls, control channels, channel assignment methods, cell splitting. Mobile Computing, Classification of mobile data networks, Cellular digital packet data (CDPD) Systems.		15 L

	Satellite in Mobile Communication. Global Mobile Communication, Interferences in cellular communication, Mobile internet .	
III	Wireless Security: Wireless Threats, Authentication and access control, secrecy in communication, Security arrangements in CDMA, Security of wireless data networks, Wireless Local Loop Architecture: Components in WLL, Problems in WLL, Modern Wireless Loop, LDMS, Wireless Application Protocol: Properties of WAP, Bearer Services, WAP Component Integration, WAP Client Support Networks.	15 L
IV	WCDMA and Fibre optic microcellular Mobile communication: System Description, Layout of Optical Fibre and Microcellular Communication System, Adhoc Networks and Bluetooth Technologies: MANET and Technical Factors affecting ad hoc networks, Bluetooth technology Intelligent Mobile Communication: Types of Intelligent Cell, Power delivery Intelligent Cells, Processing Gain intelligent cells, 4G: User-Controlled services, Reconfigurable Technology, Vision of 4G, 4G Mobile System Convergences.	15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCSP203	**RPSCSP203: Practical of Wireless and Mobile Networks**	**2**	**4**
1.	Demonstrate Frequency distribution in Cellular Network		
2	Demonstrate and over in Adhoc networks		
3	Demonstrate satellite communication with earth stations		
4	Illustrate the wireless local loops.		
5.	Demonstrate the LDM systems		
6.	Develop a Bluetooth ad hoc network		
7.	Demonstrate the working of an intelligent cell		
8	Demonstrate MANET		

Text book:

"Wireless and Mobile Communication" by T.G. Nakkeeran, R. Palanivelu

References:

1. Wireless Communications: Principles and Practice, 2e Paperback – 2010 by Rappaport
2. Wireless Communications & Networks, 2e Paperback – 2009 by Stallings
3. Mobile Communications, 2e Paperback – 2008 by Schiller

Course Code: RPSCS204

Course Title: Advanced Mining Techniques

Academic year 2020-21

COURSE OUTCOMES:

Course Outcome	Description
CO 1	Interpret different Data mining algorithms and Techniques
CO 2	Critically evaluate and apply Mining algorithms to real-world case studies
CO 3	Compare Mapreduce and traditional Software paradigms
CO 4	Assess the similarity of documents
CO 5	Apply different link analysis techniques for specific use cases.

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCS204	**RPSCS204: Advanced Mining Techniques**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	What is data Statistical Modeling?, Machine Learning, Computational Approaches to Modeling, Summarization, Feature Extraction Statistical Limits on Data Mining. MapReduce and the New Software Stack: Distributed File Systems, MapReduce, Algorithms Using MapReduce, Extensions to MapReduce, The Communication Cost Model, Complexity Theory for MapReduce		15 L
II	Finding Similar Items: Applications of Near-Neighbor Search, Shingling of Documents, Similarity-Preserving Summaries of Sets, Locality-Sensitive Hashing for Documents, Distance Measures, The Theory of Locality-Sensitive Functions, LSH Families for Other Distance Measures, Applications of Locality-Sensitive Hashing, Methods for High Degrees of Similarity. Mining Data Streams: The Stream Data Model, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Ones in a Window, Decaying Windows		15 L
III	Link Analysis: PageRank, Efficient Computation of PageRank, Topic-Sensitive PageRank, Link Spam, Hubs and Authorities. Frequent Itemset: The Market-Basket Model, Market Baskets and the A-Priori Algorithm Handling Larger		15 L

	Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.	
IV	Clustering: Introduction to Clustering Techniques, Hierarchical Clustering, K-means Algorithms, The CURE Algorithm, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism. Recommendation Systems: A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction.	15 L

COURSE CODE	**COURSE NAME**	**CREDITS**	**LECTURE/ WEEK**
RPSCSP204	**RPSCSP204: Practical for Advanced Mining Techniques**	**2**	**4**
1	Demonstrate MapReduce for a given dataset		
2	Demonstrate an application of Near Neighbor search		
3	Demonstrate an application of Locality sensitive hashing technique for large datasets		
4	Demonstrate page ranking with an appropriate application		
5	Demonstrate Market basket analysis techniques		
6	Develop an application to implement the apriori algorithm		
7	Develop an application to perform clustering using various techniques.		
8	Develop a content-based recommendations system		

Text book:

1. Mining of Massive Datasets by Jure Leskovec Stanford Univ., Anand Rajaraman Milliway Labs, Jeffrey D. Ullman Stanford Univ.

References:

1) Data mining concepts and techniques by Jiawei Han, Micheline Kamber, Jian Pei 3rd Edition.

MODALITY OF ASSESSMENT

Theory exam total marks: 100 Marks

Theory Examination Pattern:

Internal Exam - 40 Marks

3. **20 Marks -- MCQ Test:**
   Test will be taken based on any of the unit/units as informed by the faculty in-charge.
4. **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	MIX	12

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

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

PRACTICAL

Internal Exam - 20 Marks

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

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

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

External Examination - 30 Marks Practical Question -

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

Note:

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

Overall Examination & Marks Distribution Pattern

Semester II

Course	**201, 202, 203, 204**		
	Internal	**External**	**Grand Total**
Theory	**40**	**60**	**400 (4Papers)**
Practicals	**20**	**30**	**200 (3 Papers)**
Individual Semester Total			**600**

Resolution No.: AB/II (20-21).2. RPS6

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S. P. MANDALI'S

RAMNARAIN RUIA AUTONOMOUSCOLLEGE OF ARTS & SCIENCE

M.Sc. Computer Science Syllabus (Semester III to IV)

With Effect From Academic Year 2019 - 2020

Note: The following syllabus of SEM III and IV is for students belonging to 2019-2021 M.Sc. batch.

Students joining in 2020-21 will have revised syllabus.

Course Code: RPSCS301

Course Title: Social Network Analysis

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	Description
CO 1	Understanding the working of Social Networks
CO 2	Working with Social networking
CO 3	Understanding statistically the working of Social Networks
CO 4	Statistical results for analyzing Social Networking
CO 5	Understanding the behaviourof Social Networking

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSCS301	**RPSCS301 : Social Network Analysis**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Introduction to social network analysis (SNA)** Introduction to networks and relations- analyzing relationships to understand people and groups, binary and valued relationships, symmetric and asymmetric relationships, multimode relationships, Using graph theory for social networks analysis- adjacency matrices, edge-lists, adjacency lists, graph traversals and distances, depth-first traversal, breadth-first traversal paths and walks, Dijkstra's algorithm, graph distance and graph diameter, social networks vs. link analysis, ego-centric and socio-centric density.		15 L
II	**Networks, Centrality and centralization in SNA** Understanding networks- density, reachability, connectivity, reciprocity,group-externaland group-internal ties in networks, ego networks, extracting and visualizing egonetworks, structural holes, Centrality degree of centrality, closeness and betweennesscentrality, local and global centrality, centralization and graph centres, notion ofimportance within a network, Google PageRank algorithm, Analyzing network structure-bottom-up approaches using cliques, N-cliques, N-clans, K-plexes, K-cores, F-groups and top-down approaches using components, blocks and cut-points, lambda sets andbridges, and factions.		15 L
III	**Measures of similarity and structural equivalence in SNA** Approaches to network positions and social roles- defining equivalence r similarity,structural equivalence, automorphic equivalence, finding equivalence sets, brute forceand Tabu search, regular equivalence, the equivalence of distances: Maxim, regularequivalence, Measuring similarity/dissimilarity- valued relations, Pearson correlations covariance and cross-products, Understanding clustering-agglomerative and divisive clusters, Euclidean, Manhattan, and squared distances, binary relations, matches:exact, Jaccard, Hamming,		15 L
IV	**Two-mode networks for SNA** Understanding mode networks- Bi-partite data structures, visualizing two-mode data,quantitative analysis using two-mode Singular value decomposition (SVD) analysis, two-mode factor analysis, two-mode correspondence analysis, qualitative analysis usingtwo-mode core-periphery analysis, two-mode factions analysis, affiliation and attributenetworks.		15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSCSP301	**RPSCSP301** **PRACTICAL OF Social Network Analysis**	**2**	**4**
	1. Write a program to compute the following for a given a network: (i) the number of edges, (ii) number of nodes; (iii) degree of the node; (iv) node with the lowest degree; (v) the adjacency list; (vi) matrix of the graph. 2. Perform following tasks: (i) View data collection forms and/or import one-mode/two-mode datasets; (ii) Basic Networks matrices transformations 3. Compute the following node level measures: (i) Density; (ii) Degree; (iii) Reciprocity; (iv) Transitivity; (v) Centralization; (vi) Clustering. 4. For a given network find the following: (i) Length of the shortest path from a given node to another node; (ii) the density of the graph; (iii) Draw egocentric network of node G with chosen configuration parameters. 5. Write a program to distinguish between a network as a matrix, a network as an edge list, and a network as a sociogram (or "network graph") using 3 distinct networks representatives of each. 6. Write a program to exhibit structural equivalence, automatic equivalence, and regular equivalence from a network. 7. Create sociograms for the persons-by-persons network and the committee-by-committee network for a given relevant problem. Create a one-mode network and two-node network for the same. **8.** Perform SVD analysis of a network.		

References:

1. Introduction to Social Network Methods: Robert A. Hanneman, Mark Riddle,University of California, 2005 [Published in digital form and available athttp://faculty.ucr.edu/~hanneman/nettext/index.html].
2. Social Network Analysis for Startups- Finding connections on the social web:MaksimTsvetovat, Alexander Kouznetsov, O'Reilly Media, 2011.
3. Social Network Analysis- 3rd edition, John Scott, SAGE publications, 2012.

Additional References:

1. Exploratory Social Network Analysis with Pajek, Second edition: WouterdeNooy, Andrej Mrvar, Vladimir Batagelj, Cambridge University Press, 2011.

2. Analyzing Social Networks, Stephen P Borgatti, Martin G. Everett, Jeffrey.Johnson, SAGE Publications, 2013.
3. Statistical Analysis of Network Data with R: Eric D. Kolaczyk, GáborCsárdi,Springer, 2014.
4. Network Analysis: Methodological Foundations, (Editors) UlrikBrandes, ThomasErlebach. Springer, 2005.
5. Models and Methods in Social Network Analysis: (Editors) Peter J. Carrington,JohnScott,Stanley Wasserman, Cambridge University Press, 2005

Course Code: RPSCS302A

Course Title: Cyber and Information Security- II (Cyber Forensics)

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	Description
CO 1	Understanding Computer Forensics process in detail
CO 2	Study different data recovery and Back up techniques
CO 3	Analyze different sources of evidence in Network forensics
CO 4	Gain knowledge and tools used in Mobile Forensics
CO 5	Study and analyze computer forensics case study

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCS302A	**RPSCS302A** **Track A: Cyber and Information Security- II** **(Cyber Forensics)**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Computer Forensics Fundamentals:** Introduction to Computer Forensics and objective, the Computer Forensics Specialist, Use of Computer Forensic in Law Enforcement, Users of Computer Forensic Evidence, Case Studies, Information Security Investigations. Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data, Spyware and Adware, Encryption Methods and vulnerabilities, Protecting Data from Being		15 L

	Compromised, Internet Tracing Methods, Security and Wireless Technologies. Types of Computer Forensics Systems: Study different Security System: Internet, Intrusion Detection, Firewall, Storage Area, Network Disaster Recovery, Public Key Infrastructure, Wireless Network, Satellite Encryption, Instant Messaging (IM), Net Privacy, Identity Management, Biometric, Identity Theft.	
II	**Data Recovery:** Data Recovery and Backup, Role of Data Recovery, Hiding and Recovering Hidden Data. Evidence Collection: Need to Collect the Evidence, Types of Evidence, 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, Reconstructing Past Events: How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files.	15 L
III	**Network Forensics:** Sources of Network-Based Evidence, Principles of internetworking, Internet Protocol Suite. Evidence Acquisition: Physical Interception, Traffic Acquisition Software, Active Acquisition. Traffic Analysis: Protocol Analysis, Packet Analysis, Flow Analysis, Higher-Layer Traffic analysis. Statistical Flow Analysis: Sensors, Flow Record Export Protocols, Collection and Aggregation, Analysis. Wireless: the IEEE Layer 2 Protocol Series, Wireless Access Point, Wireless Traffic Capture and Analysis, Common Attacks, Locating Wireless Devices. Network Intrusion Detection and Analysis: NIDS/NIPS Functionality, Modes of Detection, Types of NIDS/NIPS,NIDS/NIPS Evidence Acquisition	15 L
IV	**Network Devices and Mobile Phone Forensics:** Sources of Logs, Network Architecture, Collecting and Analyzing Evidence, switches, routers, firewalls, interfaces Web Proxies: Need to Investigate Web Proxies, Functionality, Evidence, Squid, Web Proxy Analysis, Encrypted Web Traffic. Mobile Phone Forensics: Crime and Mobile Phones, Voice, SMS and Identification of Data Interception in GSM, Mobile Phone Tricks, SMS Security, Mobile Forensic.	15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCSP302A	**RPSCSP302A** **PRACTICAL OF -Track A: Cyber and Information Security- II (Cyber Forensics)**	**2**	**2**
	1. Write a program to take a backup of MySQL database 2. Write a program to restore MySQL database 3. Use Drive Image XML to image a hard drive 4. Write a program to create a log file 5. Write a program to find a file in a directory 6. Write a program to find a word in a file 7. Create forensic images of digital devices from volatile data such as memory using Imager for: (i) Computer System; (ii) Server; (iii) Mobile Device 8. Access and extract relevant information from Windows Registry for investigation process using Registry View, perform data analysis and bookmark the findings with respect to (i) Computer System; (ii) Computer Network; (iii) Mobile Device; (iv) Wireless Network		

Textbooks:

1. Computer Forensics Computer Crime Scene Investigation, John R. Vacca, Second Edition, 2005.

2. Network Forensics, Sherri Davidoff, Jonathan HAM, Prentice-Hall, 2012.

3. Mobile Phone Security and Forensics: A Practical Approach, Second Edition, Iosif. Androulidkis, Springer, 2012.

Additional References:

1. Digital forensics: Digital evidence in criminal investigation",Angus.Marshall,John - Wiley and Sons, 2008.
2. Computer Forensics with FTK, Fernando Carbone, PACKT Publishing, 2014.
3. Practical Mobile Forensics, Satish Bommisetty, Rohit Tamma, Heather Mahalik,PACKT Publishing, 2014.

Course Code: RPSCS302B

Course Title: Business Intelligence and Big Data Analytics -II

(Mining Massive Data sets)

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	Description
CO 1	Understanding overview of BIG data
CO 2	Analyzing Big Data
CO 3	Understanding working with Business intelligence
CO 4	Students completing this course will be able to work in Big data using Hadoop
CO 5	Students completing this course will be able to work in Map Reduce using Hadoop
CO 6	Students completing this course will be able to work in Shingling using Hadoop

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSCS303B	**RPSCS303B** **Track B: Business Intelligence and Big Data Analytics -II (Mining Massive Data sets)**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Introduction To Big Data** Big data: Introduction to Big data Platform, Traits of big data, Challenges ofconventional systems, Web data, Analytic processes and tools, Analysis is reporting,Modern data analytic tools, Statistical concepts: Sampling distributions, Re-sampling,Statistical Inference, Prediction error. Data Analysis: Regression modelling, Analysis of Time Series: Linear systems analysis, Nonlinear dynamics, Rule induction, Neuralnetworks: Learning and Generalization, Competitive Learning, Principal Component Analysis and Neural Networks, Fuzzy Logic: Extracting Fuzzy Models from Data, FuzzyDecision Trees, Stochastic Search Methods.		15 L
II	**MAP REDUCE** 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: WorkflowSystems, Recursive extensions to MapReduce, Common map-reduce algorithms.		15 L
III	**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. theory of Locality-Sensitive functions. Methods for high degrees of similarity.		15 L
IV	**MINING DATA STREAMS** Introduction to streams concepts - Stream data model and architecture, Streamcomputing, Sampling data in a stream, Filtering streams, Counting distinct elements in astream, Estimating moments, Counting oneness in a Window, Decaying window, Realtime Analytics Platform(RTAP).		15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCSP303B	**RPSCSP303B** **PRACTICAL OF Elective II - Track C: Business Intelligence and Big Data Analytics -II (Mining Massive Data sets)**	**2**	**2**
	1. Generate a regression model and interpret the result for a given data set. 2. Generate a forecasting model and interpret the result for a given data set. 3. Write a map-reduce program to count the number of occurrences of each alphabetic character in the given dataset. The count for each letter should be case-insensitive (i.e., include both upper-case and lower-case versions of the letter; Ignore non-alphabetic characters). 4. Write a map-reduce program to count the number of occurrences of each word in the given dataset. (A word is defined as any string of alphabetic characters appearing between non-alphabetic characters like nature's is two words. The count should be case-insensitive. If a word occurs multiple times in a line, all should be counted) 5. Write a map-reduce program to determine the average ratings of movies. The input consists of a series of lines, each containing a movie number, user number, rating and a timestamp. 6. Write a map-reduce program: (i) to find matrix-vector multiplication; (ii) to compute selections and projections; (iii) to find union, intersection, difference, natural Join for a given dataset. 7. Write a program to construct different types of k-shingles for a given document. Write a program for measuring similarity among documents and detecting passages which have been reused.		

Textbooks:

1. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Michael Minelli, Wiley, 2013.

Additional References:

1. Big Data for Dummies, J. Hurwitz, et al., Wiley, 2013
2. Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data, Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, McGraw-Hill, 2012.
3. Big data: The next frontier for innovation, competition, and productivity, James Manyika,Michael Chui, Brad Brown, Jacques Bughin, Richard Dobbs, Charles Roxburgh, Angela Hung Byers, McKinsey Global Institute May 2011.
4. Big Data Glossary, Pete Warden, O'Reilly, 2011.

5. Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, David Loshin, Morgan Kaufmann Publishers, 2013

Course Code: RPSCSP304
Course Title: PROJECT IMPLEMENTATION

Academic year 2020-21

COURSE CODE	COURSE NAME	Credits
RPSCSP304	**Project Implementation Guidelines**	**6**
	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.	

MODALITY OF ASSESSMENT

Theory exam total marks: 100 Marks

Theory Examination Pattern:

Internal Exam - 40 Marks

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

PRACTICAL

Internal Exam - 20 Marks

1. **Innovative Practical -- 10 Marks**
   1. It can be clubbed with assignment.
   2. Research paper review to be done for an application.
2. **Regularity -- 10 Marks**
   1. Timely submission of practical's on the Google classroom.
   2. Attendance should be 75%.
   3. Submission of e-journal on time.

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

External Examination - 30 Marks Practical Question -

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

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.

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%.**

Overall Examination & Marks Distribution Pattern

Semester- III

Course	**301, 302A, 303B, 304**		
	Internal	**External**	**Total**
Theory	**40**	**60**	**300 (3 Papers)**
Practicals	**20**	**30**	**150 (3 Papers)**
Project	**60**	**90**	**150**
Individual Semester Total			**600**

Course Code: RPSCS401

Course Title: Simulation and Modeling

The academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	Description
CO 1	Simulate and model computer applications
CO 2	Understanding various models in simulations
CO 3	Working with strategies to simulate
CO 4	Students completing this course will be able to:
CO 5	Developing a simulation system to simulate real-life scenarios
CO 6	Exploring scenarios using 3D visualizations

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCS401	**RPSCS401** **Simulation and Modeling**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Introduction** Introduction to Simulation, Need of Simulation, Time to simulate, Inside simulationsoftware: Modeling the progress of Time, Modeling Variability, Conceptual Modeling: Introduction to Conceptual modelling, Defining the conceptual model, Requirements of theconceptual model, Communicating the conceptual model, Developing the		15 L

	Conceptual Model: Introduction, A framework for conceptual modelling, methods of models implification.	
II	**Model Verification and Validation** Data Collection and Analysis: Introduction, Data requirements, Obtaining data, Representing unpredictable variability, Selecting statistical distributions. Obtaining Accurate Results: Introduction, The nature of simulation models and simulation output, Issues in obtaining accurate simulation results, example model, dealing with initialization bias: warm-up and initial conditions, Selecting the number of replications and run-length. Searching the Solution Space: Introduction, The nature of simulation experimentation, Analysis of results from a single scenario, Comparing alternatives, Search experimentation, and Sensitive analysis. Verification, Validation and confidence: Introduction, Defining Verification and Validation, The difficulties of verification and validation, Methods of verification and validation, Independent verification and validation.	15 L
III	**Modelling and simulation modelling** Types of models, Analytical vs Simulation modelling, Application of simulation modelling, Level of abstraction, Simulation Modeling. Methods, System Dynamics, Discrete Event Modeling, Agent-Based modelling: Introduction to Agent, Agent-based modelling, Time in agent-based models, Space in agent-based models, Discrete space, Continuous space movement in continuous space, Communication between agents, Dynamic creation and destruction of agents, Statics on agent population, Condition triggered events andt ransition in agents. Building agents based models: The problem statement, Phases of modelling, Assumptions, 3 D animation. Dynamics Systems: Stock and flow diagrams, examples of stock and flow diagrams. Multi-method modelling: Architecture, Technical aspects of combining modelling methods, Examples.	15 L
IV	**Design and behaviour of models** Designing state-based behaviour: Statecharts, State transitions, Viewing and debugging Statecharts at runtime, Statecharts for dynamic objects. Discrete events and Event model object: Discrete event, Event-the simplest low-level model object, Dynamic events, and Exchanging data with the external world. Presentation and animation: Working with shapes, groups and colours, Designing interactive models: using controls, Dynamic properties of controls, 3D Animation. Randomness in Models: Probability distributions, sources of randomness in the model, randomness in system dynamics model, random-number generators, Model time, date and calendar: Virtual and real-time: The model time, date and calendar, Virtual and real-time execution modes.	15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCSP401	**RPSCSP401** **PRACTICAL OF Simulation and Modeling**	**2**	**2**

1. Design and develop the agent-based model by
   - Creating the agent population
   - Defining the agent behaviour
   - Adding a chart to visualize the model output
   - Adding a word of mouth effect
   - Considering product discards
   - Consider delivery time
   - Simulating agent impatience
   - Comparing model runs with different parameter values

[Use a scenario like market model]

2. Design and develop the System Dynamic model by
   - Creating a stock and flow diagram
   - Adding a plot to visualize dynamics
   - Parameter Variation
   - Calibration

[Use a case scenario like the spread of contagious disease for the purpose]

3. Design and develop a discrete-event model that will simulate the process by:
   - Creating a simple model
   - Adding resources
   - Creating 3D animation
   - Modelling delivery

[Use a case situation like a company's manufacturing and shipping].

4. Design and develop the agent-based model by
   - Creating the agent population
   - Defining the agent behaviour
   - Adding a chart to visualize the model output
   - Adding a word of mouth effect
   - Considering product discards
   - Consider delivery time
   - Simulating agent impatience
   - Comparing model runs with different parameter values

[Use a scenario like market model]

5. Design and develop the System Dynamic model by
   - Creating a stock and flow diagram

	● Adding a plot to visualize dynamics ● Parameter Variation ● Calibration [Use a case scenario like the spread of contagious disease for the purpose] 6. Design and develop a discrete-event model that will simulate the process by: ● Creating a simple model ● Adding resources ● Creating 3D animation ● Modelling delivery [Use a case situation like a company's manufacturing and shipping]. 7. Design and develop time-slice simulation for a scenario like an airport model to design how passengers move within a small airport that hosts two airlines, each with their own gate. Passengers arrive at the airport, check-in, pass the security checkpoint and then go to the waiting area. After boarding starts, each airline's representatives check their passengers' tickets before they allow them to board. 8. Verify and validate a model developed like a bank model or manufacturing model Create a defense model to simulate aircraft behaviour

TextBooks:

1. Simulation: The Practice of Model Development and Use by Stewart Robinson, John Wiley and Sons, Ltd, 2004.
2. The Big Book of Simulation Modeling: Multi-Method Modeling by Andrei Borshchev, 2013.

Additional References:

1. Agent-Based Modeling and Simulation, Taylor S, 2014.
2. Simulation Modeling Handbook: A Practical Approach, Christopher A. Chung,2003.
3. Object-Oriented Simulation: A Modeling and Programming Perspective, Garrido,José M, 2009.
4. Simulation, Modeling and Analysis, Averill M Law and W. David Kelton, "TataMcGraw Hill, Third Edition, 2003.
5. Process Control: Modeling, Design and Simulation, Wayne Bequette W, Prentice-Hall of India, 2003.

Course Code: RPSCS402A

Course Title: Cyber and Information Security

(Cryptography and Crypt Analysis)

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	Description
CO 1	Explain the basics of cryptography and its necessity
CO 2	Compare and contrastdifferent algorithm used to secure sensitive data
CO 3	Describe key distribution and agreement scheme
CO 4	Explore different tools to secure data

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCS402A	**RPSCS402A : Cyber and Information Security (Cryptography and Crypt Analysis)**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Introduction to Number Theory** Topics in Elementary Number Theory: O and notations, time estimates for doingarithmetic-divisibility and the Euclidean algorithm, Congruence: Definitions andproperties, linear congruence, residue classes, Euler's phi function, Fermat's little theorem, Chinese Reminder Theorem, Applications to factoring, finite fields, quadraticresidues and reciprocity: Quadratic residues, Legendre symbol, Jacobi Symbol. (proofsof the theorems are not expected to cover).		15 L

II	**Simple Cryptosystems** Shift Cipher, Substitution Cipher, Affine Cipher, Vigenère Cipher, Vermin Cipher, HillCipher, Permutation Cipher, Stream Cipher, Cryptanalysis of Affine Cipher, SubstitutionCipher, Vigenère Cipher and Hill Cipher, Block Ciphers, Algorithm Modes, DES, DoubleDES, Triple DES, Meet-in-Middle Attack, AES, IDEA algorithm. Cryptographic hash functions: Hash Functions and Data Integrity, Security of Hash Functions, Secure HashAlgorithm, Message Authentication Code, Nested MACs, HMAC.	15 L
III	**RSA Cryptosystem** The RSA Algorithm, Primarily Testing, Legendre and Jacobi Symbols, The Solovay-Strassen Algorithm, The Miller-Rabin Algorithm, Factoring Algorithm: The pollard p-1Algorithm, Dixon's Random Squares Algorithm, Attacks on RSA, The RabinCryptosystem. Public Key Cryptosystems: The idea of public-key Cryptography, TheDiffie-Hellman Key Agreement, ElGamal Cryptosystem, The Pollard Rho DiscreteLogarithm Algorithm, Elliptic Curves, Knapsack problem.	15 L
IV	**Key Distribution and Key Agreement Scheme** Diffie-Hellman Key distribution and Key agreement scheme, Key Distribution Patterns,Mitchell-Piper Key distribution pattern, Station-to-station protocol, MTI Key Agreementscheme. Public-Key Infrastructure:What is PKI?, Secure Socket Layer, Certificates,Certificate Life cycle, Trust Models: Strict Hierarchy Model, Networked PKIs, The webbrowser Model, Pretty Good Privacy.	15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCSP402A	**RPSCSP402A** **PRACTICAL OF Track A: Cyber and Information Security-III (Cryptography and Cryptanalysis)**	**2**	**2**
	1. Write a program to implement the following: (i)Chinese Remainder Theorem (ii)Fermat's Little Theorem 2. Write a program to implement the (i) Affine Cipher (ii) Rail Fence Technique (iii) Simple Columnar Technique (iv) Vermin Cipher (v) Hill Cipher to perform encryption and decryption. 3. Write a program to implement the (i) RSA Algorithm to perform encryption and decryption. 4. Write a program to implement the (i) Miller-Rabin Algorithm (ii) pollard p-1 Algorithm to perform encryption and decryption. 5. Write a program to implement the ElGamal Cryptosystem to generate keys and perform encryption and decryption. 6. Write a program to implement the Diffie-Hellman Key Agreement algorithm to generate symmetric keys. 7. Write a program to implement the MD5 algorithm and compute the message digest. 8. Write a program to implement different processes of DES algorithm like (i) Initial Permutation process of DES algorithm (ii) Generate Keys for DES algorithm (iii) S-Box substitution for DES algorithm.		

Textbook:

1. Discrete Mathematics and Its Applications, Kenneth H. Rosen, 7th Edition,McGraw Hill, 2012.
2. Cryptography Theory and Practice, 3rd Edition, Douglas R. Stinson, 2005.

Additional References:

1. Network Security and Cryptography, Atul Kahate, McGraw Hill, 2003.
2. Cryptography and Network Security: Principles and Practices, William Stalling,Fourth Edition, Prentice-Hall, 2013.
3. Introduction to Cryptography with coding theory, second edition, Wade Trappe,Lawrence C. Washington, Pearson, 2005.

Course Code: RPSCS402B

Course Title: Business Intelligence and Big Data Analytics

(Intelligent Data Analysis)

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	Description
CO 1	Understanding various strategies in data mining
CO 2	Understand techniques for classification, clustering etc.
CO 3	Students completing this course will be able to develop an application to perform real-life data mining strategies
CO 4	Students completing this course will be able to Develop Working for data warehousing and big data analytics for the same

DETAILED SYLLABUS

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCS402B	**RPSCS402B: Business Intelligence and Big Data Analytics (Intelligent Data Analysis)**	**4**	**4**
UNITS	**COURSE CONTENTS**		**NO. OF LECTURES**
I	**Clustering** Distance/Similarity, Partitioning Algorithm: K-Means; K-Medoids, Partitioning Algorithmfor large data set: CLARA; CLARINS, Hierarchical Algorithms: Agglomerative(AGNES); Divisive (DIANA), Density-based clustering: DBSCAN, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism.		15 L
II	**Classification**		15 L

	Challenges, Distance-based Algorithm: K nearest Neighbors and kD-Trees, Rules andtrees based Classifiers, Information gain theory, Statistical based classifiers: Bayesianclassification, Document classification, Bayesian Networks. Introduction to Support Vector Machines, Evaluation: Confusion Matrix, Costs, Lift Curves, ROC Curves,Regression/model trees: CHAID (Chi-Squared Automatic Interaction Detector). CART(Classification And Regression Tree).	
III	**Dimensionality Reduction** Introduction to Eigenvalues and Eigenvectors of Symmetric Matrices, Principal-Component Analysis, Singular-Value Decomposition, CUR Decomposition	15 L
IV	**Link Analysis And Recommendation Systems** Link analysis: PageRank, Efficient Computation of PageRank, Topic-SensitivePageRank, Link Spam. Recommendation Systems: A Model for RecommendationSystems, Content-Based Recommendations, Collaborative Filtering, DimensionalityReduction.	15 L

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSCSP402B	**RPSCSP402B** **PRACTICAL OF Track B: Business Intelligence and Big Data Analytics - III (Intelligent Data Analysis)**	**2**	**2**
	1. Pre-process the given data set and hence apply clustering techniques like K-Means, K-Medoids. Interpret the result. 2. Pre-process the given data set and hence apply partition clustering algorithms. Interpret the result 3. Pre-process the given data set and hence apply hierarchical algorithms and density-based clustering techniques. Interpret the result. 4. Pre-process the given data set and hence classify the resultant data set using three classification techniques. Interpret the result. 5. Pre-process the given data set and hence classify the resultant data set using Statistical based classifiers. Interpret the result. 6. Pre-process the given data set and hence classify the resultant data set using support vector machine. Interpret the result. 7. Write a program to explain the different functions of Principal Components. 8. Write a program to explain the CUR Decomposition technique.		

Textbook:

1. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman,Cambridge University Press, 2012.

2. Data Mining: Introductory and Advanced Topics, Margaret H. Dunham, Pearson,2013.

Additional References:

1. Big Data for Dummies, J. Hurwitz, et al., Wiley, 2013.
2. Networks, Crowds, and Markets: Reasoning about a Highly Connected World,David Easley and Jon Kleinberg, Cambridge University Press, 2010.
3. Lecture Notes in Data Mining, Berry, Browne, World Scientific, 2009.
4. Data Mining: Concepts and Techniques third edition, Han and Kamber, MorganKaufmann, 2011.
5. Data Mining Practical Machine Learning Tools and Techniques, Ian H. Witten,Eibe Frank, The Morgan Kaufmann Series in Data Management Systems, 2005.
6. Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools,Techniques, NoSQL and Graph, David Loshin, Morgan Kaufmann Publishers,2013.

Course Code: RPSCSP403
Course Title: INTERNSHIP

Academic year 2020-21

COURSE CODE	COURSE NAME	Credits
RPSCSP403	**INTERNSHIP**	**12**
	The syllabus proposes an internship for about 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 fulltime intern during the period. 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. Proper certification by the person, to whom the student was reporting, with Organization's seal should be attached as part of the documentation.	

MODALITY OF ASSESSMENT

Theory exam total marks: 100 Marks

Theory Examination Pattern:

Internal Exam - 40 Marks

1. **20 Marks -- MCQ Test:**
   The test will be taken based on any of the unit/units as informed by the faculty in-charge.
1. **20 Marks –**
   Assignments based on the syllabus or any other topic in demand based on the syllabus.

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	MIX	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.

PRACTICAL

Internal Exam - 20 Marks

1. **Innovative Practical -- 10 Marks**
   1. It can be clubbed with the 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 the 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.**

INTERNSHIP (300 Marks)

INTERNAL COMPONENT - 120 Marks

Assessment will be done by the Employer and Internship Coordinator jointly. Following are the guidelines:

- Job description
- Technical knowledge/skills
- Open to new ideas and learning new techniques
- Innovativeness & creativity
- Adherence to Schedule (weekly activity report)
- Soft Skills (Communication, Individual & Teamwork, Resource Management, Leadership qualities)
- Discipline &behaviour

EXTERNAL COMPONENT - (180) Marks

Based on the detailed work report 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.

- Internship Report
- Suitability & Clarity of material presented
- Quality of oral presentation

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

Overall Examination & Marks Distribution Pattern

Semester- IV

Course	**401,402,403**		
	Internal	**External**	**Total**
Theory	**40**	**60**	**200 (2 Papers)**
Practicals	**20**	**30**	**100 (2 Papers)**
Intership	**120**	**180**	**300**
Individual Semester Total			**600**