Resolution No. AC/I(21-22).2(II).RPS6

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to the University of Mumbai)

Syllabus for M.Sc

Program: M.Sc (Computer Science)

Program Code: Computer Science (RPSCS)

(Choice Based Credit System for the academic year 2022-23)

GRADUATE ATTRIBUTE

GA	PO Description **A student completing master's degree in Computer Science program will be able to:**
GA 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.
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 the 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 in the planning and execution of a task.
GA 8	Understand the cross-disciplinary relevance of scientific developments and relearn and reskill to adapt to technological advancements.

PROGRAM OUTCOMES

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

PROGRAM OUTLINE

M.Sc (COMPUTER SCIENCE)							
SEMESTER – I (THEORY)					**SEMESTER – I (PRACTICALS)**		
Year	**Sem**	**Course code**	**Course title**	**Credits**	**Course code**	**Course title**	**Credits**
Part I	I	RPSCS101 **Core Course**	Analysis of Algorithm	4	RPSCSP101	Analysis of Algorithm	2
Part I	I	RPSCS102 **Core Course**	Advanced Mining Techniques	4	RPSCSP102	Advanced-Data Modelling	2
Part I	I	RPSCS103 **Core Course**	Machine Learning	4	RPSCSP103	Machine Learning	2
Part I	I	RPSCS104 SEC	Cyber & Information Security	4	RPSCSP104	Cyber & Information Security	2
Part I	I	RPSCS105 AEC	Emotional well-being through Logic-based thinking	2	-	-	0

M.Sc (COMPUTER SCIENCE)							
SEMESTER – II (THEORY)					**SEMESTER – II (PRACTICALS)**		
Year	**Sem**	**Course code**	**Course title**	**Credits**	**Course code**	**Course title**	**Credits**
Part I	II	RPSCS201 **Core Course**	Natural Language Processing	4	RPSCS201	Natural Language Processing	2
Part I	II	RPSCS202 **Core Course**	Blockchain Fundamentals	4	RPSCS202	Blockchain Fundamentals	2
Part I	II	RPSCS203 **Core Course**	Enterprise Application Integration	4	RPSCSP203	Enterprise Application Integration	2
Part I	II	RPSCS204 SEC	Internet of Things	4	RPSCSP204 mool	Internet of Things	2
Part I	II	RPSCS205 AEC	Research Methodology	2	-	-	0

M.Sc (COMPUTER SCIENCE)							
SEMESTER – III (THEORY)					**SEMESTER – III (PRACTICALS)**		
Year	**Sem**	**Course code**	**Course title**	**Credits**	**Course code**	**Course title**	**Credits**
Part II	III	RPSCS301 **Core Course**	Deep Learning	4	RPSCSP301	Deep Learning	2
Part II	III	RPSCS302 **Core Course**	Simulation and Modelling	4	RPSCSP302	Simulation and Modelling	2
Part II	III	RPSCS303 **SEC**	Bigdata Analytics (SEC)	4	RPSCSP303 (SEC)	Big Data Analytics	2
Part II	III	–	–	0	RPSCP304	Project	6

M.Sc (COMPUTER SCIENCE)							
SEMESTER – IV (THEORY)					**SEMESTER – IV (PRACTICALS)**		
Year	**Sem**	**Course code**	**Course title**	**Credits**	**Course code**	**Course title**	**Credits**
Part II	IV	RPSCS401A **DSE**	*Advanced Data Mining*	4	RPSCSP401A	*Advanced Data Mining*	2
Part II	IV	RPSCS401B **DSE**	*Social Network Analysis*	4	RPSCSP401B	*Social Network Analysis*	2
Part II	IV	--	--	--	RPSCSP402	Internship	18

M.Sc. Computer Science Part I

Course Code: RPSC101

Course Title: Analysis of Algorithms

The 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 application to various problems.
CO 6	Find applications to algorithms in real-time case studies

COURSE CODE RPSCS101	COURSE NAME ANALYSIS OF ALGORITHMS	CREDITS 4

		LECTURES
I	***Foundations:*** 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 random variables, Randomized algorithms, Probabilistic analysis and further uses of indicator random variables.	15 L
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

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	COURSE NAME PRACTICAL OF ANALYSIS OF ALGORITHMS	CREDITS 2

RPSCSP101		
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 it's application.	
7.	Implement The Knuth-Morris-Pratt algorithm	
8.	Demonstrate the travelling Sales man's problem	

Course Code: RPSC102

Course Title: Advanced Mining Techniques

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.

COURSE CODE RPSCS102	**COURSE NAME** **Advanced Mining Techniques**	**CREDITS** **4** **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 Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.	15 L
IV		15 L

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.

COURSE CODE RPSCSP204	COURSE NAME Practical for Advanced Mining Techniques	CREDITS 2
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	

Course Code: RPSC103

Course Title: Machine Learning

The 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	Effective utilisation for Swarm inspired models to modify and optimise the solution to various real-world problems.
CO 4	Understanding Artificial Immune systems and its real world applications. To solve the Fuzzy logic problem using various strategies and apply the same.

COURSE CODE RPSCS103	COURSE NAME MACHINE LEARNING	CREDITS 4 LECTURES

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.	15
III	Computational Swarm Intelligence: Particle Swarm Optimization(PSO) - Basic Particle Swarm Optimization, SocialNetwork Structures, Basic Variations and parameters, Single-Solution PSO. Advanced Topics and applications. Ant Algorithms-Ant Colony Optimization.	15 L
IV	Artificial Immune systems, Fuzzy Systems and Rough Set Natural Immune System, Artificial Immune Models, Fuzzy Sets, Fuzzy Logic and Reasoning, Fuzzy Controllers, Rough Sets.	15 L

Text Book:

1. Computational Intelligence- An Introduction (Second Edition): Andries P.Engelbrecht, John Wiley & Sons Publications (2007).

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

Maulik, Sanghamitra Bandyopadhyay, Jason T. L.Wang, JohnWiley & Sons, Inc, 2010.

3. Neural Networks for Applied Sciences and Engineering: From Fundamentals to Complex Pattern Recognition 1st Edition, Sandhya Samarasinghe, Auerbach Publications, 2006.

4. Introduction to Evolutionary Computing (Natural Computing Series) 2nd ed, A.E. Eiben, James E Smith, Springer; 2015.

5. Swarm Intelligence, 1st Edition, Russell C. Eberhart, Yuhui Shi, James Kennedy, Morgan Kaufmann,2001

6. Artificial Immune System: Applications in Computer Security, Ying Tan, Wiley-IEEE Computer

Society, 2016.

7. Computational Intelligence and Feature Selection: Rough and Fuzzy Approaches 1st Edition, Richard Jensen, Qiang Shen, Wiley-IEEE Press, 2008

COURSE CODE RPSCSP103	COURSE NAME PRACTICAL OF Machine Learning	CREDITS 2
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 the application of AIS in ML.	

Course Code: RPSC104

Course Title: Cyber and Information security

The 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

COURSE CODE RPSCS104	COURSE NAME Cyber and Information security	CREDITS 4 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

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 **RPSCSP104**	**COURSE NAME** **PRACTICAL OF Cyber & Information Security**	**CREDITS** **2**
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	

Course Code: RPSC201

Course Title: Natural Language Processing

The 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

COURSE CODE RPSCS201	COURSE NAME NATURAL LANGUAGE PROCESSING	CREDITS 4 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

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 Hinrich Schutze -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:

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

COURSE CODE **RPSCSP201**	**COURSE NAME** **PRACTICAL OF NATURAL LANGUAGE PROCESSING**	**CREDITS** **2**
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	

Course Code: RPSC202

Course Title: Blockchain

The 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

COURSE CODE RPSCS202	**COURSE NAME** **BLOCKCHAIN**	**CREDITS** **4** **LECTURES**
I	**Introduction to blockchain:** Web3 – The Decentralised Web Distributed system, History of blockchain, Need of blockchain Satoshi 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	15 L
II	**Public and Private blockchain:** Basics of Bitcoin, transactions, blockchain, Mining, Bitcoin network, Bitcoin limitations, Ethereum blockchain, elements of Ethereum blockchain, Block structure, Mining and consensus, Construction of smart contract by solidity,Introduction to Hyperledger Fabric, Features**,** Architecture, Requirements, Components of fabric, Working of fabric	15 L

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

COURSE CODE **RPSCSP202**	**COURSE NAME** **PRACTICAL OF RPSCSP104 BLOCK CHAIN**	**CREDITS** **2**
1	Double Linked list Implementation	
2	Hashing algorithms	
3	Cryptography Fundamentals	
4	Constructing single block in blockchain	
5	Construct multiple blocks in blockchain	
6	Blockchain Dapp	
7	Smart contract Basics	

8	Smart contract advanced	

Course Code: RPSC203

Course Title: Enterprise Application Integration

The academic year 2022-23

COURSE OUTCOMES:

Course Outcome	Description
CO 1	Define your specific integration problem in a useful form that enables a real solution
CO 2	Develop your own EAI architecture and ensure interoperability of legacy technology applications
CO 3	Choose the best among messaging architecture, object architecture, and transaction architecture
CO 4	Work with the best implementation technologies

COURSE CODE RPSCS203	COURSE NAME **Enterprise Application Integration**	CREDITS 4 LECTURES
I	What Is EAI?, Traditional Systems, Microcomputer Systems, Distributed Systems, Packaged Applications, Making the Business Case for EAI, The Virtual System, e-Business, Types of EAI, Middleware and EAI Data-Level EAI: Data-Level EAI by Example, Database-to-Database EAI, Federated Database EAI, Consider the Data Source, Relational Data,Object-Oriented, Multidimensional, Other Data Storage Models,Hierarchical, ISAM and VSAM, CODASYL,Adabas, Working with Data-Level EAI	15 L

II	Application Interface-Level EAI: Application Interfaces, What's an API?, Interface by Example, Approaching Application Interfaces, The Interface Tradeoff, Packaged Applications, Packaged Application Technology Architecture, Packaged Application APIs, Types of Services, Types of Interfaces, Other Interfaces, Vertical Market Application Interfaces, SWIFT, FIX, HL7, Custom Applications, Rolling Your Own API, Application Wrapping, Using Application, Interfaces Method-Level EAI: Method-Level Example, What's a Process? Scenarios, Rules, Logic, Data, Objects, Method Warehousing, Leveraging, frameworks for EAI, The Value of Frameworks, Framework Functionality, framework Types, Service Frameworks, Procedural Frameworks, Component Frameworks, Framework Categories, Application Service Frameworks, Domain Frameworks, Support Frameworks, Enabling Technology, Application or Transaction Servers, Message Brokers, Distributed Objects, Sharing Methods to Bind Your Enterprise	15 L
III	User Interface-Level EAI: Leveraging User Interface-Level EAI, Going to the User Interface, Understanding the Application, Creating the Screen Catalog, Mapping Screens, Finding the Information, Static Extraction, Dynamic Extraction, Error Processing, Approaches, Screens-as-Data, Screens-as-Objects, Enabling Technology, Screen Access Tricks, HLLAPI, ASCII or ANSI, OLE Automation, Screens as Objects, The EAI Process: 12 Step process model. Step 1: Understanding the Enterprise and Problem Domain	15 L

	Step 2: Making Sense of the Data Step 3: Making Sense of the Processes Step 4: Identifying Application Interfaces Step 5: Identifying the Business Events Step 6: Identifying the Schema and Content Transformation Scenarios Step 7: Mapping Information Movement Step 8: Applying Technology Step 9: Testing, Testing, Testing Step 10: Considering Performance Step 11: Defining the Value Step 12: Creating Maintenance Procedures	
IV	Java Middleware and EAI: Categories of Java Middleware Standards, Database-Oriented, Interprocess, Message-Oriented, Messaging Models, JMS and Application Development, Application-Hosting, Distributed Objects XML and EAI: the Rise of XML,What's XML?,Data Structures,DTDs,XML Parsers,XML Metadata,XML and Middleware,Persistent XML,RDF and EAI, XSL and EAI, XML and EAI	15 L

Text book:

- Enterprise Application Integration by David S. Linthicum Addison-Wesley Information Technology Series
- Next-Generation Application Integration: From Simple Information to Web Services 1st Edition by Mary O'Brien (Author), David Linthicum (Author), John Fuller (Series Editor)

COURSE CODE RPSCSP203	COURSE NAME PRACTICAL OF RPSCSP203 Enterprise Application Integration	CREDITS 2
1	Demonstrate usage of middleware in e-business application.	
2	Develop a database connector to integrate data from various sources into a single data model.	
3	Demonstrate the working of distributed objects in an application.	
4	Demonstrate Message broker as a Middleware for EAI	
5	Bank teller application to demonstrate API.	
6	Develop API for a dummy travel website on appropriate EAI framework.	
7	Demonstrate working of User interface level EAI	
8	Demonstrate data exchange in EAI app using XML.	

Course Code: RPSC204

Course Title: Internet of Things

Course Outcome	Description
CO 1	Work on cloud-based Embedded Systems
CO 2	Explore various aspects of IOT
CO 3	Explore and understand different technologies associated with IOT
CO 4	Implement various IOT based project in Business and Healthcare

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCS204	RPSCS401A: Internet of Things	4	4

UNITS	COURSE CONTENTS	NO. OF LECTURES

I	Introduction to internet of things: Introduction, Physical Design of IOT, IOT Enabling Technologies, IOT Levels and deployment templates, Domain-Specific IOT: Home IOT, IOT in Cities, IOT in Environment, IOT used for Energy, IOT in Health and lifestyle	15 L
II	IOT and M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software-defined Networking, Function visualization, IOT Physical Server and Cloud offerings: Introduction to cloud storage model and Communication API, WAMP- AutoBahn for IOT, Google Cloud for IOT, Python web application framework Django, Designing restful web API, Amazon Webservices for IOT, Skynet IOT Messaging platform	15 L
III	IOT Physical Server and Cloud offerings: Introduction to cloud storage model and Communication API, WAMP- AutoBahn for IOT, Google Cloud for IOT, Python web application framework Django, Designing restful web API, Amazon Webservices for IOT, Skynet IOT Messaging platform.	
IV	Case Studies: Introduction, Home Automation, Cities, Environments, Agriculture, Productive applications, health care, automobiles.	

Text book:

1. Google IOT cloud
2. Internet of Things: A hands-on Approach by Arshdeep Bahga and Vijay Madisetti

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCSP204	RPSCSP401A: PRACTICAL OF Internet of Things	2	4
1	Creating Pub/Sub Topic		
2	Creating registries and devices		
3	Creating cloud Storage bucket		
4	Creating a cloud dataflow pipeline		
5	streaming IOT data to cloud storage		
6	Streaming IOT data to Big Query		
7	Streaming IOT data to Cloud Prep		
8	Innovative challenge lab.		

Course Code: RPSC205
Course Title: Research Methodology

The academic year 2022-23

COURSE OUTCOMES:

Course Outcome	Description
CO 1	To understand the research process
CO 2	To understand research problems and develop research strategies
CO 3	To develop and implement the techniques of data collection, analysis of data and interpretation.
CO 4	Identify strategies to tackle practical problems while doing research

COURSE CODE RPSCS205	COURSE NAME Research Methodology	CREDITS 4 LECTURES
I	**preliminary considerations** The selection of a Research Approach, Review of the literature, Use of theory, writing strategies and ethical considerations.	15 L
II	**Designing research** The introduction, the purpose statement, research questions and hypotheses, quantitative methods, qualitative methods, mixed methods procedures.	15 L

Text book:

1. Research design qualitative, quantitative and mixed approaches fourth edition by John W. Creswell Sage publication

References

1. RESEARCH METHODOLOGY IN COMPUTER SCIENCE Ryhan Ebad CENTRUM PRESS
2. **Research Methodology Methods and techniques by C.R. Kothari**

MSc Computer Science Part II

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCS301	RPSCS301:Deep Learning	4	4

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	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 L
II	Convolution Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.	15 L

III	Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks. Applications: Large Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing	15 L
IV	Deep Learning Research- Linear Factor Models: Probabilistic PCA and Factor Analysis, Independent Component Analysis (ICA), Slow Feature Analysis, Sparse Coding, Manifold Interpretation of PCA. Structured Probabilistic Models for Deep Learning: The Challenge of Unstructured Modeling, Using Graphs to Describe Model Structure, Sampling from Graphical Models, Advantages of Structured Modeling, Learning about Dependencies, Inference and Approximate Inference, The Deep Learning Approach to Structured Probabilistic Models	15L

Text book:

1. Deep Learning Ian Goodfellow, Yoshua Bengio, Aaron Courville (Adaptive Computation and Machine Learning series) MIT Press

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCSP301	RPSCSP301: PRACTICAL OF DEEP LEARNING	2	4
1	Demonstrate the deep feedforward networks.		

2	Demonstrate Convolution networks using a deep learning model.
3	Demonstrate Stochastic gradient descent (SGD) with Nesterov momentum
4	Demonstrate recursive neural networks
5	Demonstrate deep learning application for NLP
6	Demonstrate Echo state networks
7	Demonstrate Independent component analysis
8	Demonstrate sampling from graph models.

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCS302	RPSCS302 Simulation & Modeling	4	4

Learning Objective:

- Developing and understanding various simulation models
- Understand the application of simulation models to perform projections

Learning Outcome:

- Develop skills for encoding a given problem and understanding which statistical technique will help stimulate the same.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Introduction to Simulation: System and System environment, Components of system, Type of systems, Type of models, Steps in the simulation study, Advantages and Disadvantages of simulation. Simulation Examples: Simulation of Queueing systems, Other examples of simulation. Concepts of discrete event simulation, List processing, History of simulation software, Desirable software features, General-purpose simulation packages, Object-oriented simulation, Trends in simulation software Simulation Modeling : The need for Simulation, Time to simulate, Inside simulation software: Modeling the progress of Time, Modeling Variability	15 L

II	Statistical Models in Simulation: Useful statistical model, Discrete distribution, Continuous distribution, Poisson process, Empirical distribution. Queueing Models: Characteristics of Queueing systems, Queueing notations, Long run measures of performance of Queueing systems, Steady-state behaviour of infinite population Markovian models, Steady-state behaviour finite population model, Network of Queues. Random Number Generation: Properties of random numbers, Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for random numbers. Inverse transform technique, Convolution method, Acceptance rejection techniques	15 L
III	Conceptual Modeling: Introduction to Conceptual modelling, Defining conceptual model, Requirements of the conceptual model, Communicating the conceptual model, Developing the Conceptual, A framework for conceptual modelling, methods of model simplification. Types of models, Analytical vs Simulation modelling, Application of simulation modelling, Agent-Based Modelling, Designing state-based behaviour	15 L

IV	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

References:

1. Jerry Banks, John Carson, Barry Nelson, David Nicol, *Discrete Event System*
2. *Simulation*.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].
3. Simulation: The Practice of Model Development and Use by Stewart Robinson, John Wiley and Sons, Ltd, 2004.

4. The Big Book of Simulation Modeling: Multimethod Modeling by AndreiBorshchev, 2013

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCSP302	RPSCSP302 PRACTICAL OF Simulation & modelling	2	4
1	Design and develop an agent-based model		

2.	Design and develop the System Dynamic model
3.	Design and develop a discrete-event model that will simulate the process.
4.	Design and develop a 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 its 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.
5.	Verify and validate a model developed like a bank model or manufacturing model & Create a defence model to simulate aircraft behaviour.
6.	Demonstrate Statistical models
7.	Demonstrate queuing models
8.	Demonstrate random number generation
9.	Case studies

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSCS303	RPSCS303: Big Data Technologies	2	4

Course Objective:

- Understanding various Big Data Technologies
- Dataanlytics and map-reduce using Hadoop

- Develop applications in Hadoop and Python for Big Data
- Visualization of analytics using various technologies

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Introduction to Hadoop, Hadoop Distributed File System, MapReduce framework, YARN, Other changes, Installing Hadoop 3. Overview of Big Data Analytics: Introduction to data analytics, Introduction to big data, Distributed computing using Apache Hadoop.	15 L
II	The MapReduce framework, Hive, Apache Spark, Visualization using Tableau. Big Data Processing with MapReduce, The MapReduce framework, MapReduce job types, MapReduce patterns. Scientific Computing and Big Data Analysis with Python and Hadoop, Scientific Computing and Big Data Analysis with Python and Hadoop, Data analysis. Statistical Big Data Computing with R and Hadoop: Introduction, Methods of integrating R and Hadoop, Data analytics.	

II	Batch Analytics with Apache Spark: SparkSQL and DataFrames, DataFrame APIs and the SQL API, Schema – the structure of data, Loading datasets, Saving datasets, Aggregations, Joins. Real-Time Analytics with Apache Spark Streaming, Spark Streaming, file Stream, Transformations Checkpointing, Driver failure recovery. Visualizing Big Data: Introduction, Tableau, Chart types, Using Python to visualize data, Using R to visualize data, Big data visualization tools	15 L

Text book:

1. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization

2. Hadoop: The Definitive Guide by Tom White 5th Edith O'Reilly.

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCSP303	PRACTICAL OF RPCSP303 Bigdata Technologies	2	4
1	Demonstrate usage of HIVE in Hadoop		
2	Demonstrate queries on streams with Apache Spark		
3	Implement Mapreduce for a case study		

4	Demonstrate an application in R to implement predictive methods in data analytics.
5	Demonstrate the usage of HBase
6.	Extract data from various sources and load it in Hadoop
7.	Demonstrate the data visualization using R
8.	Demonstrate the data visualization by creating a dashboard in R

Course Code: RPSCS401
Course Title: Social Network Analysis

The academic year 2022-23

Course Outcome	Description
CO 1	understand the behaviour of the users in the social network
CO 2	Predict the possible next outcome of the social network
CO 3	Work on the internal components of the social network

CO 4	Model and visualize the social network
CO 5	Apply social network in real-time applications

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCS401	RPSCS401: 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, social networks vs. link analysis, ego-centric and socio-centric density. Visualization and applications of social networks 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, Hybrid representation, Applications - networks, community welfare, collaboration networks, Co-citation networks.	15 L

II	Networks, Centrality and centralization in SNA Understanding networks- density, reachability, connectivity, reciprocity, group-external and group-internal ties in networks, ego networks, extracting and visualizing ego networks, structural holes, Centrality degree of centrality, closeness and betweenness centrality, local and global centrality, centralization and graph centres, the notion of importance within the network, Google Page Rank algorithm, Analyzing network structure-bottom-up approaches using cliques, N-cliques, N-clans, K-plexes, K-cores, blocks and cut-points, lambda sets and bridges & factions.	15 L
III	Measures of similarity and structural equivalence in SNA Approaches to network positions and social roles-defining equivalence similarity, structural equivalence, automorphic equivalence, finding equivalence sets, brute force and Tabu search, regular equivalence, the equivalence of distances: Maxim, regular equivalence, Measuring similarity/dissimilarity- valued relations, Pearson correlations covariance and cross-products, Euclidean, Manhattan, and squared distances, binary relations, Jaccard, Hamming distance	15 L
IV	Two-mode networks for SNA Understanding mode networks- Bi-partite data structures, visualizing two-mode data, Singular value decomposition (SVD) analysis, two-mode factor analysis. Predicting Human Behavior and Privacy Issues Understanding and predicting human behaviour for social communities, User data Management, Enabling human experience, Privacy on social networks	15 L

References:

1. Introduction to Social Network Methods: Robert A. Hanneman, Mark
2. Riddle, University of California, 2005 [Published in digital form and available athttp://faculty.ucr.edu/~hanneman/nettext/index.html].
3. Social Network Analysis for Startups- Finding connections on the social web: MaksimTsvetovat, Alexander Kouznetsov, O'Reilly Media, 2011.
4. Social Network Analysis- 3rd edition, John Scott, SAGE publications, 2012.
5. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, —Computational Social Network Analysis: Trends, Tools and Research Advances‖, Springer, 2012
6. Charu C. Aggarwal, —Social Network Data Analytics‖, Springer; 2014

COURSE CODE	COURSE NAME	CREDITS	LECTURE/WEEK
RPSCSP401	RPSCSP401: PRACTICAL OF Social Network Analysis & Simulation	2	4
	1. Write a program to compute the following for a given a network: 1. number of edges, 2. a number of nodes; 3. degree of the node; 4. node with the lowest degree; 5. the adjacency list; 6. matrix of the graph. 7. Length of the shortest path 8. edge list 2. Perform the following tasks: 1. View data collection forms and/or import one-mode/two-mode datasets; 2. Basic Networks matrices transformations 3. Compute the following node level measures: 1. Density; 2. Degree; 3. Reciprocity; 4. Transitivity; 5. Centralization; 6. Clustering. 7. equivalence 4. 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. 5. Bipartite Graph 6. Hamming distance, Manhattan, Euclidean 7. Perform SVD analysis of a network. 8. Case studies		

MSc Part I (Sem I & II) EVALUATION SCHEME

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

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

THEORY

Internal Exam - 40 Marks

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

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

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

External Examination - 60 Marks Duration 2½ Hrs

- **Pandemic changes**
  - MCQ

Theory Question Paper Pattern:-

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

Q4	Unit IV	12
Q5	MIX	12

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

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

PRACTICAL

Internal Exam - 20 Marks

1. **Innovative Practical -- 10 Marks**
    1. It can be clubbed with the 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 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 are certified are only allowed to appear for the exam.**
2. **Students have to acquire at least 40% marks in each paper individually.**

- **Pandemic changes**
    - MCQ, Viva, Written submission.

MSc Part II (Sem III & IV) EVALUATION SCHEME

THEORY

Internal Exam - 40 Marks

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

   Test will be taken based on any of the units/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%- 60 Marks

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

External Examination - 60 Marks Duration 2½ Hrs

- **Pandemic changes**
  - MCQ

Theory Question Paper Pattern:-

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

Q5	MIX	12

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

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

PRACTICAL

Internal Exam - 20 Marks

1. Innovative Practical -- 10 Marks

1. It can be clubbed with assignments.
2. Research paper review to be done for an application.

2. Regularity -- 10 Marks

1. Timely submission of practicals 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.

- **Pandemic changes**
    - MCQ, Viva, Written submission.

Note:

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

PROJECT EVALUATION - 150 Marks

Internal evaluation - 60 Marks

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

External evaluation - 90 Marks

- Project Quality - 20 Marks.
- Project Implementation - 40 Marks.
- Presentation - 30 Marks.

A Student should submit a project implementation report with the following details:

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

Note:

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

INTERNSHIP EVALUATION - 450 Marks

Internal evaluation - 180 Marks

Following are the guidelines for evaluation:

1. Job description: 20 Marks
2. Technical knowledge/skills: 40 Marks
3. Innovation & creativity : 40 Marks

4. Adherence to Schedule (weekly activity report): 20 Marks
5. Soft Skills (Communication, Teamwork, Resource Management, Leadership qualities): 40 Marks
6. Discipline & behaviour: 20 Marks

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

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

Following are the guidelines for evaluation:

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

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

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

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

Following are the guidelines laid for the same

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

4) Employer Feedback Form is prepared to assess based on the following:
    - Skills/ Knowledge
    - Self-Management
    - Dependability
    - Attitude
    - Relationships
5) Internship report:
    - Organization Overview
    - Description (Role, Activities, Technology Used, Live project link or screenshots)
    - SWOT Analysis
    - Introspection (knowledge acquired, Skills learned, challenging task performed)
    - Employers Feedback.
6) Proper certification by the person, to whom the student was reporting, with Organization's seal should be attached as part of the documentation.

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

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