Resolution No. AC/II/(23-24).2.RPS6

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

RUIA COLLEGE
Explore • Experience • Excel

Syllabus for MSc Computer Science

Program: M.Sc.

Program Code: RPSCS

As per the guidelines of NEP2020
Academic year 2023-24

GRADUATE ATTRIBUTE

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

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

PROGRAM OUTCOMES

PO	Description **A student completing Master's Degree in Science program in the subject of Computer Science 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

YEAR	SEM	COURSE CODE	TYPE OF COURSE	COURSE TITLE	CREDITS
M.Sc. CS Part I - SEMESTER I					
M.Sc. CS Part I	I	RPSCSO501	Discipline Specific Core I	Analysis of Algorithms	3
		RPSC RPO501	Practical DSC I	Practical for Analysis of Algorithms	1
		RPSCSO502	Discipline Specific Core II	Advanced Mining Techniques	3
		RPSCSPO502	Practical DSC II	Practical for Advanced Mining Techniques	1
		RPSCSO503	Discipline Specific Core III	Machine Learning	3
		RPSCSPO503	Practical DSC III	Practical for Machine Learning	1
		RPSCSO504	Skill Enhancement	DevOps	2
		RPSRMCSO505		Research Methodology	4
		RPSCSO506-I	Discipline Specific Elective	Cyber & Information Security	3
		RPSCSPO506-I	Practical on DSE	Practical for Cyber & Information Security	1
		RPSCSO506-II	Discipline Specific Elective	Wireless and Mobile Networks	
		RPSCSPO506-II	Practical on DSE	Practical for Wireless and Mobile Networks	
M.Sc. CS Part I - SEMESTER II					
M.Sc. CS Part I	II	RPSCSE511	Discipline Specific Core I	Natural Language Processing	3
		RPSCSPE511	Practical DSC I	Practical Natural Language Processing	1
		RPSCSE512	Discipline Specific Core II	Blockchain Fundamentals	3

YEAR	SEM	COURSE CODE	TYPE OF COURSE	COURSE TITLE	CREDITS
		RPSCSPE512	Practical DSC II	Practical for Blockchain Fundamentals	1
		RPSCSE513	Discipline Specific Core III	Social Network Analysis	3
		RPSCSPE513	Practical DSC III	Practical for Social Network Analysis	1
		RPSCSE514	Skill Enhancement Course	Organizational Behaviour	2
		RPSCSE515		Field Project	4
		RPSCSE516-I	Discipline Specific Elective	Cloud IOT	3
		RPSCSPE516-I	Practical of DSE	Practical of Cloud IOT	1
		RPSCSE516-II	Discipline Specific Elective	Enterprise Application Integration	3
		RPSCSPE516-II	Practical of DSE	Practical of Enterprise Application Integration	1

COURSE CODE: RPSCSO501
COURSE TITLE: ANALYSIS OF ALGORITHMS

Course Outcomes	After Completing this course student will be able to :
CO 1	Interpret Algorithmic complexity and analysing the same
CO 2	Develop an understanding of various techniques and methods to design algorithms
CO 3	Design optimised algorithm

UNITS	Analysis of Algorithms	CREDITS 3 / 45 HOURS
I	**Introduction** The Role of Algorithms in Computing, Algorithms as a technology, Insertion sort, Analysing 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 Hrs
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 Hrs

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. **NP-Completeness**: Polynomial-time, Polynomial-time verification-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 Hrs

COURSE CODE: RPSCSPO501
COURSE TITLE: PRACTICALS OF ANALYSIS OF ALGORITHMS

Course Outcomes	After Completing this course student will be able to :
CO1	Calculate the complexities of different algorithms
CO2	Examine different algorithmic methods to solve real world problems
CO2	Implement efficient algorithms in programming languages

Sr. No.	Practicals	Credits/hours 1/15
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 Radix, counting and bucket sort.	
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: RPSCSO502
COURSE TITLE: ADVANCED MINING TECHNIQUES

Course Outcomes	After Completing this course student will be able to :
CO1	Interpret different Data mining algorithms and Techniques
CO2	Evaluate and apply Mining algorithms to real-world case studies
CO3	Compare MapReduce and traditional Software paradigms
CO4	Identify the similarity of documents

UNITS	ADVANCED MINING TECHNIQUES	CREDITS 3 HOURS 45
I	What is data Statistical Modelling?, Machine Learning, Computational Approaches to Modelling, Summarization, Feature Extraction Statistical Limits on Data Mining. Clustering: Introduction to Clustering Techniques, Hierarchical Clustering, K-means Algorithms, The CURE Algorithm, Clustering in Non-Euclidean Spaces, Recommendation Systems: A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction	15 Hrs
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 Hrs

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. 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 Hrs

COURSE CODE: RPSCSPO502
COURSE TITLE: PRACTICAL OF ADVANCED MINING TECHNIQUES

Course Outcomes	After Completing this course student will be able to :
CO1	Apply Data mining algorithms and Techniques
CO2	Differentiate MapReduce and traditional Software paradigms

Course Code RPSCSP.O502	Practical Of Advanced Mining Techniques	Credits 1 / 15 Hours
	1. Create simple microservice to create TODo app 2. Create a feedback form with backend database connectivity 3. Create microservices for booking app 4. Create microservice to demonstrate use of Runnerly application 5. Create a microservice for chatbot and secure the service. 6. Demonstrate microservices using ReactJS and Flask 7. Demonstrate the working of Strava Token using ReatJS	

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: RPSCSO503
COURSE TITLE: MACHINE LEARNING

COURSE OUTCOME	DESCRIPTION After Completing this course student will be able to:
CO 1	Understand concept of Artificial neural network
CO 2	Design genetics algorithm
CO 3	Demonstrate fuzzy operation
CO 4	Implement Deep learning algorithms

UNITS	MACHINE LEARNING	Credits 3 / 45 Hours
I	Artificial Neural Networks The Artificial Neuron, Supervised Learning Neural Networks, Unsupervised Learning Neural Networks, Radial Basis Function Networks, Reinforcement Learning, Performance Issues.	15 Hrs
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 Hrs
III	Advanced Topics and applications. Ant Algorithms- Ant Colony Optimization Meta-Heuristic, Cemetery Organization and Brood Care, Division of Labor, Advanced Topics, 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. Deep Learning: Deep forward Networks, Regularization of Deep Learning, Optimization of Train Deep Models, Convolution Networks, Sequence Modelling: Recurrent and Recursive Nets	15 Hrs

Text Book:

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

References:

1. Computational Intelligence And Feature Selection: Rough And Fuzzy Approaches, Richard Jensen Qiang Shen, IEEE Press Series On Computational Intelligence, 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 Society, 2016.
8. Computational Intelligence and Feature Selection: Rough and Fuzzy Approaches 1st Edition, Richard Jensen, Qiang Shen, Wiley-IEEE P

COURSE CODE RPSCSPO503
COURSE TITLE: PRACTICALS OF MACHINE LEARNING

Course Outcomes	A student completing successfully completing this course will be able to:
CO1	Apply Artificial neural networks algorithms.
CO2	Implement different optimization algorithms
CO3	Design genetics algorithms

Course Code RPSCSP.O503	Practical of Machine Learning	Credit 1 / 15 Hours
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.	

COURSE CODE – RPSCSO504
COURSE TITLE – DEVOPS

Course Outcomes	After Completing this course student will be able to :
CO1	Implement Agile software development and modular robust software systems.
CO2	Develop optimal work processes to faster deployment of applications.
CO3	Develop hypotheses to optimize the development process.
CO4	Develop integrated processes in software development involving stakeholders and routine processes.

UNITS	DEVOPS	CREDITS 2 HOURS 30
I	Agile, Continuous Delivery, The principle of flows, the principles of Feedback, principles of continual learning and experimentation. Some Industry Case studies. Selecting which value stream to start with, Understanding the work in our value stream, making it visible and expanding it across the organization, how to design our organization and architecture with Conway's Law in mind, how to get outcomes by integrating operations into the daily work of development.	15 Hrs
II	The Technical practices of the Flow, Create the foundations of our development pipeline, enable fast and Reliable Automated Testing, Enable and Practice Continuous integration, Automate and Enable low Risk Releases, Architect for low-Risk Releases. The Technical Practices of Feedback, Create Telemetry to Enable Seeing and Solving Problems, Analyse Telemetry to Better Anticipate Problems and Achieve Goals, Enable Feedback so Development and operations can safely deploy code, Integrate Hypothesis-Driven Development and A/B Testing into Our Daily Work, Create Review and Coordination Processes to Increase Quality of our Current Work.	15 Hrs

Textbook:

- The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in technology organizations by Gene Kim, Jez Humble

Reference:

- Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale Book by Jennifer Davis.

• Practical DevOps Book by Joakim VeronaThe DevOps 2.0 Toolkit Book by Viktor Farcic

COURSE CODE – RPSRMCSO505
COURSE TITLE – RESEARCH METHODOLOGY

Course Outcomes	After Completing this course student will be able to :
CO 1	Formulate Problem statement
CO 2	Define research problems and develop research strategies
CO 3	Develop and implement the techniques of data collection, analysis of data and interpretation.
CO 4	Identify strategies to tackle practical problems while doing research

UNITS	RESEARCH METHODOLOGY	Credits 4 Hours 60
I	Kinds of Publication ,Writing, Science, and Skepticism, Spelling and Terminology Beginnings: Shaping a Research Project ,Research Planning, Students and Advisors ,A "Getting Started" Checklist Reading and Reviewing: Research Literature, Finding Research Papers ,Critical Reading , Developing a Literature Review, Authors, Editors, and Referees Contribution, Evaluation of Papers, Content of Reviews, Drafting a Review Hypotheses, Questions, and Evidence :Hypotheses ,Defending Hypotheses ,Forms of Evidence ,Use of Evidence ,Approaches to Measurement, Good and Bad Science ,Reflections on Research ,A "Hypotheses, Questions, and Evidence" Checklist	15 Hrs
II	Writing a Paper, The Scope of a Paper ,Telling a Story , Organization ,The First Draft, From Draft to Submission ,Co-authoring, Theses , Getting It Wrong ,A "Writing Up" Checklist Algorithms: Presentation of Algorithms, Formalisms ,Level of Detail, Figures ,Notation, Environment of Algorithms, Asymptotic Cost Good Style : Economy ,Tone ,Motivation, Balance ,Voice, The Upper Hand, Obfuscation, Analogies, Straw Men, Reference and Citation, Quotation, Acknowledgements, Grammar	15 Hrs

	Style Specifics :Titles and Headings, The Opening Paragraphs, Variation, Paragraphing ,Ambiguity ,Sentence Structure, Repetition and Parallelism ,Emphasis, Definitions, Choice of Words, Qualifiers , Misused Words, Spelling Conventions , Jargon ,Foreign Words ,Overuse of Words ,Padding, Plurals, Abbreviations Acronyms, Sexism, Punctuation :Fonts and Formatting ,Stops, Commas,Colons and Semicolons,Apostrophes,Exclamations,Hyphenation ,Capitalization, Quotations,Parentheses ,Citations Mathematics :Clarity,Theorems,Readability,Notation,Ranges and Sequences,Alphabets,Line Breaks ,Numbers,Percentages,Units of Measurement	
III	Graphs, Figures, and Tables: Graphs,Diagrams,Tables ,Captions and Labels ,Axes, Labels, and Headings Editing: Consistency,Style ,Proofreading ,Choice of Word-Processor,An "Editing" Checklist Experimentation:Baselines ,Persuasive Data ,Interpretation,Robustness,Performance of Algorithms,Human Studies ,Coding for Experimentation, Describing Experiments ,An "Experimentation" Checklist	15 Hrs
IV	Statistical Principles : Variables ,Samples and Populations,Aggregation and Variability,Reporting of Variability ,Statistical Tools,Randomness and Error,Intuition,Visualisation of Results,A "Statistical Principles" Checklist Presentations:Research Talks ,Content , Organization,The Introduction ,The Conclusion,Preparation ,Delivery,Question Time ,Slides, Text on Slides , Figures,Posters, A "Presentations and Posters" Checklist Ethics: Intellectual Creations ,Plagiarism,Self-plagiarism, Misrepresentation ,Authorship, Confidentiality and Conflict of Interest,An "Ethics" Checklist	15 Hrs

Text book:

1. Writing for Computer Science by Justin Zobel Third Edition Springer
2. 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

COURSE CODE: RPSCSO506-I
COURSE TITLE: CYBER & INFORMATION SECURITY

Course Outcomes	After Completing this course student will be able to :
CO 1	Understand CIA traid
CO 2	Design security mechanism
CO 3	Explain network security concepts
CO 4	Describe importance to secure mobile and IOT devices

UNITS	CYBER & INFORMATION SECURITY	Credits 3 Hours 45
I	**Computer Security** Principles of Security, Different Attacks: malicious and non-malicious program, Types of Computer Criminals. Operating System Security: Protected objects and methods of protection. Memory address protection: Fence, Relocation, Base/Bound Registers, Tagged Architecture, Segmentation, Paging, Directory, access control list. Database Security: Security requirements, Integrity, Confidentiality, Availability, Reliability of Database, Sensitive data, Multilevel database, Proposals for multilevel security. .	15 Hrs
II	**Network and Mobile Security** Different types of network layer attacks, Firewall, IDS, IPS and its types. Secure Network Design, Network device security, Firewalls, Virtual private networks, Wireless network security, VOIP, SET, Mobile architecture, Mobile security, Mobile threats	15 Hrs
III	**Cloud and IOT Security** Cloud Computing Software Security Fundamentals, Cloud Computing Risk Issues, Cloud Computing Security Challenges, Cloud Computing Security Architecture, Cloud Computing Life Cycle Issues, IOT Security and architecture, IOT attacks, IoT Security Challenges security requirements, Security in IOT networks	15 Hrs

Text Book

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

Reference

- Cloud Security and Privacy, Tim mather, Subra Kumaraswamy

- Securing Cloud and Mobility A Practitioner's Guide, Ian Lim. Coleen CoolidgePaul Hourani

COURSE CODE: RPSCSPO506-I
COURSE TITLE: PRACTICAL OF CYBER & INFORMATION SECURITY

Course Outcomes	After Completing this course student will be able to :
CO 1	Apply Confidentiality and integrity techniques
CO 2	Use penetration testing tools to exploit system
CO 3	Demonstrate Database security mechanisms
CO 4	Apply Confidentiality and integrity techniques

SR. NO.	PRACTICAL OF CYBER & INFORMATION SECURITY	CREDITS 1 HOURS 15
1	Security goals	
2	Secure Communication	
3	Computer security	
4	Database security	
5	Network security	
6.	Cloud security	
7.	IOT Security	
8.	Security practices	
9.	Penetration testing	

COURSE CODE: RPSCSO506-II
COURSE TITLE: WIRELESS AND MOBILE NETWORKS

Course Outcomes	After Completing this course student will be able to :
CO 1	Understand Wireless Networking Systems
CO 2	Describe Mobile Technologies and innovations
CO 3	Use wireless networking for developing applications and projects
CO 4	Explain various mobile communication technologies along with wireless systems.

UNITS	WIRELESS AND MOBILE NETWORKS	Credits 3 Hours 45
I	Wireless transmission Frequencies for radio transmission ,Regulations, Signals , Antennas, Signal propagation ,Path loss of radio signals, Additional signal propagation effects, Multi-path propagation ,Multiplexing , Space division multiplexing , Frequency division multiplexing, Time division multiplexing , Code division multiplexing, Modulation, Amplitude shift keying, Frequency shift keying , Phase shift keying , Advanced frequency shift keying, Advanced phase shift keying, Multi-carrier modulation , Spread spectrum , Direct sequence spread spectrum, Frequency hopping spread spectrum, Cellular systems Hidden and exposed terminals, Near and far terminals, SDMA, FDMA, TDMA, Fixed TDM. Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, inhibit sense multiple access, CDMA, Spread Aloha multiple access, Mobile communications, Comparison of S/ T/ F/ CDMA	15 Hrs
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. Satellite in Mobile Communication. Global Mobile Communication, Interferences in cellular communication, Mobile internet	15 Hrs

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 Hrs

Text book:

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

References:

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

COURSE CODE: RPSCSPO506-II
COURSE TITLE: WIRELESS AND MOBILE NETWORKS

Course Outcomes	After Completing this course student will be able to :
CO 1	Demonstrate satellite communication
CO 2	Illustrate the wireless local loops.
CO 3	Demonstrate working of an intelligent cell

Sr. No.	PRACTICAL OF Wireless and Mobile Networks	Credits 1 Hours 15
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	

SEMESTER II

COURSE CODE: RPSCSE511
COURSE TITLE: NATURAL LANGUAGE PROCESSING

Course Outcomes	After Completing this course student will be able to :
CO 1	Understand 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	Design an innovative application system that uses NLP components
CO 4	Implement and test algorithms for NLP problems
CO 5	Apply NLP techniques to design real-world NLP applications

UNITS	NATURAL LANGUAGE PROCESSING	Credits 3 Hours 45
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. **Syntax:** Formal Grammars of English, Parsing with context-free grammars, Statistical Parsing, Language and complexity, Features and unification	15 L
III	**Semantics & applications:** Representing Meaning, Computational semantic, lexical-semantic, Computational lexical-semantic, Information Extraction, Machine translation. Case study on Application of NLP.	15 L

Text book:

- Speech and Language Processing - By Daniel Jurafsky, James H. Martin – 2nd Edition, Prentice-Hall, 2008/2009.
- Foundations of Statistical Natural Language Processing - By Christopher D. Manning and HinrichSchutze -The MIT Press(1999), Cambridge, Massachusetts, London, England.
- 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: RPSCSPE511
COURSE TITLE: NATURAL LANGUAGE PROCESSING

Course Outcomes	After Completing this course student will be able to :
CO 1	Demonstrate to apply algorithms
CO 2	Illustrate morphology along with its affixes
CO 3	Dramatize an innovative application system that uses NLP components
CO 4	Illustrate and test algorithms for NLP problems

Sr. No.	PRACTICAL OF Natural Language Processing	Credit 1 Hours 15
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	

COURSE CODE: RPSCSE512
COURSE TITLE: BLOCKCHAIN FUNDAMENTALS

Course Outcomes	After Completing this course student will be able to :
CO 1	Understand importance of Blockchain technology
CO 2	Explore Bitcoin technology
CO 3	Develop Ethereum application using solidity
CO 4	Study different blockchain use cases

UNITS	BLOCKCHAIN FUNDAMENTALS	CREDITS 3 HOURS 45

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

COURSE CODE: RPSCSPE512
COURSE TITLE: BLOCKCHAIN FUNDAMENTALS

Course Outcomes	After Completing this course student will be able to :
CO 1	Implement chain of blocks
CO 2	Design DAPP
CO 3	Develop Ethereum application using solidity

SR. NO.	PRACTICAL OF BLOCKCHAIN FUNDAMENTALS	CREDIT 1 HOURS 15
1.	Double link list implementation	
2.	Cryptography Basics	
3.	Single block generation	
4.	Multiple block generation	
5.	Block mining	
6.	Basic smart contracts	
7.	Advanced smart contract-I	
8.	Advanced smart contract-II	

Text book:

- Understanding Bitcoin, PEDRO Ransomville
- A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara Paul R. Allen
- Ethereum Smart Contract Development, Mayukh Mukhopadhyay, packt 4. Blockchain A Beginners Guide, Blockchain Hub

References:

- Josh Thompson, „Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", Create Space Independent Publishing Platform, First Edition - 2017.
- https://solidity.readthedocs.io/en/v0.6.2/
- https://bitcoin.org/bitcoin.pdf

COURSE CODE: RPSCSE513
COURSE TITLE: SOCIAL NETWORK ANALYSIS

Course Outcomes	After Completing this course student will be able to:
CO 1	Understand the working of Social Networks
CO 2	Interpret working of social networking
CO 3	Understand statistically the working of Social Networks
CO 4	Analyze Statical result Social Networking
CO 5	Understand the behavior of Social Networking

UNITS	SOCIAL NETWORK ANALYSIS	CREDITS 3 HOURS 45
UNIT 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. **Networks, Centrality and centralization in SNA** Understanding networks- density, reachability, connectivity, reciprocity, group-external and group-internal ties in	15 Hrs

	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, notion of importance 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 and bridges, and factions.	
UNIT II	**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 force and Tabu search, regular equivalence, the equivalence of distances: Maxim, regulare quivalence, 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, **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	15 Hrs
UNIT III	**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 Hrs

COURSE CODE: RPSCSPE513
COURSE TITLE: PRACTICALS OF SOCIAL NETWORK ANALYSIS

Course Outcomes	Practical Of Social Network Analysis
CO!	Illustrate the working of Social Networks through real world network
CO2	Demonstrate working of social networking based on graphs & algorithm
CO3	Interpret Statistical result Social Networking

SR. NO.	PRACTICAL OF SOCIAL NETWORK ANALYSIS	CREDITS 1 HOURS 15
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..	

Textbook:

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.

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: RPSCSE514
COURSE TITLE: ORGANIZATIONAL BEHAVIOR

Course Outcomes	After Completing this course student will be able to :
CO 1	Interpret the needs of the organization
CO 2	Define and develop organizational culture.
CO 3	Explain how to accept positive behaviour in organization

UNITS	ORGANIZATIONAL BEHAVIOR	CREDITS 2 HOURS 30
UNIT I	Organizational Behavior: College Textbook Revolution, Understanding Organizational Behavior Understanding Your Learning Style, Understanding How OB Research Is Done, Trends and Changes, Maintaining Core Values: The Case of Nau Managing Demographic and Cultural Diversity: Doing Good as a Core Business Strategy: The Case of Goodwill Industries, Demographic Diversity, Cultural Diversity, The Role of Ethics and National Culture, Managing Diversity for Success: The Case of IBM Designing a Motivating Work Environment: Motivating Steelworkers Works: The Case of Nucor, Motivating Employees Through Job Design, Motivating Employees Through Goal Setting, Motivating Employees Through Performance Appraisals, Motivating Employees Through Performance Incentives, The Role of Ethics and National Culture, Motivation Key for Success: The Case of Xerox Facing Foreclosure: The Case of Camden Property Trust: What Is Stress? Avoiding and Managing Stress, What Are Emotions? Emotions at Work the Role of Ethics and National Culture, Getting Emotional: The Case of American Express	15 Hrs
UNIT II	Teamwork Takes to the Sky: The Case of General Electric, Group Dynamics, Understanding Team Design Characteristics, Management of Teams, Barriers to Effective Teams, The Role of Ethics and National Culture, Green Teams at Work: The Case of New Seasons Market. Conflict and Negotiations: Negotiation Failure: The Case of the PointCast, Understanding Conflict, Causes and Outcomes of Conflict, Conflict Management, Negotiations, The Role of Ethics and National Culture, Avoiding Conflict at WorldCom: The Case of Bernard Ebbers. Building a Customer Service Culture: The Case of Nordstrom, Understanding Organizational Culture, Characteristics of Organizational Culture, Creating and Maintaining Organizational Culture, Creating Culture Change, The Role of Ethics and National Culture, Clash of the Cultures: The Case of Newell Rubbermaid	15 HRs

Textbook:

Organizational Behavior UNIVERSITY OF MINNESOTA LIBRARIES PUBLISHING EDITION, 2017.

COURSE CODE: RPSITE515
COURSE TITLE: FIELD PROJECT

Course Outcomes	After Completing this course student will be able to :
CO 1	Demonstrate the knowledge about the culture and societal
CO 2	Develop sense of responsibility and bond with the local
CO 3	Apply knowledge gained towards significant contributions to the local community and the Society at large
CO 4	Identify opportunities for contribution to the Socio-economic

COURSE CODE RPSCSE515	FIELD PROJECT	CREDITS 4 HOURS 60

Course Objective:

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

The student is expected to give a presentation of the project proposed and get verified and sanctioned by the project guide. In addition, experimental setup, analysis of results, comparison with results of related works, conclusion and future prospects will be part of the project implementation. A student is expected to make a project implementation report and appear for a project viva.

COURSE CODE: RPSCSE516-I
COURSE TITLE: CLOUD INTERNET OF THINGS

Course Outcomes	Description
CO 1	Understand cloud-based Embedded Systems
CO 2	Interpret various aspects of IOT
CO 3	Analyze different technologies associated with IOT

UNITS	CLOUD INTERNET OF THINGS	CREDITS 3 HOURS 45
UNIT 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 Hrs
UNIT II	IOT and M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software-defined Networking, Function visualization, IOT Management with NETCONF-YANG: Need for IOT System management, Simple Network Management Protocol, Network Operator requirement, NETCONF, YANG, IOT System management with NETCONF, YANG	15 Hrs
UNIT 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, case study	15 Hrs

COURSE CODE: RPSCSPE516-I
COURSE TITLE: PRACTICALS OF CLOUD INTERNET OF THINGS

Course Outcomes	After Completing this course student will be able to :
CO 1	Implement IOT concepts in cloud storage
CO 2	Use cloud services

SR. NO.	PRACTICALS OF CLOUD INTERNET OF THINGS	CREDIT 1 HOURS 15
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.	

Text book:

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

COURSE CODE: RPSCSE516-II
COURSE TITLE: ENTERPRISE APPLICATION INTEGRATION

Course Outcomes	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
CO4	Choose best implementation technologies

UNITS	ENTERPRISE APPLICATION INTEGRATION	CREDITS 3 HOURS 45
UNIT 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 Hrs
UNIT 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 Hrs

UNIT 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. 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 Hrs

COURSE CODE: RPSCSPE516-II
COURSE TITLE: PRACTICALS OF ENTERPRISE APPLICATION INTEGRATION

Course Outcomes	After Completing this course student will be able to:
CO 1	Illustrate different techniques of integrating data from multiple sources
CO 2	Demonstrate data exchange in EAI
CO 3	Design application using API

Sr. No.	Enterprise Application Integration	Credit 1 Hours 15
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.	

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)

MODALITIES OF ASSESSMENT

MODALITY OF ASSESSMENT- (FOR 3 CREDITS COURSES)

Theory Examination Pattern:

A) Internal Assessment (40%) - 30 Marks

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

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

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

Paper Pattern:

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

Practical Examination Pattern:

A) External Assessment Semester End - 50 Marks

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

MODALITY OF ASSESSMENT - (FOR 2 CREDITS COURSES)

Theory Examination Pattern:

A) External Examination - 50 Marks
Semester End Theory Examination:

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

Paper Pattern:

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

MODALITY OF ASSESSMENT – RESEARCH METHODOLOGY

Theory Examination Pattern:

A) Internal Assessment (40%) - 40 Marks

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

B) External Examination (60%) - 60 Marks
Semester End Theory Examination:

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

Paper Pattern:

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

MODALITY OF ASSESSMENT – FIELD PROJECT

A) Internal Assessment (40%) - 40 Marks

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

B) External Assessment (60%) - 60 Marks

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

A Student should submit project implementation report with following details:

1. **Title:** Title of the project.
2. **Introduction:** A description of how the project has been implemented. It shall be of 2 to 4 pages.
3. **System Analysis and Design:** A detail analysis of client requirement about working and interface of system
4. **Implementation:** A detailed explanation on how experiments were conducted, what software used and the results obtained. Details like screen shots, tables and graphs and code can come here.
5. **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.
6. **Conclusion:** A conclusion of the project performed in terms of its outcome (May be half a page).
7. **Future enhancement:** A small description on what enhancement can be done when more time and resources are available (May be half a page).

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%.