M.Sc.(Computer Science) Lateral Entry

M. G. S. UNIVERISTY, BIKANER

SYLLABUS

SCHEME OF EXAMINATION AND

COURSES OF STUDY

FACULTY OF COMPUTER SCIENCE

M.SC. COMPUTER (LATERAL ENTRY)

Department of Computer Science

Maharaja Ganga Singh University

Bikaner

Learning Outcome-based Curriculum Framework (LOCF)

for

M.Sc.(Computer Science) Lateral Entry

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Background

Considering the curricular reforms as instrumental for desired learning outcomes, all the academic departments of Maharaja Ganga Singh University Bikaner, made a rigorous attempt to revise the curriculum of postgraduate programs in alignment with National Education Policy-2020 and UGC Quality Mandate for Higher Education Institutions-2021. The process of revising the curriculum could be prompted with the adoption of the "Comprehensive Roadmap for Implementation of NEP-2020". The Roadmap identified the key features of the Policy and elucidated the Action Plan with well-defined responsibilities and an indicative timeline for major academic reforms.

The process of revamping the curriculum started with a series of webinars and discussions conducted by the University to orient the teachers about the key features of the Policy, enabling them to revise the curriculum in sync with the Policy. Proper orientation of the faculty about the vision and provisions of NEP-2020 made it easier for them to appreciate and incorporate the vital aspects of the Policy in the revised curriculum focused on creating holistic thoughtful, creative, and well-rounded individuals equipped with the key 21st-century skills 'for the development of an enlightened, socially conscious, knowledgeable, and skilled nation'.

With NEP-2020 in the background, the revised curricula articulate the spirit of the Policy by emphasising upon - an integrated approach to learning; innovative pedagogies and assessment strategies; multidisciplinary and cross-disciplinary education; creative and critical thinking; ethical and Constitutional values through value-based courses; 21st century capabilities across the range of disciplines through life skills, entrepreneurial and professional skills; community and constructive public engagement; social, moral, and environmental awareness; Organic Living and Global Citizenship Education (GCED); holistic, inquiry-based, discovery-based , discussion-

based and analysis-based learning; exposure to Indian knowledge system, cultural traditions and literature through relevant courses offering "Knowledge of India, fine blend of modern pedagogies with indigenous and traditional ways of learning; flexibility in course choices, student-centric participatory learning; imaginative and flexible curricular structures to enable creative combinations of disciplines for study; offering multiple entry and exit points, alignment of Vocational courses with the International Standard Classification of Occupations maintained by the International Labor Organization; breaking the silos of disciplines; integration of extra-curricular and curricular aspects, exploring internships with local industry, businesses and artists and craft persons; closer collaboration between industry and higher education institutions for technical, vocational, and science programs, and formative assessment tools to be aligned with the learning outcomes, capabilities, and dispositions as specified for each course. The university has also developed a consensus on Blended Learning with 10% component of online teaching and 60% face-to-face classes for each program.

The revised curricula of various programs could be devised with concerted efforts of the faculty, Heads of the Departments, and the Deans of Schools of Study. The draft prepared by each department was discussed in a series of discussion sessions conducted at the Department, School, and University levels. The leadership of the University has been a driving force behind the entire exercise of developing the uniform template and structure for the revised curriculum. The Vice-Chancellor of the University conducted series of meetings with Heads and Deans to deliberate upon the vital parameters of the revised curriculum to formulate a uniform template featuring Background, Programme Outcomes, Programme Specific Outcomes, Postgraduate Attributes, Structure of Masters Course, Learning Outcome Index, Semester-wise Courses and Credit Distribution, Course-level Learning Outcomes, Teaching-Learning Process, Blended Learning, Assessment and Evaluation, Keywords, References, and Appendices. The experts of various Board of Studies and School Boards contributed to a large extent in giving the final shape to the revised curriculum of each program.

To ensure the implementation of curricular reforms envisioned in NEP-2020, the University has decided to implement various provisions in a phased manner. Therefore, the curriculum may be reviewed annually so as to gradually include all relevant provisions of NEP-2020.

Program Outcomes

On completing Masters in the Faculty of Science, the students shall be able to realize the following outcomes:

PO	Description
PO1	Acquired knowledge with facts and figures related to various subjects in pure sciences such as Physics, Chemistry, Botany, Zoology, Mathematics, etc.
PO2	Understood the basic concepts, fundamental principles, and scientific theories related to various scientific phenomena and their relevance in day-to-day life.
PO3	Acquired the skills in handling scientific instruments, planning, and performing laboratory experiments The skills of observations and drawing logical inferences from the scientific experiments.
PO4	Analyzed the given scientific data critically and systematically and the ability to draw objective conclusions.

PO5	Been able to think creatively (divergent and convergent) to propose novel ideas in explaining facts and figures or providing new solutions to problems.
PO6	Realized how developments in any science subject help develop other science subjects and vice-versa and how interdisciplinary approach helps provide better solutions and new ideas for sustainable outcomes.
PO7	Developed a scientific outlook concerning science subjects and all aspects related to life.
PO8	Realized that knowledge of subjects in other faculties such as humanities, performing arts, social sciences, etc., can have greatly and effectively influence, which inspires in evolving new scientific theories and inventions.
PO9	Imbibed ethical, moral, and social values in personal and social life, leading to a highly cultured and civilized personality.
PO10	Developed various communication skills such as reading, listening, speaking, etc., which will help express ideas and views clearly and effectively.
PO11	Realized that pursuit of knowledge is a lifelong activity and in combination with untiring efforts and positive attitude and other necessary qualities leads towards a successful life.

Program Specific Outcomes (PSO)

On completing Masters in the M.Sc. in Computer Science Lateral Entry, the students shall be able to realize the following outcomes:

PSO	Description
PSO1	Communicate computer science concepts, designs, and solutions effectively and professionally
PSO2	Apply knowledge of computing to produce effective designs and solutions for specific problems
PSO3	Use software development tools, software systems, and modern computing platforms
PSO4	To have the knowledge and the ability to develop creative solutions
PSO5	To develop skills to learn new technology
PSO6	To develop critical reasoning
PSO7	To apply computer science theory and software development concepts to construct computing-based solutions
PSO8	To design and develop computer programs/computer-based systems in the area related to algorithms, networking, web design, cloud computing, Artificial Intelligence, Mobile applications

PSO9	The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity
PSO10	The ability to understand the evolutionary changes in computing, apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success, real-world problems, and meet the challenges of the future
PSO11	The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, lifelong learning and a zest for higher studies and also to act as a good citizen by inculcating in them moral values & ethics

Postgraduate Attributes

- Disciplinary Knowledge
- Creative & Critical Thinking
- Reasoning and Analytical abilities
- Logic/Discrete Mathematics knowledge
- Logical Thinking
- Problem analysis and solving abilities
- Life Skills
- Moral & Ethical Values
- Research Skills

Structure of Masters' Programme

Scheme for
M.Sc. Computer Science Lateral Entry (Semester I)
Examination 2021
Session 2021-22

	Course Code	Course Title	Exam Hours	Max. Marks		Min. Marks	L	T	P*	Credits
				Int. Marks	Ext. Marks					
Core Courses										
1	FS-COMP-MCSLE-CC-101	Data Structures	3	10	40	13 (25%)	3	1	1	5
2	FS-COMP-MCSLE-CC-102	Java	3	10	40	13 (25%)	3	1	1	5

	Course Code	Course Title	Exam Hours	Int. Marks	Ext. Marks	Min. Marks	L	T	P*	Credits
3	FS-COMP-MCSLE-CC-103	a) Software Engineering & Research Methodology b) Artificial Intelligence c) Python d) Theory of Computation	3	10	40	13 (25%)	3	1	1	5
4	FS-COMP-MCSLE-CC-104	a) Data Analysis Using R b) Introduction to LaTeX	3	10	40	13 (25%)	3	1	1	5
5	FS-COMP-MCS-CP-105	Combined Practical	3	25	75	26 (25%)	*combined practical of above subjects			
Core Foundation Course										
1	FS-COMP-MCS-FC-106	Computer Fundamentals	3	10	40	13 (25%)	4	2	2	5

Scheme for
M.Sc. Computer Science (Semester II)
Examination 2022
Session 2021-22

Semester II										
	Course Code	**Course Title**	**Exam Hours**	**Max. Marks**		**Min. Marks**	**L**	**T**	**P***	**Credits**
				Int. Marks	**Ext. Marks**					
Core Courses										
1	FS-COMP-MSC-LE-CC-201	Computer Graphics & Multimedia	3	10	40	13 (25%)	3	1	1	5
2	FS-COMP-MSC-LE-CC-202	Android Programming	3	10	40	13 (25%)	3	1	1	5
3	FS-COMP-MSC-LE-CC-203	a) Cloud Computing b) Internet of Things c) Big Data & Data Mining d) Machine Learning	3	10	40	13 (25%)	3	1	1	5
4	FS-COMP-MSC-LE-CC-204	a) Natural Language Processing b) Introduction to Cyber Security	3	10	40	13 (25%)	3	1	1	5
5	FS-COMP-MSC-LE-CP-205	Combined Practical & Project	3	20	80	13 (25%)	*combined practical of above subjects			
Core Foundation Course										
1	FS-COMP-MSC-LE-FC-206	Computer Moral Values	3	10	40	13 (25%)	4	2	2	5

Learning Outcome Index

Learning Outcomes are statements of knowledge, skills, and abilities a student should possess and demonstrate upon completion of learning experiences.

I. Programme Outcomes(PO) and Programme Specific Outcomes (PSO)

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11
PO1	x	x	x	x	x	x	x	x		x	x
PO2	x		x		x	x	x	x	x	x	x
PO3	x	x	x		x	x	x	x	x	x	x
PO4	x	x	x	x	x	x		x	x	x	x
PO5	x	x	x	x	x	x	x	x	x	x	x
PO6	x	x	x	x	x	x	x			x	x
PO7				x	x		x		x	x	x
PO8		x		x		x	x	x			x
PO9	x	x		x	x		x	x			x
PO10	x	x	x		x				x		x
PO11	x	x	x		x	x	x	x	x	x	x

II. Programme Specific Outcomes (PSO) and Core Courses (CC)

	MCSLE 101	MCSLE 102	MCSLE 201	MCSLE 202
PSO1	x	x	x	x
PSO2	x	x	x	x
PSO3	x	x		x
PSO4	x	x	x	x
PSO5	x	x	x	x
PSO6			x	
PSO7	x	x	x	x
PSO8	x	x		x
PSO9	x	x	x	x
PSO10	x	x	x	x
PSO11	x	x	x	x

III. Programme Specific Outcomes (PSO) and Core Elective Courses (CEC)

	MCSLE 103a	MCSLE 103b	MCSLE 103c	MCSLE 103d	MCSLE 203a	MCSLE 203b	MCSLE 203c	MCSLE 203d
PSO1	x	x	x	x	x	x	x	x
PSO2	x	x	x	x	x	x	x	x
PSO3	x		x		x		x	
PSO4	x	x	x	x	x	x	x	x
PSO5	x	x	x	x	x	x	x	x
PSO6		x		x		x		x
PSO7	x	x	x	x	x	x	x	x
PSO8	x		x		x		x	
PSO9	x	x	x	x	x	x	x	x
PSO 10	x	x	x	x	x	x	x	x
PSO 11	x	x	x	x	x	x	x	x

IV. Programme Specific Outcomes (PSO) and Open Elective Courses (OEC)

	MCSLE 105a	MCSLE 105b	MCSLE 205a	MCSLE 205b

PSO1	X	X	X	X
PSO2	X	X	X	X
PSO3	X		X	
PSO4	X	X	X	X
PSO5	X	X	X	X
PSO6		X		X
PSO7	X	X	X	X
PSO8	X		X	
PSO9	X	X	X	X
PSO 10	X	X	X	X
PSO 11	X	X	X	X

Objectives, Course-level Learning Outcomes, Contents, and Suggested Readings
Semester I

Paper Code: FS-COMP-MCSLE-CC-101
Paper Name: Data Structures

Course Objectives:
CO1. To Create and initialize variables, constants, arrays, pointers, structures, and unions.
CO2. To Manipulate values of variables, arrays, pointers, structures, unions, and files.
CO3. To Create a function that can receive variables, arrays, pointers, and structures.
CO4. To define functions that can receive variables, arrays, pointers, and structures.
CO5. To create open, read, manipulate, write and close files.
CO6. To select and use appropriate data structures for the given problems.
CO7. To design efficient algorithms using various algorithm designing strategies
CO8. To analyze the problem and develop the algorithms related to these problems
CO9. To classify the problem and apply the appropriate design strategy to develop an algorithm
CO10. To design algorithm in the context of space and time complexity and apply the asymptotic notation
CO11. To be able to analyze algorithms and algorithm correctness.
CO12. To be able to summarize searching and sorting techniques
CO13. To be able to describe stack, queue, and linked list operations.
CO14. To be able to know. tree and graphs concepts

Learning Outcomes:
After completing this course, students will be able to:
LO1. Create and initialize variables, constants, arrays, pointers, structures, and unions.
LO2. Manipulate values of variables, arrays, pointers, structures, unions, and files.
LO3. Create a function that can receive variables, arrays, pointers, and structures.
LO4. Define functions that can receive variables, arrays, pointers, and structures.
LO5. Create open, read, manipulate, write and close files.
LO6. Select and use appropriate data structures for the given problems.
LO7. Design efficient algorithms using various algorithm designing strategies
LO8. Analyze the problem and develop the algorithms related to these problems
LO9. Classify the problem and apply the appropriate design strategy to develop an algorithm
LO10. Design algorithm in the context of space and time complexity and apply the asymptotic notation
LO11. Ability to analyze algorithms and algorithm correctness.
LO12. Ability to summarize searching and sorting techniques
LO13. Ability to describe stack, queue, and linked list operations.
LO14. Ability to know. tree and graphs concepts

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Unit I

Algorithm: Efficiency & Analysis Algorithm: Time and Space complexity of Algorithm. **Abstract Data Type: Linked List-** Linear, Circular, Two Way List, Basic Operation on Linked Lists, Application of Linked List.

Unit II

Stack: primitive operations, stack Application- Infix, postfix, prefix and Recursion Array, and Linked Representation of Stack. **Queue:** Primitive operation, Circular Queue, Priority Queue, D-queue, Array, and Linked Representation of Queue.

Unit III

Trees: Basic terminology, **Binary Tree**: Representation as Array and link List, Basic operation, **Tree Traversal**: Inorder, Preorder, Postorder, Application of Binary Tree. B-tree, Height Balance Tree (AVL Tree) **Graph:** Basic Terminology, Directed, Undirected, Weighted, Representation of Graphs, **Graph Traversal**: Depth First Traversal, Breadth-First Search.

Recommended Readings
1. Expert Data Structure with 'C' By R.B Patel (Khana Book Publishing Co.(P))
2. Data structure By Lipschutz (Tata McGraw Hill)

Suggested Readings
3. Data Structure By Yashvant Kanitkar (BPB)
4. An Introduction to Data Structures with Applications By Jean-Paul Tremblay, Paul G.Sarerson (Tata McGraw Hill)
5. Data Structure Using C and C++ By Yedidyah Langsam, Moshe J.Augenstein, Arora M. Tenenbaum (Prentice- Hall India)

Paper Code: FS-COMP-MCSLE-CC-102

Paper Name: Java

Course Objectives:
CO1. To use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
CO2. To read and make elementary modifications to Java programs that solve real-world problems.
CO3. To validate input in a Java program.
CO4. To identify and fix defects and common security issues in code.
CO5. To document a Java program using Javadoc.
CO6. To use a version control system to track source code in a project.

Learning Outcomes:
After completing this course, students will be able to:
LO1. Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
LO2. Read and make elementary modifications to Java programs that solve real-world problems.
LO3. Validate input in a Java program.
LO4. Identify and fix defects and common security issues in code.
LO5. Document a Java program using Javadoc.
LO6. Use a version control system to track source code in a project.

Unit I

Introduction to Java: evolution, features, comparison with C and C++; Java program structure; tokens, keywords, constants, variables, data types, typecasting, statements, Operators and Expression; Conditional Statements and Loop Statements. **Class:** syntax, instance variable, class variables, methods, constructors, overloading.

Unit II

Inheritance: types of inheritance, use of super, method overriding, final class, abstract class, wrapper classes.

Arrays, Strings and Vectors, Packages and Interfaces, visibility controls

Unit III

Errors and Exceptions: Types of errors, Exception classes, Exception handling in java, use of try, catch, finally, throw and throws. Taking user input, Command line arguments.

Multithreaded Programming: Creating Threads, the Life cycle of thread, Thread priority, Thread synchronization, Inter-thread communication, Implementing the Runnable Interface.

Recommended Readings
1. The Complete reference Java Ninth Edition By Herbert Schildt (Tata McGraw Hill)
2. Beginning Programming with Java For Dummies by <u>Burd</u>, For Dummies; 3 edition

Suggested Readings

3. Java: A Beginner's Guide, Sixth Edition: A Beginner's Guide by Herbert Schildt, McGraw-Hill Osborne MediaProgramming in JAVA By E. Balagurusamy (TMH)
4. JAVA 2 programming Black Book By Steven Holzner et al. (Dreamtech Press)
5. Programming in JAVA By E. Balagurusamy (TMH)

Paper Code: FS-COMP-MCSLE-CC-103a

Paper Name: Software Engineering & Research Methodology

Course Objectives:
CO1. To learn the phases of software development
CO2. To develop process models and process systems multiple collections, models
CO3. To gather, understand, analyze and specify requirements
CO4. To develop architectural diagram, and implement by following coding principles
CO5. To apply testing strategies and handle software product maintenance issues
CO6. To get a good knowledge of the issues and challenges faced while doing the Software project Management.
CO7. To understand why the majority of the software projects fail and how that failure probability can be reduced effectively.
CO8. To do the Project Scheduling, tracking, Risk analysis, Quality management, and Project Cost estimation using different techniques.
CO9. To identify and discuss the role and importance of research in the social sciences.
CO10. To identify and discuss the issues and concepts salient to the research process.
CO11. To identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
CO12. To identify and discuss the concepts and procedures of sampling, data collection, analysis, and reporting.

Learning Outcomes:
After completing this course, students will be able to:
LO1. Learn the phases of software development
LO2. Develop process models and process systems multiple collections, models
LO3. Gather, understand, analyze and specify requirements
LO4. Develop architectural diagram, and implement by following coding principles
LO5. Apply testing strategies and handle software product maintenance issues
LO6. Get a good knowledge of the issues and challenges faced while doing the Software project Management.
LO7. To understand why the majority of the software projects fail and how that failure probability can be reduced effectively.

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LO8. To do the Project Scheduling, tracking, Risk analysis, Quality management, and Project Cost estimation using different techniques.
LO9. Identify and discuss the role and importance of research in the social sciences.
LO10. Identify and discuss the issues and concepts salient to the research process.
LO11. Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
LO12. identify and discuss the concepts and procedures of sampling, data collection, analysis, and reporting.

Unit I
Software: Software Characteristics, Software Process, Process Characteristics, **Software Process Model:** Linear Sequential Model, Prototyping Model, Spiral Model, Software Quality, McCall's Quality Factors, **Software Requirement Analysis and Specification (SRS):** Need Characteristics and Components.

Unit II
Planning a Software Project: COCOMO Model, Project Monitoring Plan, and Risk Management. **Design Principle:** Abstraction, Modularity, Cohesion and Coupling, **Software Management**: Size Oriented Metrics, Function Oriented Metrics. **Testing:** Testing Fundamental, Functional Testing (Black Box), Structural Testing (White Box), Alpha And Beta Testing, **Testing Process:** Comparison of Different Testing, Level of Testing.

Unit III
Research Methodology: Meaning of Research, Objective of Research, Types of Research, Research Approaches, Significance of research, Research Methods versus Methodology, Research Process, Criteria of Good Research, What is Research Problem, Selecting the problem, Necessity of defining the problem, Technique involved in defining a problem.

Recommended Readings
1. Software Engineering: A Practitioner's Approach By Roger S. Pressman, McGraw Hill.

Suggested Readings
2. Software Engineering: A Precise Approach by Pankaj Jalote, Wiley Precise textbook Series
3. Research Methodology Methods and Techniques by C. R. Kothari, New Age International Publisher

Paper Code:FS-COMP-MCSLE-CC-103b
Paper Name: Artificial Intelligence

Course Objectives:
CO1. To analyze and formalize the problem as a state space, graph, design heuristics
CO2. To have the ability to represent solutions for various real-life problem domains using logic-based techniques
CO3. To understand the numerous applications and huge possibilities in the field of AI
CO4. To ability to express ideas in AI research and programming language related to emerging technology.

Learning Outcomes:
After completing this course, students will be able to:
LO1. To analyze and formalize the problem as a state space, graph, design heuristics
LO2. Ability to represent solutions for various real-life problem domains using logic-based techniques
LO3. Understand the numerous applications and huge possibilities in the field of AI
LO4. Ability to express ideas in AI research and programming language related to emerging technology.

Unit I

11

Definition, History, Agents, and environment, Defining the problem as a state and space search, What is Intelligence? Types of Intelligence, Difference between Human and Machine Intelligence, The Structure of Intelligent Agents. Solving problems by searching: Uninformed search strategies- Brute-Force, Breadth-First, Uniform-cost search Depth-First, Depth-limited search,depth-first search, Bidirectional search. Informed (heuristic) search strategies- Greedy best-first search, A*, AO* Memory-bounded heuristic search.

Unit II
Heuristic functions, local search algorithms- Hill-climbing search, Simulated annealing, Local beam search. Knowledge-Based System: Knowledge, Procedure V/S Declarative Knowledge, Knowledge Representation: Using Procedural and Predicate Logic, Inference in First-order logic: Unification and Lifting, Forward Chaining, Backward Chaining, Resolution. Rule-based System, Frames, Frames, Scripts, and Semantic Nets.

Unit III
Probabilistic Reasoning, Probability, and Bayes Theorem represent knowledge in the uncertain domain, Certainty factors, Bayesian Networks, Dempster–Shafer theory, introduction to Fuzzy logic. Learning: types of learning, decision trees. **Expert System: types, architecture. Introduction to A**rtificial Neural Networks, Reinforcement Learning, Natural Language Processing, Pattern Recognition, and Perception.

Recommended Readings
1. Artificial Intelligence By Rich And Knight (Tata McGraw Hill)

Suggested Readings
2. Introduction to Artificial Intelligence and Expert Systems By Patterson (Prentice-Hall India)
3. Artificial Intelligence A Modern Approach by Russell and Norvig, Prentice Hall

Paper Code:FS-COMP-MCSLE-CC-103c

Paper Name: Python

Course Objectives:
CO1. Apply language features including strings, lists, tuples, dictionaries, regular expressions.
CO2. Create and call functions.
CO3. Create and manipulate files.
CO4. Develop classes using OO features.
CO5. Develop internet applications using packages such as urllib.
CO6. To understand why Python is a proper scripting language for developers.
CO7. To learn how to design and program Python applications.
CO8. To learn how to use lists, tuples, and dictionaries in Python programs.
CO9. To learn how to identify Python object types.
CO10.To learn how to use indexing and slicing to access data in Python programs.
CO11. To define the structure and components of a Python program.
CO12. To learn how to write loops and decision statements in Python.
CO13. To learn how to write functions and pass arguments in Python.
CO14. To learn how to build and package Python modules for reusability.
CO15. To learn how to read and write files in Python.
CO16. To learn how to design object☐oriented programs with Python classes.
CO17. To learn how to use class inheritance in Python for reusability.
CO18. To learn how to use exception handling in Python applications for error handling.

Learning Outcomes:
After completing this course, students will be able to:
LO1. Apply language features including strings, lists, tuples, dictionaries, regular expressions. LO2. Create and call functions.

LO3. Create and manipulate files.
LO4. Develop classes using OO features.
LO5. Develop internet applications using packages such as urllib.
LO6. To understand why Python is a proper scripting language for developers.
LO7. To learn how to design and program Python applications.
LO8. To learn how to use lists, tuples, and dictionaries in Python programs.
LO9. To learn how to identify Python object types.
LO10.To learn how to use indexing and slicing to access data in Python programs.
LO11. To define the structure and components of a Python program.
LO12. To learn how to write loops and decision statements in Python.
LO13. To learn how to write functions and pass arguments in Python.
LO14. To learn how to build and package Python modules for reusability.
LO15. To learn how to read and write files in Python.
LO16. To learn how to design object□oriented programs with Python classes.
LO17. To learn how to use class inheritance in Python for reusability.
LO18. To learn how to use exception handling in Python applications for error handling.

Unit I

Basics: Python Interpreter, writing code in Jupyter Notebook, Indentation, comments, importing a module, binary operators, standard scalar data types, typecasting, if-else statements, loops(while, for), pass, range, ternary expressions. Data Structures and Sequences: Tuples, Lists, and slicing, Built-in Sequence functions, Dictionary, Sets; List, Set, and Dict Comprehensions.

Unit II

Functions: Namespaces, Scope, and Local Functions; Returning Multiple Values, Anonymous (Lambda) Functions, Partial Argument Application, Generators, Errors, and Exception handling. Basic File Handling. Objects and Methods in Python. NumPy: creating N-dimensional arrays, arithmetic with NumPy arrays, basic indexing, and slicing, Psuedorandom number generation.

Unit III

Pandas: Overview of Series and DataFrames, reading data from csv file, DataFrame operations-working with data using functions like head, tail , info, shape, reshape, columns, isnull, dropna, mean, sum, describe, value_counts, corr, loc, iloc, apply. Matplotlib- plotting basic figures, subplots, line plots, bar plots, histograms, scatter plots. Overview of Scikit-learn, SciPy, networkx. Applications of python.

Recommended Readings
1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython, by Wes McKinney, O'Reilly Media, 2017Python All-in-One for Dummies, by John Shovic and Alan Simpson, John Wiley & Sons, Inc., 2019
Suggested Readings
2. Programming in Python 3: A Complete Introduction to the Python Language, Mark Summerfield, Pearson.
3. Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.

4. Introduction to Computation and Programming Using Python. By John V. Guttag, MIT Press.
5. Learning Python, Mark Lutz, David Ascher, O'Reilly
6. T. Budd, Exploring Python, TMH, 1st Ed, 2011

Web Resources

1. https://www.learnpython.org/
2. https://nptel.ac.in/courses/106/106/106106212/
3. http://greenteapress.com/thinkpython/thinkpython.pdf
4. Python tutorial: https://docs.python.org/3/tutorial/index.html
7. Python All-in-One for Dummies, by John Shovic and Alan Simpson, John Wiley & Sons, Inc., 2019

Paper Code:FS-COMP-MCSLE-CC-103d
Paper Name: Theory of Computation

Course Objectives:
CO1. able to design Finite Automata machines for given problems;
CO2. able to analyze a given Finite Automata machine and find out its Language;
CO3. able to create Pushdown Automata machine for given CF language(s);
CO4. able to generate the strings/sentences of given context-free languages using its grammar;
CO5. Able to design Turing machines forgivenApplyto identifyInterprettational problem.

Learning Outcomes:
After completing this course, students will be able to identify.:
LO1. able to design Finite Automata machines for given problems;
LO2. able to analyze a given Finite Automata machine and find out its Language;
LO3. able to create Pushdown Automata machine for given CF language(s);
LO4. able to generate the strings/sentences of given context-free languages using its grammar;
LO5. Able to design Turing machines forgivenApplyto identifyInterprettational problem.

Unit I

Languages: Alphabets, string, language, Basic Operations on language, Concatenation, KleeneStar. Finite Automata and Regular Languages: Regular Expressions, Transition Graphs, Deterministic and non-deterministic finite automata, NFA to DFA Conversion, Regular languages and their relationship with finite automata, Pumping lemma, and closure properties of regular languages.

Unit II

Context-free languages: Context-free grammars, parse trees, ambiguities in grammars and languages, Pushdown automata (Deterministic and Non-deterministic), Pumping Lemma, Properties of context-free languages, normal forms.

Unit III

Turing Machines and Models of Computations: RAM, Turing Machine as a model of computation, Universal Turing Machine, Language acceptability, decidability, halting problem, Recursively enumerable and recursive languages, unsolvability problems.

Recommended Readings
1. Daniel I.A.Cohen, Introduction to computer theory – John Wiley (1996 2nd Edition).

2. Lewis & Papadimitriou, Elements of the theory of computation – II Edition PHI 1997.

Suggested Readings

1. Hopcroft, Aho, Ullman, Introduction to Automata theory, Language & Computation –3rd Edition 2006, Pearson Education.
2. P. Linz, An Introduction to Formal Language and Automata 4th edition Publication Jones Bartlett 2006

Paper Code:FS-COMP-MCSLE-CC-105a

Paper Name: Data Analysis Using R

Course Objectives:

CO1. To use Jupyter Notebook for interactive computation

CO2. To practice Python features such as lists, dictionaries, and files for the given problem

CO3. To use NumPy functions for array processing

CO4. To apply Pandas Dataframe for data wrangling

CO5. To generate graphs for the given data using Matplotlib

CO6. To understand the basics of R programming in terms of constructs, control statements, string Functions.

CO7. To understand the use of R for Data analytics.

CO8. To conduct your independent data analysis.

CO9. To be able to appreciate and apply the R programming from a statistical perspective.

Learning Outcomes:

After completing this course, students will be able to:

LO1. Use Jupyter Notebook for interactive computation

LO2. Practice Python features such as lists, dictionaries, and files for the given problem

LO3. Use NumPy functions for array processing

LO4. Apply Pandas Dataframe for data wrangling

LO5. Generate graphs for the given data using Matplotlib

LO6. Understand the basics of R programming in terms of constructs, control statements, string Functions.

LO7. Understand the use of R for Data analytics.

LO8. Conduct your independent data analysis.

LO9. Able to appreciate and apply the R programming from a statistical perspective.

Unit I

Foundations for data analysis-matrices, the notion of probability, the concept of random variables and various distributions, mean, variance, covariance, normal distributions, an overview of sampling, hypothesis testing, confidence interval, the concept of optimization.

Unit II

installation of R, data editing, use of R as a calculator; functions, and assignments. matrix operations, logical operators, Conditional executions and loops, data management with sequences, repeats, sorting and ordering, lists, vector indexing, factors; display and formatting of strings.

Unit III

Working with data frames, Importing data files; Graphics and plots; basic statistical functions for central tendency, variation, box plots, skewness and kurtosis, correlations; overview of using R functions for simple hypothesis testing, Applications of R.

Recommended Readings

1. Hands-On Programming with R, Garrett Grolemund, O′Reilly Publishers.
2. R for Beginner - https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf

Suggested Readings

3. A Learning Guide to R -
https://www.westernsydney.edu.au/__data/assets/pdf_file/0011/830909/Rnotes_20180905_web.pdf

4. Applied Statistics And Probability For Engineers – by Douglas Montgomery, John Wiley & Sons Inc.

5. Research Methodology: Methods And Techniques, C.R. Kothari, New Age International Publishers.

6. Design and Analysis of Experiments (Wiley India), Montgomery, Douglas C.

Paper Code:FS-COMP-MCSLE-CC-105b

Paper Name : LaTeX: a document preparation system

Course Objectives:
CO1. To apply various Excel tools and add-ins for analyzing Business problems.
CO2. To compare mathematical formulas with Spreadsheet formulas
CO3. To explore, query, and summarize business data.
CO4. To apply descriptive statistical measures for business decisions.
CO5. To perform progression analysis and forecasting techniques.
CO6. To understand how to write documents containing mathematical formulas.
CO7. To understand how to write articles in different journal styles.
CO8. To understand how to create PPT in a more presentable manner.
CO9. To understand how to create using built-in templates.

Learning Outcomes:
After completing this course, students will be able to:
LO1. Apply various Excel tools and add-ins for analyzing Business problems.
LO2. Compare mathematical formulas with Spreadsheet formulas
LO3. Explore, query, and summarize business data.
LO4. Apply descriptive statistical measures for business decisions.
LO5. Perform progression analysis and forecasting techniques.
LO6. Understand how to write documents containing mathematical formulas.
LO7. Understand how to write articles in different journal styles.
LO8. Understand how to create PPT in a more presentable manner.
LO9. Understand how to create using built-in templates.

Unit I

Installation of the software LaTeX, Structure of LaTeX documents; Special Characters, Producing equations, Matrices, Tables, itemised lists, hypertext links; Page Layout –Title, Abstract, Chapters, Sections, References.

Unit II

Including graphics, images, floating bodies; Producing basic mathematical graphics like line segments, arrows, circles, ovals, Generating index and bibliography, creating PDF files.

Unit III

Adding a new command; generating spaces, colored text; Writing a sample resume, question paper, article/ research paper; Creating a presentation using beamer.
of part A, B and C are 50, 200 and 500 respectively

Recommended Readings

1. LaTeX: A Document Preparation System, By Leslie Lamport, Addison- Wesley.

Suggested Readings

2. LaTeX Beginner's Guide, by Stefan Kottwitz, Packt Publishing Limited

3. Tobias Oetiker, Hubert Partl, Irene Hyna, and Elisabeth Schegle: The Not So Short Introduction to LaTeX 2e, https://tobi.oetiker.ch/lshort/lshort-a5book.pdf, 2014.

Semester IV

Paper Code: FS-COMP-MCSLE-CC-201
Paper Name: Computer Graphics & Multimedia

Course Objectives:
CO1. To develop line and circle generation algorithms
CO2. To apply 2D and 3D transformations
CO3. To develop clipping algorithms for point, line, and polygons
CO4. To learn the concepts of projections, viewing, and graphics pipeline
CO5. To create a simple animation and interaction for multimedia presentation
CO6. To understand image types and color models
CO7. To describe the concepts regarding the digitization of audio signals
CO8. To compress images, videos, and audios using data compression methods
CO9. To encode videos and audios using MPEG
CO10. To ExplainfunctionalIdentify the core concepts of computer graphics, including viewing, projection, perspective, modeling, and transformation in two and three dimensions.
CO11. To apply the concepts of color models, lighting and shading models, textures, ray tracing, hidden surface elimination, anti-aliasing, and rendering.
CO12. To interpret the mathematical foundation of the concepts of computer graphics.
CO13. To describe the fundamentals of animation, parametric curves, and surfaces, and spotlighting.
CO14. To identify a typical graphics pipeline and apply graphics programming techniques to design and create computer graphics.
CO15. To create effective OpenGL programs to solve graphics programming issues, including 3D transformation, object modeling, color modeling, lighting, textures, and ray tracing.
CO16. To understand multimedia concerning any applications, including business, schools, home, education, and virtual reality.
CO17. To understand the hardware and software needed to create projects using creativity and organization to create them.
CO18. To develop multimedia skills to be the principal player of individual multimedia teams in developing projects.
CO19. To work with all aspects of images.
CO20. To work with all aspects of sound.
CO21. To work with all aspects of the video.
CO22. To learn copyright laws associated with multimedia.
CO23. To learn the cost involved in multimedia planning, designing, and producing.
CO24. To learn ways to present their multimedia projects.

Learning Outcomes:
After completing this course, students will be able to:
LO1. Develop line and circle generation algorithms
LO2. Apply 2D and 3D transformations
LO3. Develop clipping algorithms for point, line, and polygons
LO4. Learn the concepts of projections, viewing, and graphics pipeline
LO5. Create a simple animation and interaction for multimedia presentation
LO6. Understand image types and color models
LO7. Describe the concepts regarding the digitization of audio signals
LO8. Compress images, videos, and audios using data compression methods
LO9. Encode videos and audios using MPEG
LO10. ExplainfunctionalIdentify the core concepts of computer graphics, including viewing, projection, perspective, modeling, and transformation in two and three dimensions.
LO11. apply the concepts of color models, lighting and shading models, textures, ray tracing, hidden surface elimination, anti-aliasing, and rendering.

LO12. interpret the mathematical foundation of the concepts of computer graphics.
LO13. Describe the fundamentals of animation, parametric curves, and surfaces, and spotlighting.
LO14. Identify a typical graphics pipeline and apply graphics programming techniques to design and create computer graphics.
LO15. Create effective OpenGL programs to solve graphics programming issues, including 3D transformation, object modeling, color modeling, lighting, textures, and ray tracing.
LO16. Students will understand multimedia concerning any applications, including business, schools, home, education, and virtual reality.
LO17. Students will understand the hardware and software needed to create projects using creativity and organization to create them.
LO18. The student will develop multimedia skills to be the principal player of individual multimedia teams in developing projects.
LO19. Students will work with all aspects of images.
LO20. Students will work with all aspects of sound.
LO21. Students will work with all aspects of the video.
LO22. Students will learn copyright laws associated with multimedia.
LO23. Students will learn the cost involved in multimedia planning, designing, and producing.
LO24. Students will learn ways to present their multimedia projects.

Unit I

Basic elements of Computer Graphics, Graphics display devices, Applications of Computer Graphics, Raster and random scan; Color Models: RGB, CMY, HSV; Graphics Standard: OpenGL; Scan Conversion: DDA line algorithm, Midpoint circle Algorithm. 2D Transformation: Translation, Rotation, Scaling, Homogeneous Coordinates and Matrix Representation of 2D Transformation, Composite Transformation.

Unit II

3D Graphics: Matrix Representation of 3D transformations, Translation, Rotation, Scaling, Composite Transformation. Overview of concepts: Clipping, orthographic and parallel projection, hidden surface removal, lighting, transparency, modeling and texturing, rendering; Animations: Principles of animations, keyframing, the concept of 2D and 3D animation.

Unit III

Blender: GUI Interface, Selecting, rotating, and Translating Objects, Using Snap to move objects precisely, Creating mesh primitives and extrusions, Subdividing meshes, Creating a simple creature, Joining mesh objects and stitching vertices, Organizing a scene with layers, groups, and hierarchies, Assigning glossy and reflective materials to objects, Creating bump maps, Creating sky and ambient light, Understanding ambient occlusion, Adding motion blur and depth of field, Editing animation in the Graph Editor, Building and animating a simple character.

Recommended Readings

1. Computer Graphics (Principles and Practice) by Foley, van Dam, Feiner, and Hughes, Addison Wesley (Indian Edition)
2. Computer Graphics by D Hearn and PM Baker, Prentice Hall of India (Indian Edition).

Suggested Readings

3. Mathematical Elements for Computer Graphics by DF Roger.
4. Introduction to Computer Graphics By Krishnamurthy N (Tata McGraw Hill
5. Theory and Problems of Computer Graphics (Schaum's Outline) By Zhigang X. and Plastock Ra. (Tata McGraw Hill)

Web Resources

1. https://www.cs.duke.edu/brd/Teaching/Previous/Animation/animation.html

2. http://zikky.lecturer.pens.ac.id/Produksi 3D untuk Designer/Beginning Blender-book.pdf
3.http://www.blenderhd.com/wp-content/uploads/2015/08/BeginnersGuideToBlender.pdf
4. https://people.sc.fsu.edu/~gerlebacher/gd/blender/blender/blender_noob_to_pro.pdf
5. http://download.blender.org/documentation/pdf/John M Blain - An Introduction To Blender 3D - A Book For Beginners (2011).pdf
6.http://www.cdschools.org/cms/lib04/PA09000075/Centricity/Domain/81/BlenderBasics_4thEdition2011.pdf
7. https://docs.blender.org/manual/en/dev/index.html

Paper Code:FS-COMP-MCSLE-CC-201

Paper Name: Android Programming

Course Objectives:
CO1. To create an android project from XML Layout.
CO2. To debug Android apps and create UI fragments
CO3. To pass data between fragments
CO4. To design apps with audio playback.
CO5. To create a database and communicate with mobile apps
CO6. To install and configure Android application development toolsCO7. To design and develop user interfaces for the Android platform.
CO8. To save state information across important operating system events.
CO9. To apply Java programming concepts to Android application development.
CO10. To develop the ability to develop Android Application

Learning Outcomes:
After completing this course, students will be able to:
LO1. Create an android project from XML Layout.
LO2. Debug Android apps and create UI fragments
LO3. Pass data between fragments
LO4. Design apps with audio playback.
LO5. Create database and communicate with mobile apps
LO6. Install and configure Android application development tools.
LO7. Design and develop user interfaces for the Android platform.
LO8. Save state information across important operating system events.
LO9. Apply Java programming concepts to Android application development.
LO10. Develop the ability to develop Android Application

Unit -I
Introduction: What is Android?, Android Architecture, Setting Android Environment, Android SDK Manager & required Packages, Using Android Studio, Android Virtual Device(AVD), Creating First Android Application, Package Structure, Introduction to Gradle, Running the Application, Views, Layouts and more.

Unit – II
Introduction to Views: TextView, EditText View, RadioButton and CheckBox View, Button View, ImageView and ImageButton View, Toast, Notifications.
Introduction to Layouts/ViewGroups: Linear Layout, Relative Layout, Tabular Layout, Hierarchical Layout Arrangements, Adapter, and Adapter View, Using ListView and GridView, SQLite Database.

Unit – III
Spinner in Android, Working with Spinners, Margin, and Padding, Working with EditText and TextView, RadioGroup, RadioButton and CheckBox, AutoCompleteTextView in Android, Android Core, and Projects.
Location-Based Services: Sending Email, Sending SMS, Phone Calls
Activity in Android, Intents in Android, Introduction to Fragments, Working with Fragments

Recommended Readings

Android Programming for Beginners by John Horton Publisher: Packt Publishing

Learn Java for Android Development (2nd edition) by Jeff Friesen Publisher: Apress

Suggested Readings

Android application development for java programmers. By James C. Sheusi. Publisher: Cengage Learning, 2013.

Beginning Android Programming with Android Studio, Fourth Edition by Jerome F. DiMarzio Publisher: John Wiley & Sons

Android Programming: The Big Nerd Ranch Guide by Kristin Marsicano, Chris Stewart, Bill Phillips Publisher: Big Nerd Ranch Guides

Paper Code:FS-COMP-MCSLE-CC-203a

Paper Name : Cloud Computing

Objective – After completing this course the student will have an understanding of key aspects of cloud computing

Unit I

Introduction to Cloud Computing, Services provided by cloud-SaaS, PaaS, IaaS, DaaS etc. Functioning of cloud computing, Advantages, Disadvantages, Applications, Cloud Service Providers- Amazon AWS, Google App Engine, Microsoft, VMware. Virtualization concepts, Objectives, Types of Virtualization & its benefits, Introduction to Various Virtualization OS (Hypervisor). Virtualization for Enterprises

Unit II

Designing and Implementing a Data Center-Based Cloud, Industry and International Standards for Cloud Implementation, Building private cloud using open source tools, Integration of Public and Private Cloud. Private, Public & Hybrid Clouds, their Advantages & Disadvantages, On-Premises, and Off-Premises Cloud services, installing a Cloud service.

Unit III

Cloud Security issues - Infrastructure Security, Network level security, Host level security, Application-level security, Data privacy and security Issues, Jurisdictional issues raised by Data location, Access Control, Trust, Reputation, Risk and Authentication in cloud computing

Recommended Readings

1. Cloud Computing Concepts Technology and Architecture by Thomas Erl, Prentice Hall
2. Cloud Computing Principles and paradigms by Rajkumar Buyya, James Broberg and Andrzej Goscinski, John Wiley and Sons, Inc. Publication
3. Cloud Computing Theory and Practice by Dan C. Marinescu, Morgon Kaufman Publication

Paper Code:FS-COMP-MCSLE-CC-203b

Paper Name: Internet of Things

Course Objectives:

CO1. To understand the definition and significance of the Internet of Things

CO2. To discuss the architecture, operation, and business benefits of an IoT solution

CO3. To examine the potential business opportunities that IoT can uncover

CO4. To explore the relationship between IoT, cloud computing, and big data

CO5. To identify how IoT differs from traditional data collection systems

CO6. To understand the definition and significance of the Internet of Things

CO7. To discuss the architecture, operation, and business benefits of an IoT solution

CO8. To examine the potential business opportunities that IoT can uncover

CO9. To explore the relationship between IoT, cloud computing, and big data

CO10. To identify how IoT differs from traditional data collection systems.
Learning Outcomes:
After completing this course, students will be able to:
LO1. Understand the definition and significance of the Internet of Things
LO2. Discuss the architecture, operation, and business benefits of an IoT solution
LO3. Examine the potential business opportunities that IoT can uncover
LO4. Explore the relationship between IoT, cloud computing, and big data
LO5. Identify how IoT differs from traditional data collection systems
LO6. Understand the definition and significance of the Internet of Things
LO7. Discuss the architecture, operation, and business benefits of an IoT solution
LO8. Examine the potential business opportunities that IoT can uncover
LO9. Explore the relationship between IoT, cloud computing, and big data
LO10. Identify how IoT differs from traditional data collection systems.

Unit I

M2M to IoT: Introduction, Market Perspective, Architectural Overview. M2M to IoT Technology- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, IoT analytics, Knowledge management, IOT Architecture, Architecture Reference Model, Real-world design constraints.

Unit II

IoT Use Cases- Asset Management, **Industrial Automation-** Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, **Commercial Building Automation-** Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Unit III

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, IoT and Smart Cities, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

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Recommended Readings

From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence by Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1st Edition, Academic Press, 2014.

1. Internet of Things (A Hands-on-Approach) by Vijay Madisetti and Arshdeep Bahga, 1stEdition, VPT, 2014.
2. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything by Francis daCosta, 1st Edition, Apress Publications, 2013

Suggested Readings

3. Designing the Internet of Things, Adrian McEwen (Author), Hakim Cassimally
4. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems by Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers
5. Internet of Things (A Hands-on-Approach), Vijay Madisetti, Arshdeep Bahga
6. Building the internet of things with ipv6 and mipv6, The Evolving World of M2M Communications, Daniel Minoli John Wiley & Sons

Paper Code:FS-COMP-MCSLE-CC-203c

Paper Name: Big Data & Data Mining

Course Objectives:
CO1. To explain characteristics and use cases and applications of Big Data
CO2. To develop MapReduce operation using Hadoop
CO3. To be able to understand the role of Virtualization Technologies
CO4. To design and implement systems for data mining.
CO5. To evaluate the performance of different data-mining algorithms.
CO6. To propose data-mining solutions for various applications.

Learning Outcomes:
After completing this course, students will be able to:
LO1. Explain characteristics and use cases and applications of Big Data
LO2. Develop MapReduce operation using Hadoop
LO3. Ability to understand the role of Virtualization Technologies
LO4.design and implement systems for data mining.
LO5. Evaluate the performance of different data-mining algorithms.
LO6. Propose data-mining solutions for various applications.

Unit I

Data mining Introduction: Definition, Data mining tasks, Data mining as a step of the Knowledge discovery process, Applications of Data mining; Data objects and types of attributes, Recalling mean, median, mode, and weighted arithmetic mean, Data quality, an overview of data preprocessing.

Unit II

Classification analysis- definition, Overview of various classification techniques; Decision tree induction- working, examples, specifying attribute test conditions, Measures of node impurity, measures for selecting best split; Evaluating the performance of a classifier- Holdout method, Random subsampling, cross-validation, Bootstrap.

Unit III

Association analysis: support, confidence, association rules, Frequent Itemsets; Frequent itemset generation - Apriori principle, Apriori algorithm, and examples, FP growth algorithm and examples; Closed and maximal frequent itemsets. Cluster analysis: Definition, an overview of basic clustering methods, Density-based methods-DBSCAN.

Recommended Readings

1. Data Mining: Concepts and Techniques, 3rd edition, Jiawei Han and Micheline Kamber
2. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education.

Suggested Readings

3. Data Mining: A Tutorial Based Primer, Richard Roiger, Michael Geatz, Pearson Education 2003.
4. Introduction to Data Mining with Case Studies, G.K. Gupta, PHI 2006
5. Insight into Data mining: Theory and Practice, Soman K. P., DiwakarShyam, Ajay V., PHI 2006
6. Data Mining:: Practical Machine Learning Tools and Techniques (Morgan Kaufmann Series in Data Management Systems) by Witten, Frank, Hall

Paper Code:FS-COMP-MCSLE-CC-203d
Paper Name: Machine Learning

M.Sc.(Computer Science) Lateral Entry

Course Objectives:
CO1. To be able to design Finite Automata machines for given problems;
CO2. To be able to analyze a given Finite Automata machine and find out its Language;
CO3. To be able to create Pushdown Automata machine for given CF language(s);
CO4. To be able to generate the strings/sentences of given context-free languages using its grammar;
CO5. To be able to design Turing machines forgivenApplyto identifyInterprettational problem.

Learning Outcomes:
After completing this course, students will be able to-
LO1. Able to design Finite Automata machines for given problems;
LO2. Able to analyze a given Finite Automata machine and find out its Language;
LO3. Able to create Pushdown Automata machine for given CF language(s);
LO4. Able to generate the strings/sentences of given context-free languages using its grammar;
LO5. Able to design Turing machines forgivenApplyto identifyInterprettational problem.

Unit I

Introduction: Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier. Tools for Machine Learning and Linear Algebra Overview: Plotting of Data, Vectorization, Matrices, and Vectors: Addition, Multiplication, Transpose and Inverse using available tools/libraries with Python.

Unit II

Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection. Logistic Regression: Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

Unit III

Regularization: Regularization and its utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance. Neural Networks: Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Backpropagation Algorithm.

Recommended Readings
1. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013
2. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012

Suggested Readings

M.Sc.(Computer Science) Lateral Entry

1. Machine Learning For Dummies, John Paul Mueller, Luca Massaron,For Dummies; 1st edition
2. Machine Learning for Absolute Beginners: A Plain English Introduction, O Theobald, Scatterplot Press; 2nd edition
3. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido,O'Reilly; 1st edition
4. https://www.cmpe.boun.edu.tr/~ethem/i2ml3e/

Paper Code:FS-COMP-MCSLE-CC-205a
Paper Name: Natural Language Processing

Course Objectives:
CO1. To have an introduction of the fundamental concepts and techniques of natural language processing (NLP).
CO2. To gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
CO3. To examine NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
CO4. To understand critical concepts from NLP are used to describe and analyze language.
CO5. To perform POS tagging and context-free grammar for the English language.
CO6. To understanding semantics and pragmatics of English language for processing·
CO7. To write programs in Python to carry out natural language processing

Learning Outcomes:
After completing this course, students will be able to-
LO1. Introduction to the fundamental concepts and techniques of natural language processing (NLP).
LO2. Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
LO3. The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
LO4. Critical concepts from NLP are used to describe and analyze language.
LO5. POS tagging and context-free grammar for the English language.
LO6. Understanding semantics and pragmatics of English language for processing·
LO7. Writing programs in Python to carry out natural language processing

Unit I

Introduction, Basics of text processing, Spelling Correction: Edit Distance; N-Gram Language Models, Evaluation of Language Models, Basic Smoothing, Computational Morphology, Introduction to POS Tagging, Overview of Hidden Markov Model, Basics of Models for Sequential tagging – Introduction to Maximum entropy and Conditional Random Fields.

Unit II

Constituency syntax parsing, examples of parsing using CKY and PCFG, Introduction to Dependency Grammars and Parsing, understanding of Transition Based Parsing; Distributional Semantics - Introduction, Applications; Word Embedding: Frequency-based embedding, Prediction based embeddings. Lexical Semantics: an overview of WordNet, Word Sense Disambiguation.

M.Sc.(Computer Science) Lateral Entry

Unit III

Topic models: introduction, LDA; Introduction to Entity Linking and Information Extraction; Text Summarization: an overview of various approaches; Text Classification: introduction and simple practical implementation using Python. Sentiment Analysis: Concept, Analysis, and Applications.

Recommended Readings

1. Natural Language Understanding, Pearson Education; 2nd edition, James Allen
2. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, 2e, Jurafsky / Martin.
3. Handbook of Natural Language Processing, Nitin Indurkhya, Fred J. Damerau, Taylor and Francis; Second edition
4. The Handbook of Computational Linguistics and Natural Language Processing, Alexander Clark, Chris Fox, Shalom Lappin, Wiley-Blackwell; 1st edition
5. Natural Language Processing with Python: Analysing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, Edward Loper, Shroff pub.
6. **Foundations of Statistical Natural Language Processing, Christopher D. Manning, Hinrich Schütze, MIT press.**

Suggested Readings

1. Statistical Methods for Speech Recognition (Language, Speech, and Communication) Fourth Printing Edition, by Frederick Jelin
2. Neural Network Methods for Natural Language Processing Synthesis Lectures on Human Language Technologies, Yoav Goldberg, Graeme Hirst, Morgan and Claypool Life Sciences.

Paper Code:FS-COMP-MCSLE-CC-205b
Paper Name: Introduction to Cyber Security

Course Objectives:
CO1. To identify and classify various attacks
CO2. To encrypt and decrypt messages using block chippers and signs.
CO3. To create a digital signature using multiple algorithms.
CO4. To describe web security, intruders, viruses, and firewalls

Learning Outcomes:
After completing this course, students will be able to-
LO1. Identify and classify various attacks
LO2. Encrypt and decrypt messages using block chippers and signs.
LO3. Create a digital signature using multiple algorithms.
LO4. Describe web security, intruders, viruses, and firewalls

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Unit I

Basics: Linux/Mac Terminal and Commands, Basic Computer Terminology, Computer Security models, Computer Security Terms, Computer Ethics, Business, and Professional Ethics, Need for cyber security; Cyber Frauds and crimes, Digital Payments, Various Search Engines, Introduction to Auditing, Deep Web, VAPT, Smartphone Operating systems, introduction to compliances, Globalization and borderless world.

M.Sc.(Computer Science) Lateral Entry

Unit II

Basic Python Scripting: Python Basics, Variables and Types, Lists, Basic Operators, String Formatting, Basic String Operations, Conditions, Loops, Functions, Classes and Objects, Dictionaries, Modules, and Packages.

Unit III

Cyber Laws: Need for Cyber Regulations; Scope and Significance of Cyber laws: Information Technology Act 2000; Network and Network Security, Access and Unauthorised Access, Data Security, E Contracts and E Forms. Penal Provisions for Phishing, Spam, Virus, Worms, Malware, Hacking, Trespass, and Stalking; Human rights in cyberspace, International Co-operation in investigating cybercrimes.

Recommended Readings
1. Behrouz A. Forouzan (2004). Data communication and Networking. Tata McGraw-Hill.
2. Kurose, James F. & Ross, Keith W. (2003). Computer Networking: A Top-Down Approach Featuring the Internet (3rd Ed.). Pearson Education.
3. Langtangen, H.P. (2012). Python Scripting for Computational Science (4th Ed.). Springer
4. Craig, B. (2012). Cyber Law: The Law of the Internet and Information Technology. Pearson. Sharma J. P. & Kanojia S. (2016). Cyber Laws. New Delhi: Ane Books Pvt Ltd.
5. Paintal, D. Law of Information Technology. New Delhi: Taxmann Publications Pvt. Ltd

Suggested Readings
1. Shema, M. (2012). Hacking Web Apps: Detecting and Preventing Web Application Security Problems.
2. https://uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf
3. Computer Programming And Cyber Security for Beginners: This Book Includes: Python Machine Learning, SQL, Linux, Hacking with Kali Linux, Ethical Hacking. Coding and Cybersecurity Fundamentals, Zach Codings, Independently published

Paper Code:FS-COMP-MCSLE-CC-205c

Paper Name: Combined Practical & Project/Dissertation/Industrial Training

Course Objectives:
CO1. Identify and define the problem statement
CO2. Define and justify the scope of the proposed problem
CO3. Gather and analyze system requirements
CO4. Propose an optimized solution among the existing solutions
CO5. Practice software analysis and design techniques
CO6. Develop technical report writing and oral presentation skills
CO7. Develop a functional application based on the software design
CO8. Apply to code, debugging, and testing tools to enhance the quality of the software
CO9. Prepare the proper documentation of software projects following the standard guidelines
CO10. Become a master in specialized technology
CO11. Become updated with all the latest changes in the technological world.
CO12. Ability to communicate efficiently.
CO13. Ability to be a multi-skilled engineer with sound technical knowledge, management, leadership, and entrepreneurship skills.
CO14. Capability and enthusiasm for self-improvement through continuous professional development and life-long learning
CO15. Awareness of the social, cultural, global, and environmental responsibility of an engineer.

Learning Outcomes

After completing this course, students will be able to:

LO1. Identify and define the problem statement

LO2. Define and justify the scope of the proposed problem

LO3. Gather and analyze system requirements

LO4. Propose an optimized solution among the existing solutions

LO5. Practice software analysis and design techniques

LO6. Develop technical report writing and oral presentation skills

LO7. Develop a functional application based on the software design

LO8. Apply to code, debugging, and testing tools to enhance the quality of the software

LO9. Prepare the proper documentation of software projects following the standard guidelines

L10. Become a master in specialized technology

LO11. Become updated with all the latest changes in the technological world.

LO12. Ability to communicate efficiently.

LO13. Ability to be a multi-skilled engineer with sound technical knowledge, management, leadership, and entrepreneurship skills.

LO14. Capability and enthusiasm for self-improvement through continuous professional development and life-long learning

LO15. Awareness of the social, cultural, global, and environmental responsibility of an engineer.

Practical Training and Project Work:

1. Project Work may be done individually or in groups in case of bigger projects. However, if the project is done in groups, each student must be given responsibility for a distinct module and care should be taken to monitor the individual student.
2. Project Work can be carried out in the college or outside with prior permission of the college.
3. The Student must submit a synopsis of the project report to the college for approval. The Project Guide can accept the project or suggest modification for resubmission. Only on acceptance of the draft project report, the student should make the final copies.

Submission Copy:

The Student should submit a spiral-bound copy of the project report.

Format of the Project:

1. **Paper:**
   The Report shall be typed on White Paper of A4 size.
2. **Final Submission:**
   The Report to be submitted must be original.
3. **Typing:**
   Font:- Times New Roman
   Heading:- 16 pt., Bold
   Subheading:- 14 pt, Bold
   Content:- 12 pt.
   Line Spacing:- 1.5 lines.
   Typing Side:-One Side
   Font Color:- Black.
4. **Margins:**
   The typing must be done in the following margin:
   Left: 0.75"
   Right: 0.75"
   Top: 1"
   Bottom: 1"
   Left Gutter: 0.5"

5. **Binding:**
   The report shall be Spiral Bound.
6. **Title Cover:**
   The Title cover should contain the following details:
   Top: Project Title in block capitals of 16pt.
   Centre: Name of project developer's and Guide name.
   Bottom: Name of the university, Year of submission all in block capitals of 14pt letters on separate lines with proper spacing and centering.
7. **Blank sheets:**
   At the beginning and end of the report, two white blank papers should be provided, one for the Purpose of Binding and the other to be left blank.
8. **Content:**
   I). Acknowledgment
   II). Institute/College/Organization certificate where the project is being developed.
   III). Table of contents
   IV). A brief overview of the project
   V). Profiles of problems assigned
   VI). Study of Existing System
   VII). System Requirement
   VIII). Project plan
   - Team Structure
   - Development Schedule
   - Programming language and Development Tools
      IX). Requirement Specification
      X). Design
   - Detailed DFD and Structure Diagram
   - The data structure, Database, and File Specification
   XI). Project Legacy
   - Current Status of project
   - Remaining Areas of concern
   - Technical and Managerial Lessons Learnt
   - Future Recommendations
   - Nomenclature and Abbreviations.
   - Bibliography
   - Source Code

Teaching-Learning Process

The teaching-learning process may include the following-
- Lectures
- Discussions
- Simulations
- Virtual Labs
- Role-Playing
- Participative Learning
- Interactive Sessions
- Seminars
- Research-based Learning/ Dissertation/ Case Study/ Project Work

The Blended Learning mode of teaching and learning is preferable in which offline (face-to-face) and online learning both are used to provide learners the opportunity to enjoy both of the worlds. Teachers can share instructions, lecture notes, and assignments online. On the other hand,

students can share information/work/assignments with teachers and other students directly in a collaborative setting. This may have a more enriched learning experience, and collaboration between students can be improved upon if group activities rely on information gathered from online resources or lessons. Students who complete online coursework followed by interactive, face-to-face class activities have richer educational experiences.

Assessment and Evaluation

1. **ELIGIBILITY FOR ADMISSION**
   PGDCA from the MGS University and affiliated colleges under the jurisdiction of the university shall be eligible for admission to the M.Sc.(CS) LE Course. (Relaxation to SC/ST etc. as per State Government/University Admission Rules)

2. **PASS CRITERIA**
   For passing in the examination, a candidate is required to obtain at least a Satisfactory Grade in each paper (Internal + External) and also acquire a Satisfactory Grade in theory and practical separately (in each semester examination).

3. **INSTRUCTIONS TO PAPER SETTER**
   The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit). **Section-B** will consist of 9 questions (3 questions from each unit). **Section C** will consist of 6 questions (2 questions from each unit).
   The word limit of parts A, B, and C are 50, 200, and 500 respectively

1. **INSTRUCTIONS FOR PRACTICAL EXAMINATION**
   Marks Distribution for Practical Exam -
   1. Each practical exam is to be conducted by two examiners one External and one Internal. The external examiner should be a senior lecturer from the jurisdiction of other universities. Credit Weightage distribution for external practical of 4 credits is as under
      a) Practical Examination exercise of 3 questions   2 credits
      b) Viva-Voce   1 credit
      c) Laboratory Exercise File   1 credit
   2. Marks distribution for External Project report of 40 marks is as under
      a. External Evaluation-
         i. Research Project/ Case Study   2 credits
         ii. Presentation   1 credit
         iii. External Viva Voce   1 credit
      b. Internal Evaluation- Dissertation   1 credit

2. **INSTRUCTIONS FOR STUDENTS**
   - The student has to complete two months of career-oriented summer training from any firm/organization. If the student does not get a chance to go for training, he/she can choose a research topic and can complete the dissertation under the supervision of any of the faculty in his college.
   - The student who has to opt for training has to provide a signed certificate from the firm/ organization authority stating that the student has spent two months as a trainee in his organization/firm. The student who has opted for a dissertation has to submit his/her dissertation report with a certificate from his supervisor.
- In both cases, the student has to present his work in front of all the faculty members and fellow students at the starting of the next session.
   - In terms of credits, every one-hour session of L amounts to 1 credit per semester and a minimum of two-hour sessions of T or P amounts to 1 credit per semester.

M.Sc.(Computer Science) Lateral Entry

* An Academic/ Industrial Tour shall be organized by the college/department in every session. A Tour Report shall be prepared and submitted by the students after a study tour to industries/academic institutions of repute.

- A comprehensive and continuous evaluation by mid-semester examinations at regular intervals to find out each course level learning outcome
- Formative assessment on the basis of activities of a learner throughout the program instead of one assessment. for this provision of internal exams, student seminars, and assignments is included
- Open book exam is suggested for internal/ mid-term exams to better facilitate the understanding of the knowledge required
- Group examinations are recommended on problem-solving exercises and in major projects to enhance the teamwork capabilities of the learner
- Collaborative/Individual assignments are useful to enhance the capability of learners to gain domain-specific knowledge
- Student Seminars and Quizzes are recommended for the continuous learning and evaluation process

Evaluation

Internal Assessment - Midterm Examination   10%
Term paper   10%
Students Participation   5%
External Assessment-   75%

Examination Paper Pattern

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of parts A, B, and C are 50, 200, and 500 respectively

Key Features of Revised Curriculum

Following are the key features of the revised curriculum-

- Student Centric Teaching and Learning approach
- Technology oriented approach of teaching
- Hand-on Practical/ Laboratory Sessions
- Problem-oriented teaching and learning
- Problem-analysis oriented assignments and evaluation
- Enhance logical thinking and analytical capabilities

Appendices

List of Open Electives offered by the University -