MVJCE CURRICULUM

for

Department of Information Science and Engineering

(2022 Scheme)

5th semester to 7th semester syllabus

V Semester

Course Title	Software Engineering and Project Management	Semester	V
Course code	MVJ22IS51	CIE	50
Total No.of Contact Hours	40	SEE	50
No.Of Contact Hours/week	3(L:T:P:S::3:0:0:0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objective : ***This course will enable students to***

1. Outline software engineering principles and activities involved in building large software programs and identify ethical and professional issues faced by Software Engineers.
2. Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
3. Infer the fundamentals of object-oriented concepts, differentiate system models, use UML diagrams, apply design patterns and explain the role of DevOps in Agile Implementation.
4. Discuss various types ofsoftware testing practices and software evolution processes. Recognize the importance of Project Management with its methods and methodologies and identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved.

MODULE 1	8 HRS

Introduction: The evolving role of software, Software, The changing nature of software, Software engineering, A Process Framework, Process Patterns, Process Assessment, Personal and Team Process Models, Process Technology, Product and Process.

Process Models: Prescriptive models, Waterfall model, Incremental process models, Evolutionary. process models, Specialized process models.

Requirements Engineering: Requirements Engineering Task, Initiating the Requirements Engineering process, Eliciting Requirements, Developing use cases, Building the analysis model, Negotiating Requirements, Validating Requirements, Software Requirement Document.

MODULE 2	8 HRS

Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling, abstraction, The Three models. Class Modelling: Object and Class Concept, Link and associations concepts, Generalization and Inheritance, A sample class model, Navigation of class models, Introduction to RUP and UML diagrams.

Building the Analysis Models: Requirement Analysis, Analysis Model Approaches, Data modelling Concepts, Object Oriented Analysis, Scenario-Based modelling, Flow-Oriented Modelling, class Based modelling, Creating a Behavioural Model.

MODULE 3	8 HRS

Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging. Agile Methodology & DevOps: Before Agile – Waterfall, Agile Development. What is DevOps? DevOps Importance and Benefits, DevOps Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing, How to Choose Right DevOps Tools?, Challenges with DevOps Implementation

MODULE 4	8 HRS

Introduction to Project Management: Introduction, Project and Importance of Project Management,

Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.

MODULE 5	8 HRS

Activity Planning: Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, Identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks.
Software Economics: Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts.

Course Outcome: students will be able to

CO1	Understand the activities involved in software engineering and analyze the role of various process models
CO2	Explain the basics of object-oriented concepts and build a suitable class model using modelling. Techniques.
CO3	Describe various software testing methods and to understand the importance of agile methodology and DevOps.
CO4	Illustrate the role of project planning and quality management in software development
CO5	Understand the importance of activity planning and different planning models.

Textbooks :

1	Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw
2	Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.
3	Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018
4	Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner's Viewpoint, Wiley
5	Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.
6	Management and Entrepreneurship, N V R Naidu, T Krishna Rao 4th reprint Willey Publications.
7	Schaum's outline oftheory and problems ofsoftware engineering, David A. Gustafson, McGrawHill's

References:

1	Principles of Management, P C Tripathi, P N Reddy, 5th edition, Tata Mc Graw Hill, 2012
2	Dynamics of Entrepreneurial Development & Management, Vasant Desai, Himalaya publishing house, 2009

CIE Marks:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having

choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.
CO-PO Mapping :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**3**	**2**	**3**					**2**	**3**	**3**
CO2	**1**	**3**	**3**	**2**	**2**					**2**	**3**	**3**
CO3	**2**	**3**	**2**	**2**	**3**					**2**	**3**	**3**
CO4	**2**	**2**	**2**	**2**	**2**					**3**	**3**	**3**
CO5	**1**	**2**	**3**	**2**	**2**					**2**	**3**	**3**

3- HIGH 2- MODERATE 1- LOW

Course Title	Computer Networks	Semester	v
Course Code	MVJ22IS52	CIE	50
Total No. Of Contact Hours	40T+26P	SEE	50
No.of Contact Hours/week	5(L:T:P:S::3:0:2:0)	Total	100
Credits	4	Exam Duration	3

Course Objectives : This course will enable students to

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in network protocols.
3. Get details about Functions of Network layer, Router and delivery of data to host network.
4. Learn the function of mobile networking and switching. 5. Multimedia data transmission in network.

Module 1	8 hrs

Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division.

Module 2	8 hrs

Data Link Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ. Medium Access Sub Layer: Switching, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA, IEEE802 standard protocol

Module 3	8 hrs

The Network Layer: Network layer design issues, Logical Addressing: IPV4, IPV6; Address mapping, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.

Module 4	8 hrs

Transport Layer: Elements of Transport protocols: Addressing, Connection establishment, Connection release, Crash recovery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Module 5	8 hrs

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls; AI in network infrastructure, Self-Healing Networks.

LABORATORY EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, lookup and trace route. Capture ping and trace route PDUs using a network protocol analyzer and examine. Screen effectiveness studies.
2. Write a program for error detecting code using CRC-CCITT (16- bits).
3. Write a program to find the shortest path between vertices using the Bellman-ford algorithm.
4. Applications using TCP and UDP sockets like: a) Chat b) File Transfer
5. Simulation of DNS using UDP sockets.
6. Write a code for simulating ARP /RARP protocols.
7. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
8. Write a program for congestion control using leaky bucket algorithm.
9. Implement three nodes point – to- point networks with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped using NS 2 .

10. Simulate the transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion using NS 2.
11. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination using NS 2.
12. Simulate simple ESS and with transmitting nodes in wireless LAN by simulation and determine the performance with respect to transmission of packets using NS 2

Course Outcome : At the end of the course students will be able to

CO1	Analyze and compare different methods of bandwidth utilization to optimize data transfer efficiency.
CO2	Select the specific IEEE 802 standard protocols to be implemented in the network environment.
CO3	Apply theoretical knowledge of network layer design issues to real-world networking scenarios and troubleshoot network problems effectively.
CO4	Analyze metrics such as throughput, delay, and packet loss rate to see how the protocols behave in each scenario.
CO5	create a user-friendly website that meets modern standards in terms of navigation, design, and performance.

Textbooks :

1. Computer Networks:5th ed by Andrew. S. Tanenbaum PHI Publication.
2. Data Communications and Networks: 3 rd ed byBehrouz A. Forouzan. TataMcGraw Hill publication.

References :

1. William Stallings, Data and Computer Communication, Tenth Edition, Pearson Education, 2013.
2. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach Featuring the Internet, 3 rd Edition

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.
One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2						1	2
CO2	1	1	2	2	3						2	2
CO3	2	2	2	2	2						2	2
CO4	3	2	2	3	3						2	2
CO5	2	2	2	3	3						1	2

3-High 2-Moderate 1- low

Course Title	Theory of Computation	Semester	V
Course Code	MVJ22IS53	CIE	50
Total No. Of Contact Hours	40	SEE	50
No. Of Contact Hours/week	4(L:T:P:S::4:0:0:0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

1. Acquire knowledge of Automata Theory as the basis of all computer science languages design.
2. Understand the concept of Context Free Grammars and Languages.
3. Understand the concepts of Turing Machine and Chomskian Languages.
4. Acquire knowledge of Decidability.
5. Enrich the knowledge in various phases of compiler ant its use.

Module 1	**8 Hrs**
Finite Automata: Mathematical preliminaries and notations – Central concepts of automata theory – Finite automata -Deterministic Finite Automata - Nondeterministic Finite Automata – Equivalence of DFA and NFA –Finite Automata with Epsilon transitions - Application of FA	
Module 2	**8 Hrs**
Regular Expressions: Regular languages: Regular Expressions – Finite Automata and Regular Expressions –Applications of Regular Expressions - Regular Grammars. Problems on CFG, pushdown automata	
Module 3	
Regular Languages: Properties of regular languages: Pumping lemma for regular languages – Closure properties of regular languages –Equivalence and Minimization of Finite Automata. C Problems on Turing Machine, Halting Problem	
Module 4	**8Hrs**
Context Free Grammar: Context Free languages: Context Free Grammars – Parse Trees - Ambiguity in Grammars and languages– Applications of Context Free Grammars – Pushdown automata (PDA) – Languages of a PDA -Equivalence of PDA ‘s and CFG ‘s, Conversion of PDA -CFG and CFG - PDA Problems on Computational Complexity	
Module 5	**8Hrs**
Context Free Languages: Properties of Context Free Languages: Normal Forms (CNF, GNF) for Context Free Grammars - Pumping lemma for CFL ‘s - Closure properties of CFL Turing Machines: Turing Machines- Programming Techniques for Turing Machines – Multitape Turing Machines. Problems on lexical analysis	

Course Outcomes: At the end of the course students will be able to

CO1	Construct finite automata for given pattern and find its equivalent regular expressions.
CO2	Design and simplify context free grammar and find equivalent pushdown automata for given language
CO3	Design Turing Machines for any languages
CO4	Derive whether a problem is decidable or not
CO5	Understand the basic concepts of compiler Design

Textbooks:

1.Hopcroft J E, MotwaniR and Ullman J D, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2012.

2.Rich Eiane—Automata Computability and Complexity: Theory and Applications, Second Edition, PHI, 2003.

References:

1. Padma Reddy.A, ―Finite Automata and Formal Languages: A Simple Approach.

2. Raghavan V, Principles of Compiler Design, Third Edition, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2009

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	2	3							
CO2	2	2	2	2	3							
CO3	1	3	3	2	3							
CO4	2	3	2	2	3							
CO5	2	3	1	2	3							

3-High 2-Moderate 1- low

Course Title	Data Visualization Lab	Semester	V
Course Code	MVJ22ISL54	CIE	50
Total No. Of Contact Hours	26	SEE	50
No. Of Contact Hours/week	2(L:T:P:S::0:0:2:0)	Total	100
Credits	1	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

1. Effective use of Business Intelligence (BI) technology (Tableau) to apply data visualization
2. Discern patterns and relationships in the data.
3. Build Dashboard applications.
4. Communicate the results clearly and concisely.
5. Work with different formats of data sets.

Sl no	LIST OF PROGRAMS
1	Understanding Data, what is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?
2	Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps), Using the Show me panel.
3	Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.
4	Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view
5	Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.
6	Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data
7	Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors.
8	Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
9	Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and Exporting.
10	Creating custom charts, cyclical data and circular area charts, Dual Axis charts

Course Outcomes: At the end of the course students will be able to

CO1	Understand How to import data into Tableau
CO2	Understand Tableau concepts of Dimensions and Measures.
CO3	Develop Programs and understand how to map Visual Layouts and Graphical Properties
CO4	Create a Dashboard that links multiple visualizations
CO5	Use graphical user interfaces to create Frames for providing solutions to real world problems.

Textbooks:

1.Microsoft Power BI cookbook, Brett Powell, 2nd edition

2.R Programming for Data Science by Roger D. Peng (References)

3. The Art of R Programming by Norman Matloff Cengage Learning India

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3							
CO2	2	2	3	2	3							
CO3	2	3	3	2	3							
CO4	2	3	3	2	3							
CO5	2	3	3	2	3							

Course Title	Computer Vision	semester	V
Course Code	MVJ22IS551	CIE	50
Total No. Of Contact Hours	40	SEE	50
No. Of Contact Hours/week	3 (L: T : P :S:: 3: 0: 0 : 0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

1. Understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization
2. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision
3. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Module 1

Overview of computer vision and its applications: Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation

Image Processing: Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal

Module 2

Feature detection: edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operations.

Segmentation: Active contours, split & merge, watershed, region splitting, region merging, graph-based segmentation, mean shift and model finding, Normalized cut

Module 3

Camera calibration: camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models.

Module 4

Motion representation: the motion field of rigid objects; motion parallax; optical flow, the image brightness ,constancy equation, affine flow; differential techniques; feature-based techniques; regularization and robust estimation

Motion tracking: statistical filtering; iterated estimation; observability and linear systems; the Kalman filter

Module 5

Object recognition and shape representation: alignment, appearance-based methods, invariants, image eigenspaces

Course Outcome

CO1	Learn fundamentals of computer vision and its applications
CO2	Understand the basic image processing operations to enhance, segment the images.
CO3	Understand the analyzing and extraction of relevant features of the concerned domain problem

CO4	Understand and apply the motion concepts and its relevance in real time applications
CO5	Apply the knowledge in solving high level vision problems like object recognition, image classification etc

Textbooks:

1	Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011
2	Introductory techniques for 3D computer vision, E. Trucco and A. Verri, Prentice Hall, 1998

CIE Assessment:

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SEE Assessment:

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Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3							2
CO2	2	2	3	2	3							2
CO3	2	3	3	2	3							2
CO4	2	3	3	2	3							2
CO5	2	3	3	2	3							2

3-High 2- Moderate 1-Low

Course Title	Artificial Intelligence	**semester**	**V**
Course Code	**MVJ22IS552**	**CIE**	**50**
Total No. Of Contact Hours	**40**	**SEE**	**50**
No. Of Contact Hours/week	**3 (L: T : P :S:: 3: 0: 0 : 0)**	**Total**	**100**
Credits	**3**	**Exam Duration**	**3 hours**

Course Objectives : This Course will enable the students to

1.Understand fundamental concepts in Artificial Intelligence.
2.Understand and analyze the problem-solving techniques and knowledge representation.
3.Design intelligent components or programs to meet desired needs.
4.Implement, and evaluate computer-based intelligent systems.
5.Understand fundamental concepts in Artificial Intelligence.

Module 1	**8 hrs**

Introduction: AI problems, foundation of AI and history of AI, Intelligent agents: Agents and Environments, The concept of rationality, The nature of environments, Structure of agents, Problem solving agents, Problem formulation

Module 2	**8 hrs**

Knowledge Representation & Reasons: Knowledge – Based Agents, The Wumpus world. Propositional Logic: Reasoning patterns in propositional logic - Resolution, Forward & Backward Chaining. Inference in First order logic: Propositional vs. first order inference, Unification & lifting, Forward chaining, Backward chaining, Resolution

Module 3	**8 hrs**

Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first search, Depth limited search, Iterative deepening depth first search bi-direction search, Comparing uninformed search strategies. Search with partial information (Heuristic search), Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions.
Local search Algorithms: Hill climbing, Simulated annealing search, Local beam search, Genetic algorithms

Module 4	**8 hrs**

Constrain satisfaction problems: Backtracking search for CSPs local search for constraint satisfaction problems.
Game Playing: Games, Minimax algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, Cutting of search.

Module 5	**8 hrs**

Planning: Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state – space search, Forward state spare search, Backward state space search, Heuristics for state space search, Partial order planning Graphs, Planning graphs
Learning: what is learning, Forms of learning, Inductive learning, Learning Decision Trees.

Course Outcome

CO1	Understand the various types and working units of an expert systems
CO2	Evaluate the logic behind the building of knowledge base and knowledge representation
CO3	Deploy Searching Techniques to design intelligent agents
CO4	Implement various Constraint Satisfaction Problem, Game Playing techniques to use in various intelligent system designs
CO5	Apply suitable learning methodology while designing systems based on their applications

Textbooks:

1	Stuart Russel, Peter Norvig, (2009), Artificial Intelligence – A Modern Approach,3rd Edition,

	Pearson Education.
2	E.Rich and K.Knight, (2008), Artificial Intelligence , 3rd Edition, Tata McGraw Hill
3	
References:	
1	Patterson, (2009), Artificial Intelligence and Expert Systems, 2nd Edition, PHI.
2	Ivan Bratka, (2000), PROLOG Programming for Artificial Intelligence. 3rdEdition – Pearson Education.

CIE Assessment:

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SEE Assessment:

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Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	2							1
CO2	2	3	3	2	3							1
CO3	3	3	2	2	2							2
CO4	2	3	3	3	3							1
CO5	2	3	2	2	2							1

3-High 2- Moderate 1- Low

Course Title	Unix System Programming	semester	V
Course Code	MVJ22IS553	CIE	50
Total No. Of Contact Hours	40	SEE	50
No. Of Contact Hours/week	3(L:T:P:S::3:0:0:0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

1.Understand fundamental concepts in Unix Programming .
2.Understand the problem solving techniques and knowledge representation.
3.Design intelligent components or programs to meet desired needs.
4. Ability to understand and reason out the working of Unix Systems
5. Build an application/service over a Unix system.

Module 1

UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.
Introduction to UNIX - Introduction, History, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, and bc.

Module 2

UNIX Files and APIs : File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs.

Module 3

UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.
Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection.

Module 4

Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client- Server Model

Module 5

Interprocess Communication : Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.

Course Outcomes:At the end of the course the students will be able to

CO1	Learn fundamentals of Unix system and its applications
CO2	Understand the basic image processing operations to enhance, segment the images
CO3	Understand the analyzing and extraction of relevant features of the concerned domain problem

CO4	Understand and apply the motion concepts and its relevance in real time applications
CO5	Apply the knowledge in solving high level unix system problems.

Textbooks:

1	Charlie jacob, "Unix Programming System: An Introduction", Springer-Verlag
2	Hassan K Khalil, Unix Systems, Prentice - Hall International (US), 2006.

References:

1	**V R Ganapthi, "Interprocess Communication", Prentice-Hall, India, 1991, 2. Shankar Sastry, "Nonlinear System Analysis, Stability and Control", Springer, 1999**

CIE Assessment :

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3							
CO2	2	3	3	2	3							
CO3	2	2	3	2	3							
CO4	2	2	3	2	3							
CO5	2	2	2	2	3							

Course Title	Distributed Systems	semester	V
Course Code	MVJ22IS554	CIE	50
Total No. Of Contact Hours	40	SEE	50
No. Of Contact Hours/week	3(L:T:P:S::3:0:0:0)	Total	100
Credits	3	Exam Duration	3 hours

Course Objectives : This Course will enable the students to

Understand fundamental concepts in Distributed systems
Understand the problem-solving techniques and knowledge representation.
Design intelligent components or programs to meet desired needs.
Implement, and evaluate a computer-based distributed systems.
Understand fundamental concepts in Distributed systems.

Module 1 — **8 Hrs**

Distributed Systems: Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models

Module 2 — **8 Hrs**

Files and APIs: For complete syllabus and results, class timetable and more pls download iStudy. It's a light weight, easy to use, no images, no pdfs platform to make students life easier.

Module 3 — **8 Hrs**

Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System

Module 4 — **8 Hrs**

Time and Global States: Introduction, Clocks, events and process status, synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections

Module 5 — **8 Hrs**

Inter-process Communication: Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Client-Server Communication, Group Communication, Case Study: IPC in UNIX.

Course Outcome: At the end of the course the students will be able to

CO1	Illustrate the mechanism of IPC between distributed objects
CO2	Describe the distributed file service architecture and the important characteristics of SUN NFS.
CO3	Discuss concurrency control algorithms applied in distributed transactions
CO4	Apply logical time and logical clocks to order events correctly in a distributed system
CO5	Design and implement communication systems between processes in various computing environments.

Textbooks:

1	George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5th Edition, Pearson Publications, 2009

References:

1	T Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2	AjayD. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3	Sunita Mahajan, Seema Shan, Distributed Computing, Oxford University Press,2015

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3							3	3
CO2	2	2	3	3							2	3
CO3	2	2	2	3							3	2
CO4	3	2	3	2							2	3
CO5	2	3	3	2							3	2

3-High 2- Moderate 1-low

VI SEMESTER
(2022 SCHEME)

Course Title	Full Stack Development	Semester	VI
Course code	MVJ22IS61	CIE	50
Total No. of Contact Hours	3:0:1	SEE	50
No. of Contact Hours/week	40 L+26 P	Total	100
Credits	4	Exam. Duration	3

COURSE OBJECTIVES: **This course will enable students to**

1. Explain the use of learning full stack web development.
2. Make use of rapid application development in the design of responsive web pages.
3. Illustrate Models, Views and Templates with their connectivity in Django for full stack web development.
4. Demonstrate the use of state management and admin interfaces automation in Django.

Module 1	8hrs

The Modern Web: Rise of the web, Mobile web, The state of HTML, Applications vs web sites
Planning your Work: Identifying Requirements, Defining the work, Tracking the work, Continuous Improvements
User Experience: Information Architecture, Getting the user Experience, Polishing the user Experience, Implementing The user Experience.

MODULE-II	8hrs

Front End: HTML, From Server to browser, Styling, Components, Responsive design, Progressive Enhancement, search engine Optimization.
Javascript: Asynchronicity, Javascript in the browser, Offline First Development, Document object Model, Server side javascript, Javascript Modules, Structuring your javascript, javascript types, Functional Programming, Connecting components together , communication between components

MODULE-III	8hrs

Accessibility : working with Assistive Technologies, Dealing with interative UI, Testing for Accessibilty, Avoiding common mistakes
API: API responsibilities, Designing REST API, Securing Your API, Event Based APIs, Discovering APIs, Using APIs, API testing – postman

MODULE-IV	8hrs

Deployment: Twelve Factor Apps, Developer Machines, Production Environments, Moving code into Production, Infrastructure, Immutable infrastructure, Continuous Delivery and Continuous Deployment

MODULE-V	8hrs

Introduction to React JS: Introduction, understanding Components and Props, State and Lifecycle, React Hooks, handling Events, Working with Forms, Conditional Rendering, List and Keys, Styling in React JS .

LABORATORY EXPERIMENTS

Programs:

1. Write a program to create a simple webpage using HTML.
2. Write a program to create a website using HTML CSS and JavaScript
3. Write a program to build a Chat module using HTML CSS and JavaScript
4. Write a program to create a simple calculator Application using React JS
5. Write a program to create a voting application using React JS
6. Write a program to create and Build a Password Strength Check using JQuery
7. Write a program to create and Build a star rating system using JQuery
8. Create a Simple Login form using React JS
9. Using the CMS users must be able to design a web page using the drag and drop method
10. Create a project on Grocery delivery application
11. Connecting our TODO React js Project with Firebase

Course outcomes: Students will able to

CO1	Understand the basics of Web Application Development
CO2	Learn the Front End Developing Tools.
CO3	Develop the REST APIs for Real time Applications
CO4	Apply different Deployment strategies for Producing products
CO5	Create Applications using React JS

Textbooks:

1	The Full Stack Developer Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, Chris Northwood https://doi.org/10.1007/978-1-4842-4152-3
2	Learning React JavaScript Library From Scratch eBook : Sidelnikov, Greg.

CIE Assessment:

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Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	3						3	3
CO2	2	2	3	3	3						2	3
CO3	2	2	2	3	3						3	2
CO4	3	2	3	2	3						2	3
CO5	2	3	3	2	3						3	2

3- High 2- Moderate 1- Low

Course Title	Machine Learning	Semester	VI
Course code	MVJ22IS62	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S::3:0:0:0)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

Course objectives: The course will enable the students to

1.Understand fundamentals of machine learning, including the types of learning, data pre-processing techniques, and design principles, to enable them to develop effective learning systems that can tackle real-world problems.

2. Implement and evaluate regression and classification models, including linear and polynomial regression, logistic regression, and decision trees, to solve real-world problems and make informed decisions.

3.Understand classification techniques, including decision trees, random forests, naive Bayes, K-NN, SVM, and evaluation metrics, to develop robust and accurate classification models that can handle complex data sets and real-world applications.

4. Understand the concepts and techniques of clustering and artificial neural networks, enabling them to apply clustering algorithms and design neural networks to solve real-world problems, including data clustering, classification, and prediction.

5. Understand the fundamentals of reinforcement learning and deep learning, enabling them to understand the concepts of learning from feedback and building deep neural networks to solve complex problems in artificial intelligence, such as decision-making and pattern recognition.

Module 1	8hrs

Introduction: Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning, Unsupervised learning, and Reinforcement learning.

Data Pre-processing: Need of Data Pre-processing, Data Pre-processing Methods: Data Cleaning, Data Integration, Data Transformation, Data Reduction; Feature Scaling (Normalization and Standardization), Splitting dataset into Training and Testing set.

Association Rules Learning: Need and Application of Association Rules Learning, Basic concepts of Association Rule Mining, Naïve algorithm, Apriori algorithm.

Module 2	8hrs

Regression: Linear Regression, Multiple Linear Regression and Polynomial Regression, Evaluation Regression Model's Performance (RMSE, Mean Absolute Error, Correlation,RSquare),Regularization Methods

Classification: Need and Applications of Classification, Logistic Regression, Decision tree.

Module 3	8hrs

Advanced Classification: Tree induction algorithm – split algorithm based on information theory,

split algorithm based on Gini index; Random Forest classification, Naïve Bayes algorithm; K-Nearest Neighbors (K-NN), Support Vector Machine (SVM), Evaluating Classification Model's Performance (Sensitivity, Specificity, Precision, Recall, etc.)

Module 4	**8hrs**

Clustering: Need and Applications of Clustering, Partitioned methods, Hierarchical methods, Density-based methods. Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron, Backpropagation algorithm

Module 5	**8hrs**

Reinforcement Learning: Introduction, Learning Task, Q Learning. Deep Learning: Introduction to Deep Learning-Reasons to go Deep Learning.

Course outcomes: Students will able to	
CO1	Identify the issues in machine learning and Algorithms for solving it.
CO2	Explain theory of probability and statistics related to machine learning.
CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor.
CO4	Describe protocols of resource constraint network.
CO5	Explain the concepts of deep learning.

Textbooks:	
1	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2	Alpaydin E., Introduction to Machine Learning, MIT Press (2014) 3rd Edition.
3	Vijayvargia Abhishek, Machine Learning with Python, BPB Publication (2018)

Reference Books:	
1	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2	Ethem Alpaydin,Introduction toMachine learning,2nd Edition,MIT Press.

CIE Assessment:

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SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	3						3	3
CO2	2	2	3	3	3						2	3
CO3	2	2	2	3	3						3	2
CO4	3	2	3	2	3						2	3
CO5	2	3	3	2	3						3	2

Course Title	Blockchain Technology	Semester	VI
Course code	MVJ22IS631	CIE	50+50
Total No. of Contact Hours	3:0: 0:0 (L:T:P:S)	SEE	50+50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Familiarise the functional/operational aspects of cryptocurrency ecosystem.
2. Understand emerging abstract models for Blockchain Technology.
3. Understand how blockchain systems (mainly Bitcoin and Ethereum) work and how to securely interact with them.
4. Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain.
5. Design, build, and deploy smart contracts and distributed applications.

Module 1		8hrs

IN Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Module 2		8hrs

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Module 3		8hrs

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

Module 4		8hrs

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

Module 5		8hrs

Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects- Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Course outcomes: Students will able to

CO1	Basic Cryptographic primitives used in Blockchain – Secure, Collison-resistant hash
CO2	functions, digital signature, public key cryptosystems, zero-knowledge proof systems.
CO3	Policies and applications of Blockchain in Distributed databases.
CO4	Explain the Nakamoto consensus, List and describe differences between proof-of-
CO5	work and proof-of-stake consensus.

Textbooks:

1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2	Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.

Reference Books:

1	Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
2	DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
3	Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

CIE Assessment:

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SEE Assessment:

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	-	-	-	-	-	-	-	3
CO2	3	3	1	-	-	-	-	-	-	-	-	3
CO3	3	3	1	2	-	-	-	-	-	1	-	3
CO4	3	3	3	3	-	-	-	2	2	2	-	3
CO5	3	3	3	3	-	-	2	2	3	2	-	3

Course Title	Internet of Things	Semester	VI
Course code	MVJ22IS632	CIE	50
Total No. of Contact Hours : L:T:P:S	3:0:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

Course Objective : This course will enable the students to

1.Assess the genesis and impact of IoT applications, architectures in real world
2.Illustrate diverse methods of deploying smart objects and connect them to network.
3.Compare different Application protocols for IoT.

Module 1	8hrs

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Module 2	8hrs

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies, IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT, Profiles and Compliances.

Module 3	8hrs

Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods, Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security

Module 4	8hrs

Common Challenges in OT Security**, How IT and OT Security Practices and Systems Vary, Formal** Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment, IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints.

Module 5	8hrs

RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

Course outcomes: Students will able to

CO1	Describe the characteristics and key technologies for IoT system
CO2	Interfacing Sensor and Actuator with Arduino development board.
CO3	Implementing IoT device by interfacing communication module and cloud
CO4	Describe protocols of resource constraint network.

CO5	Elaborate the need for Data Analytics and Security in IoT.
Textbooks:	
1	"IoTFundamentals: Networking Technologies, Protocols, and Use Cases for the Internet ofThings", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743
2	"Internet of Things", Srinivasa K G,CENGAGE Leaning India,2017

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SEE Assessment:

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Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	3	0	0	0	0	0	0	1	1
CO2	2	3	0	3	0	0	0	0	0	0	1	1
CO3	2	3	0	3	0	0	0	0	0	0	1	1
CO4	3	3	0	3	0	0	0	0	0	0	1	1
CO5	3	3	0	3	0	0	0	0	0	0	1	1

Course Title	Compiler Design	Semester	VI
Course code	MVJ22IS633	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Learn the various parsing techniques and different levels of translation.
2. Learn how to obtain specific object code from source language.
3. Learn how to optimize the code and schedule for optimal performance.

Module 1	8hrs

FRONT END OF COMPILERS: The Structure of Compiler – Lexical Analysis: Role of Lexical Analyzer, Specification and Recognition of Tokens, Syntax Analysis: Top Down Parsing, Bottom up Parsing, LR Parsers: SLR, CLR, and LALR.

Module 2	8hrs

INTERMEDIATE CODE GENERATION: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Syntax Directed Translation Schemes, Intermediate Languages: Syntax Tree, Three Address Code, Postfix Code, Declarations, Translation of Expressions, Type Checking, Back Patching.

Module 3	8hrs

RUNTIME AND OBJECT CODE GENERATION: Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of Code Generator - Register Allocation and Assignment – Instruction Selection by Tree Rewriting – Optimal Code Generation for Expressions – Dynamic Programming Code Generation.

Module 4	8hrs

CODE OPTIMIZATION: Basic Blocks and Flow Graphs – Optimization of Basic Blocks – Principal Sources of Optimizations – Data Flow Analysis – Constant Propagation – Partial Redundancy Elimination – Peephole Optimizations.

Module 5	8hrs

SCHEDULING AND OPTIMIZING FOR PARALLELISM: Code Scheduling Constraints – Basic Block Scheduling – Global Code Scheduling - Basic Concepts in Parallelization – Parallelizing Matrix Multiplication – Iteration Spaces – Affine Array Indexes.

Course outcomes: Students will able to

CO1	Design compiler phases from language specification.
CO2	Design code generators for the specified machine.
CO3	Analyze Object Code Generation techniques.
CO4	Apply the various optimization techniques.
CO5	Understand the Optimizing for Parallelism
Textbooks:	
1	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, ―Compilers: Principles, Techniques and Tools‖, Second Edition, Pearson Education, 2009.
2	Randy Allen, Ken Kennedy, ―Optimizing Compilers for Modern Architectures: A Dependence based Approach‖, Morgan Kaufmann Publishers, 2002.
3	Keith D Cooper and Linda Torczon, ―Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004
4	V. Raghavan, ―Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.
5	Allen I. Holub, ―Compiler Design in C‖, Prentice-Hall Software Series, 1993.
6	Steven S. Muchnick, ―Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
7	Keith D Cooper and Linda Torczon, ―Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004

CIE Assessment:

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SEE Assessment:

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	2	-	-	-	-	-	-	-	2
CO2	3	3	2	3	1	-	-	-	-	-	-	2
CO3	3	3	2	3	1	-	-	-	-	-	-	2
CO4	3	3	2	3	2	-	-	-	-	-	-	2
CO5	3	3	2	3	2	-	-	-	-	-	-	2

Course Title	Cloud Computing	Semester	VI
Course code	MVJ22IS634	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. To explain the fundamentals of cloud computing
2. To illustrate the cloud application programming and aneka platform
3. To Contrast different cloud platforms used in industry

Module 1	**8hrs**

Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services

Module 2	**8hrs**

Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud.

Module 3	**8hrs**

Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization
Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems

Module 4	**8hrs**

Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds,
Exercises and problems.

Module 5	**8hrs**

Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

Course outcomes: Students will able to

CO1	Compare the strengths and limitations of cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Apply suitable virtualization concept (can be attained through assignments and CIE)

CO4	Choose the appropriate cloud player
CO5	Address the core issues of cloud computing such as security, privacy and interoperability (can
Textbooks:	
1	Cloud Computing Theory and Practice, Dan C Marinescu ,Elsevier(MK) 2013.
2	Computing Principles and Paradigms, Rajkumar Buyya , James Broberg, Andrzej Goscinski Willey 2014.
3	Cloud Computing Implementation, Management and Security, John W Rittinghouse, James F Ransome CRC Press 2013

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	2	2	-	-	-	-	-
CO2	3	3	-	-	3	-	2	-	-	-	-	-
CO3	3	3	3	-	3	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	2	-	-	-	2	-
CO5	3	3	-	3	-	2	-	2	-	2	2	2

Course Title	Introduction To Data Structures	Semester	VI
Course code	MVJ22IS641	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Discuss the fundamental concepts and principles of data structures.
2. Understand the importance of data structures in computer programming and problem solving.
3. A compressive overview of various data structures such as arrays, linked lists, stacks, queues, trees and graphs.
4. Prepare the students for advanced courses in algorithms, data analysis.

Module 1	8hrs

Introduction : Data Structures definition , classification of data structures , Arrays – Definition, Declaration , Types of arrays, Structures , Pointers.

Module 2	8hrs

Stacks- definition, implementation of stacks using arrays, operations of stacks.

Queues- Introduction, Types of queues, Linear queue using arrays, operations on linear queue, circular queue. Limitation of linear queue, Linear Queue vs circular queue.

Module 3	8hrs

Linked List -Linked-list and its types- singly linked lists- doubly-linked lists- circular linked lists, Applications of Linear Data Structures.

Module 4	8hrs

Non Linear Data Structures: Trees – Introduction , Terminologies, Representation of trees , Types of Trees, Application of trees , Binary Tree – Representation, Traversal techniques, Binary Search trees – Tree Construction, Expression trees. Application of Binary search tree.

Module 5	8hrs

Graphs: Introduction , terminologies, Representation of graphs , Connected graph , graph traversal techniques, Application of graphs in data structures **.**
Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extensible Hashing.

Course outcomes: Students will able to

CO1	Evaluate the performance and efficiency of different operations on arrays, stacks, queues, and circular queues.
CO2	Understand the different types of linked list.
CO3	Implement basic operations on trees.
CO4	Demonstrate the representation and traversal techniques of graphs and their applications.

CO5	Use the concepts of Hashing in storing data.

Textbooks:	
1	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2011
2	Fundamentals of Data structures , Ellis Horowitz, sartaj sahni,
3	Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures & Algorithms, Pearson Education, New Delhi, 2006

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**3**	**3**	**3**							**2**
CO2	**3**	**2**	**2**	**3**	**3**							**2**
CO3	**3**	**2**	**2**	**3**	**3**							**2**
CO4	**3**	**2**	**3**	**3**	**3**							**2**
CO5	**3**	**2**	**3**	**3**	**3**							**2**

Course Title	Fundamentals of Operating Systems	Semester	VI
Course code	MVJ22IS642	CIE	50
Total No. of Contact Hours : L:T:P:S	3:0:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. understanding the fundamental concepts of operating systems.
2. Analyse the exchanging data between different process.
3. Discuss the deadlock mechanism in operating systems.
4. Recognize the importance of process and memory management.
5. Outline the features of files and file management systems.

Module 1	8hrs

The Basics: An overview: Introduction to operating systems, components of an operating systems, Evolution of operating system, architecture of operating system, Functions of operating system.

Module 2	8hrs

Operating system services, user and operating system interface, system calls and services, operating system structure, **Process:** Introduction, Process management, OS view of processes. Process states. **Interrupts:** Interrupts in operating systems, Interprocess communication, types of interprocess communications.

Module 3	8hrs

Deadlocks: what is Deadlock, Deadlock Characteristics, resource management, conditions of deadlock – Handling Deadlocks, deadlock avoidance, Deadlock Detection, Deadlock Recovery.

Module 4	8hrs

Process scheduling: Concept of Process Scheduling, operation on Processes scheduling, Scheduling criteria.

Memory Management: Memory organization in operating system, Memory Hierarchy, Memory Management Strategies. Contiguous Memory Allocation, Non-contiguous Memory Allocation.

Module 5	8hrs

File and Database Systems: File concept, Access methods, Data Hierarchy, Directory Structure, File Protection, File System Structure. File access control.

Course outcomes: Students will able to

CO1	Demonstrate need for OS and different types of OS
CO2	Understand the process and interprocess communication
CO3	Apply suitable methods to handle and avoid deadlock
CO4	Analyze and solve problems related to process management, memory management
CO5	create, modify, and delete files and directories within an operating system.

Textbooks:

1	"Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, 10th ed.
2	"Modern Operating Systems" by Andrew S. Tanenbaum and Herbert Bos,5th ed.

3	"Operating Systems: Internals and Design Principles" by William Stallings,7th ed

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**3**	**2**	**3**							
CO2	**2**	**3**	**3**	**3**	**3**							
CO3	**2**	**3**	**3**	**2**	**3**							
CO4	**2**	**3**	**2**	**3**	**3**							
CO5	**2**	**3**	**2**	**2**	**2**							

Course Title	Mobile Application Development	Semester	VI
Course code	MVJ22IS643	CIE	50
Total No. of Contact Hours :	3:0:0:0(L:T:P:S)	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1.Understand system requirements for mobile applications.

2.Generate suitable design using specific mobile development frameworks.

3.Implement the design using specific mobile development frameworks.

4.Deploy the mobile applications in marketplace for distribution.

Module 1	8hrs

Introduction: Introduction to mobile application - Market values for mobile applications System requirements for mobile application,Mobile application development architecture.

Module 2	8hrs

Designing Applications using Android: Developing user interfaces -Layout -Input Controls and Events- Menus - Dialogs, Notifications and Toasts

Module 3	8hrs

Multimedia & Services: Lifecycle of a Service - Managing ServicesGPS API Playing audio, video.

Module 4	8hrs

Technology I Android: Introduction Establishing the development environment, Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment.

Module 5	8hrs

Technology II IOS: Introduction to Objective C IOS features UI implementation Touch frameworks Data persistence using Core Data and SQLite.

CO1	Demonstrate knowledge on basics of mobile application.
CO2	Understand the framework of mobile application and design simple interfaces
CO3	Create an application using multimedia components.
CO4	Develop and deploy application with server side connectivity.
CO5	Understand basic concepts of IOS

Textbooks:	
1	James Dovey and Ash Furrow ,"Beginning objective C",Apress,20212
2	Android in Practice",Dream Tech,2012 Charlie Collins,Michael Galpin and Matthias Kappler.

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	-	-	-	-	-	-	-	3
CO2	3	3	1	-	-	-	-	-	-	-	-	3
CO3	3	3	1	2	-	-	-	-	-	1	-	3
CO4	3	3	3	3	-	-	-	2	2	2	-	3
CO5	3	3	3	3	-	-	2	2	3	2	-	3

Course Title	Introduction to AI	SEMESTER	VI
Course code	MVJ22IS644	CIE	50
Total No. of Contact Hours : L:T:P:S	3:0:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Identify the problems where AI is required and the different methods available
2. Compare and contrast different AI techniques available.
3. Define and explain learning algorithms

Module 1	8hrs
What is artificial intelligence?, Problems, Problem Spaces and search	

Module 2	8hrs
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules.	

Module 3	8hrs
Symbolic Reasoning under Uncertainty, Statistical reasoning	

Module 4	8hrs
Heuristic search techniques: Generate and test, Hill Climbing, Best First Search, ProblemReduction, Constraint Satisfaction, Means-ends Analysis.	

Module 5	8hrs
Learning, Expert Systems.	

Course outcomes: Students will able to

CO1	Identify the AI based problems.
CO2	Apply techniques to solve problems
CO3	Define learning and explain various learning techniques.
CO4	Implement projects using different AI learning techniques.
CO5	Discuss Expert system.

Textbooks:

1	E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.
2	Stuart Russel, Peter Norvig, "Artificial Intelligence: A Modern Approach" , 2nd Edition, Pearson Education, 2003.
3	Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50

marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
CO1	2	2	3	3	2							**2**	
CO2	2	3	3	3	2							**2**	
CO3	3	2	2	2	3							**2**	
CO4	3	2	2	3	3							**2**	
CO5	3	3	3	3	3							**2**	

SEMESTER -6TH MACHINE LEARNING LAB			
Course code	MVJ22ISL66	**CIE**	**50**
Total No. of Contact Hours : L:T:P:S	**0:0:2:0**	**SEE**	**50**
No. of Contact Hours/week	**20**	**Total**	**100**
Credits	**1**	**Exam. Duration**	**3**

COURSE OBJECTIVES: ***This course will enable students to***

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

LIST OF PROGRAMS

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
3	Develop a program to demonstrate the prediction of values of a given dataset using Linear regression.
4	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
8	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

9	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k- Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
10	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
11	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

Course outcomes: Students will able to	
CO1	Preprocess raw data for machine learning algorithms. to implement andevaluate linear regression models.
CO2	Implement and evaluate logistic regression models.
CO3	Implement and evaluate KNN models for both classification and regression tasks. To implement and evaluate SVM models with different kernels
CO4	Perform dimensionality reduction using PCA and understand its impact on the dataset. to implement and evaluate K-Means clustering and determine the optimal number of clusters.
CO5	To implement and evaluate ensemble methods and understand their advantages over individual models

Textbooks:	
1	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.

CIE Assessment:

Continuous Internal Evaluation (CIE):
Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

SEE Assessment:

SEE for 50 marks are executed by means of an examination.

CO-PO MAPPING

COPO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	1	-	-	-	-	-	-	2	-	1
CO2	2	1	1	-	-	-	-	-	-	2	-	1

CO3	2	1	1	-	-	-	-	-	-	2	-	1	
CO4	2	1	1	-	-	-	-	-	-	2	-	1	
CO5	2	1	1	-	-	-	-	-	-	2	-	1	

VII SEMESTER
(2022 SCHEME)

Course Title	Big Data Analytics	Semester	VII
Course code	MVJ22IS71	CIE	50+50
Total No. of Contact Hours	3:0:1	SEE	50+50
No. of Contact Hours/week	40 L+26 P	Total	100
Credits	4	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hadoop Eco System.
6. Explain different approaches for text analysis and big data.

Module 1	8hrs

Introduction To Big Data : Types of Digital Data, Introduction to Big Data, Analysing Data with Unix tools, The Big Data Foundation, Big Data Computing Platforms (or Computing Platforms That Handle the Big Data Analytics Tsunami), Big Data Computation, More on Big Data Storage, Big Data Computational Limitations, Big Data Emerging Technologies.

Module 2	8hrs

Basics of Hadoop: Hadoop Architecture, The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance. Analysing Data with Hadoop, Hadoop Streaming, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

Module 3	8hrs

Map Reduce: Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.
Hadoop Ecosystem And Yarn: Hadoop ecosystem components - SPARK, FLUME, Hadoop 2.0 New Features- NameNode High Availability, HDFS Federation, MRv2, YARN.

Module 4	8hrs

Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.
Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.
Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

Module 5	8hrs

Understanding Text Analytics and big Data: Exploring Unstructured data, Understanding Text Analytics, Analysis and extraction techniques, Putting the results together with structured data, putting big data to use, Text analytics tools for Big Data.
Customized approaches for Analysis of Big Data: Different approaches to big data Analysis, custom and semi-custom applications for big data analysis.

LABORATORY EXPERIMENTS

1. Installation of Hadoop and basic commands execution on Hadoop.
2. Implementation of wordcount program using MapReduce.
3. Implementation of max avg of student marks using MapReduce programs.
4. Implement MapReduce program to find the max temperature.
5. Implementation of matrix multiplication using map reduce program.
6. Implement MapReduce program to find the max. Fuel consumed by the vehicles in the city.
7. Implement MapReduce program to find the average of city MPG just for electric cars for the given data sets
8. Implement the MapReduce program to find Even and odd numbers.
9. Implement the MapReduce program to find the list of prime numbers in the given data sets.
10. Implement MapReduce program to find the total and Average salary of the employees.

Course outcomes: Students will able to

CO1	Describe big data and use cases from selected business domains
CO2	Install, configure, and run Hadoop and HDFS
CO3	Perform map-reduce analytics using Hadoop
CO4	Use Hadoop related tools such as HBase, Pig, and Hive for big data Analytics
CO5	Understand different Applications of big data approaches

Textbooks:

1	Big Data Analytics" , Seema Acharya, Subhasini Chellappan, Wiley 2015
2	Understanding Big data: Analytics for Enterprise Class Hadoop and Streaming Data,Chris Eaton, Dirk deroos et al., 1 st edition, Tata McGraw Hill, 2015, ISBN 13: 978-9339221270
3	Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
4	Big data for dummies, Judith Hurwitz, Alan Nugent,Fern Halper, Marcia Kaufman, Wiley Publications, 1st edition, 2013, ISBN: 978-1-118-50422-2
5	Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Michael Minelli ,Michele Chambers , Ambiga Dhiraj

CIE Assessment:
CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks
Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**1**	**2**	**2**	**-**							1
CO2	**2**	**2**	**2**	**2**	**-**							1
CO3	**2**	**2**	**2**	**2**	**3**							1
CO4	**2**	**2**	**2**	**2**	**3**							1
CO5	**2**	**2**	**2**	**2**	**3**							1

Course Title	Parallel Computing	Semester	VII
Course code	MVJ22IS72	CIE	50+50
Total No. of Contact Hours	3:0:1	SEE	50+50
No. of Contact Hours/week	40 L+26 P	Total	100
Credits	4	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Understand fundamental concepts in Parallel Computing.
2. Understand Distributed-Memory Programming with MPI.
3. Understand parallel programming model, analyse synchronization in real computing problems.
4. Apply open MP on Shared memory programming.

Module 1	8hrs

Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing. Parallel Programming Platforms: Trends in microprocessor architectures - limitations of memory system performance – parallel computing platforms – communication costs in parallel machines – routing mechanisms for interconnection networks.

Module 2	8hrs

Principles of Parallel Algorithm Design: Preliminaries – decomposition techniques – characteristics of tasks and interactions – mapping techniques for load balancing – methods for containing interaction overheads – parallel algorithm models. Basic Communication Operations: One-to-all broadcast and all-to-one reduction – all-to-all broadcast reduction – all-reduce and prefix-sum operations – scatter and gather – all to-all personalized communication – circular shift – improving the speed of some communication Operation.

Module 3	8hrs

Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

Module 4	8hrs

System Model Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI.

Module 5	8hrs

Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry. Distributed File Systems –Introduction – File service architecture – Andrew File system.

LABORATORY EXPERIMENTS

1.Familiarization with HPC programming paradigms: Single program multiple data (SPMD) & MPMD

2. To interface Speeding up C/Fortran/Python programs: Vectorization; Compiler options.

3. Programming in Message Passing Interface (MPI): Point-to-point and collective communications; Parallel I/O; MPI for Python and C/Fortran.

4. Programming in OpenMP.

5. Programming GPUs using OpenACC.

6. Programming GPUs using CuPy and CUDA

7. Reduction clause in OpenMP

8. Scheduling loops in OpenMP-odd even transposition sort

9. Synchronization in OpenMp – Producer – Consumer problem

10. OpenMP program for fork join model

Course outcomes: Students will able to

CO1	Acquire the skills to implement software effectively and efficiently on parallel hardware platforms
CO2	Discuss trends in Distributed Systems
CO3	Apply network virtualization.
CO4	Apply remote method invocation and objects.
CO5	Differentiate the file systems.

Textbooks:

1	P. S. Pacheco, An Introduction to Parallel Programming, Elsevier (2011)
2	M. Quinn, Parallel Programming in C and OpenMP, McCraw Hill Education (India) (2003)
3	A. Grama, A. Gupta, G. Karypis, and V. Kumar, Introduction to Parallel Computing, Pearson (2007)
4	G. Zaccone. Python Parallel Programming Cookbook, Packt Publ. (2015)
5	R. Farber, Parallel Programming with OpenACC, Morgan Kaufmann

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**3**	**3**							
CO2	**3**	**2**	**3**	**3**	**3**							
CO3	**2**	**3**	**2**	**3**	**3**							
CO4	**3**	**2**	**3**	**3**	**3**							
CO5	**2**	**3**	**3**	**3**	**3**							

Course Title	Information and Network Security	Semester	VII
Course code	MVJ22IS73	CIE	50+50
Total No. of Contact Hours	3:0:0	SEE	50+50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Identify the major types of threats to information security and the associated attacks, Services and Mechanisms.
2. Design and develop cryptographic algorithms using public key cryptography.
3. Generate the own key for developing cryptography algorithms.
4. Understand various Transport-level Security and Wireless Network Security
5. Generate and distribute a PGP key pair and use the PGP package to send an encrypted e- mail message.

Module 1	8hrs

Computer Security Concepts: Introduction, The need for security, Security approaches, Principles of security, The OSI Security Architecture, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security. **Cryptography:** Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4 45, Cipher Block Modes of Operation, Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Algorithms (Knapsack, RSA, Diffie-Hellman, Elliptic Curve Cryptography), Digital Signatures.

Module 2	8hrs

Network Security Applications: Symmetric Key Distribution Using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption**,** Public key infrastructure, Federated Identity Management. **Transport Level Security:** Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell (SSH). **Wireless Network Security:** Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security.

Module 3	8hrs

Electronic Mail Security: Pretty Good Privacy**,** S/MIME 241, DomainKeys Identified Mail. IP **Security**: IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites, Intrusion Detection, Password Management, Firewalls – Types, Location and Configurations, Basics of SNMP, Legal and Ethical Aspects - Intellectual Property, Privacy, Ethical Issue

Module 4	8hrs

Hash Functions: Introduction, The Birthday Problem, Non-Cryptographic Hashes, Tiger Hash, HMAC, Uses. **Advanced Cryptanalysis:** Linear and differential Cryptanalysis, Side Channel Attack on RSA, Lattice Reduction and Knapsack, Hellman's time memory trade off. **Access Control:** Authentication, Authorization, Simple Authentication Protocols

Module 5	8hrs

Malware: Introduction, Types **Insecurity in software:** Software Reverse Engineering, Software Tamper Resistance, Digital Rights Management, Software Development. **Operating System and Security:** Operating System Security Functions, Trusted Operating Systems	
Course outcomes: Students will able to	
CO1	Identify common security threats and vulnerabilities in networks and information systems.
CO2	learn about encryption techniques, access control mechanisms, and security protocols.
CO3	Evaluate and propose solutions to legal and ethical challenges in the context of technology and information systems.
CO4	Apply mathematical and statistical methods to cryptanalysis and develop strategies for breaking encrypted messages.
CO5	Develop skills in malware analysis, reverse engineering, and incident response to effectively combat malware threats.
Textbooks:	
1	Principles of Information Security - Michael E. Whitman and Herbert J. Mattord, 2nd Edition, Thompson, 2005.
2	Network Security Essentials Applications and Standards - William Stallings, Person Education, 2000
3	Cryptography and Network Security - Behrouz A. Forouzan, Tata McGraw-Hill, 2007

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**3**	**3**							**2**
CO2	**2**	**3**	**2**	**2**	**3**							**2**
CO3	**3**	**3**	**3**	**2**	**2**							**3**
CO4	**2**	**3**	**3**	**2**	**3**							**2**
CO5	**3**	**3**	**2**	**2**	**3**							**3**

Course Title	Deep Learning	Semester	VII
Course code	MVJ22IS741	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Learn feed forward deep networks.
2. Understand convolutional networks and sequence modelling.
3. Study probabilistic models and auto encoders.
4. Expose the students to various deep generative models.
5. Study the various applications of deep learning.

Module 1	8hrs

DEEP NETWORKS: Machine Learning Basics: Learning Algorithms – Supervised and Unsupervised learning – Feed forward Deep networks – regularization – Optimization for training Deep models.

Module 2	8hrs

CONVOLUTIONAL NETWORKS AND SEQUENCE MODELLING : Convolutional Networks – Convolution operation – Motivation Pooling – Basic Convolution function – Algorithms – Recurrent and recursive nets : Recurrent neural networks – Bidirectional RNN – Recursive Neural networks – Auto regressive networks – Long term dependencies – Temporal dependencies – Approximate search.

Module 3	8hrs

PROBABILISTIC MODELS AND AUTO ENCODERS : Structured Probabilistic models : Challenges of unstructured modelling – using graphs to describe model structure – Learning about dependencies – inference – Deep learning approach – Monte carlo models Linear Factor models and Auto encoders

Module 4	8hrs

DEEP GENERATIVE MODELS : Restricted Boltzmann Machines – Deep Belief networks – Deep Boltzmann machine – Convolutional Boltzmann machine

Module 5	8hrs

APPLICATIONS: Speech, Audio and Music processing – Language modelling and Natural language processing – information retrieval – object recognition and computer vision – Multi modal and multi task learning

Course outcomes: Students will able to

CO1	Use feed forward deep networks
CO2	Apply convolutional networks and sequence modelling for problem solving
CO3	Use probabilistic models and auto encoders.
CO4	Use deep generative models for problem solving
CO5	Apply the deep learning techniques

Textbooks:

1	Yoshua Bengio and Ian J.Goodfellow and Aaron Courville, "Deep Learning", MIT Press, 2015
2	Li Deng, Dong Yu, "Deep Learning: Methods and Applications", now publishers, 2014

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3							2
CO2	2	3	2	2	3							2
CO3	3	3	3	2	2							3
CO4	2	3	3	2	3							2
CO5	3	3	2	2	3							3

Course Title	Natural Language Processing	Semester	VII
Course code	MVJ22IS742	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Learn the fundamentals of natural language processing
2. Understand the use of CFG and PCFG in NLP
3. Understand the role of semantics of sentences and pragmatics
4. Gain knowledge in automated Natural Language Generation and Machine Translation.

Module 1	8hrs

INTRODUCTION: Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM –Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance values of real symmetric matrices: Jacobi and Givens method.

Module 2	8hrs

WORD LEVEL AND SYNTACTIC ANALYSIS: N grams Models of Syntax - Counting Words Unsmoothed N grams-Smoothing-Back off Deleted Interpolation – Entropy – English Word Classes - Tag sets for English-Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging -Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Module 3	8hrs

CONTEXT FREE GRAMMARS: Context-Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

Module 4	8hrs

Representing Meaning - Meaning Structure of Language, First Order Predicate Calculus-Representing Linguistically Relevant Concepts –SyntaxDriven Semantic Analysis - Semantic Attachments –Syntax Driven Analyzer- Robust Analysis – Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval.

Module 5	8hrs

LANGUAGE GENERATION AND DISCOURSEANALYSIS: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Co reference Resolution – Resources: Porter Stemmer, Lemmatize, Penn ,Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, and British National Corpus (BNC).

Course outcomes: Students will able to	
CO1	Tag a given text with basic Language features.
CO2	Design an innovative application using NLP components
CO3	Implement a rule-based system to tackle morphology/syntax of a language
CO4	Design a tag set to be used for statistical processing for real-time applications
CO5	Compare the use of different statistical approaches for different types of NLP applications
Textbooks:	
1	Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014
2	C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MITPress. Cambridge, MA:1999

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**3**	**3**	**2**							
CO2	**3**	**2**	**3**	**3**	**2**							
CO3	**3**	**3**	**3**	**3**	**3**							
CO4	**2**	**2**	**3**	**3**	**3**							
CO5	**3**	**3**	**3**	**3**	**3**							

Course Title	Embedded Systems	Semester	VII
Course code	MVJ22IS743	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Comprehend the underlying features and building blocks of embedded system development.
2. Outline the advanced architecture components of 8051 microcontroller.
3. Build the assembly language routines using 8051 microcontroller.
4. Analyze various models of embedded system development
5. Evaluate the RTOS concepts of embedded system applications
6. Design embedded systems prototypes for real-time applications.

Module 1	**8hrs**

Introduction to Embedded Systems: Definition, Purpose, Embedded systems Vs. General computing systems, Classifications, Applications, Innovative bonding of lifestyle with embedded technologies, Building Blocks of Embedded Systems: Core components including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (on board and external types), Embedded firmware, Other system components

Module 2	**8hrs**

Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions

Module 3	**8hrs**

Introduction to the ARM Instruction Set : Data Processing Instructions , Programme Instructions, Software Interrupt Instructions, Program Status Register Instructions, Co-processor Instructions, Loading Constants ,ARM programming using Assembly language: Writing Assembly code, Profiling and cycle counting, instruction scheduling.

Module 4	**8hrs**

Exception, Interrupt Handling : Exception handling,Interrupts, Interrupt handling Schemes.
Memory Management Unit : The Memory Hierarchy and Cache Memory, Cache Architecture, Cache Policy, Moving from MPU to an MMU,How Virtual Memory Works, Details of ARM MMU.

Module 5	**8hrs**

Real Time Operating System (RTOS) based Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread pre-emption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS.

Course outcomes: Students will able to

CO1	Comprehend the underlying features and building blocks of embedded system development

CO2	Describe the architectural features and instructions of ARM microcontroller
CO3	Develop Assembly Programs in ARM for Embedded applications
CO4	Describe the fundamentals of Exception, Interrupt Handling and Memory Management Unit of ARM Controller
CO5	Demonstrate the need of real time operating system for embedded system applications.
Textbooks:	
1	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developer's guide, Elsevier, Morgan Kaufman publishers, 2008.
2	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**3**	**3**	**3**							
CO2	**3**	**-**	**3**	**3**	**3**							
CO3	**3**	**-**	**3**	**3**	**3**							
CO4	**2**	**2**	**3**	**3**	**3**							
CO5	**3**	**3**	**3**	**3**	**3**							

Course Title	Distributed File Systems	Semester	VII
Course code	MVJ22IS744	CIE	50+50
Total No. of Contact Hours	3:0:0	SEE	50+50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
2. To understand Distributed on multiple file servers or multiple locations. It allows programs to access or store isolated files as they do with the local ones, allowing programmers to access files from any network or computer.
3. Illustrates DFS is executed as a part of the operating system.
4. Analyse DFS, a namespace is created, and this process is transparent for the clients.

Module 1	**8hrs**
Distributed file System: What is distributed file system, File Service architecture, Need of Distributed File system, Distributed file system requirement, – Case Study 1: Sun Network File System, Case Study 2: The Andrew File System. Name Services, Domain Name System, Directory Services.	
Module 2	**8hrs**
Name Services and Domain Name System: Name servers and Navigation, Domain Name systems, Main Features, Directory service protocol, Name Hierarchy, Case study Global Name service, The X.500 directory service, X.500 Infrastructure.	
Module 3	**8hrs**
Distributed File system: Motivation, Naming and Transparency, Remote File Access, Stateful vs State less service, why did we choose these systems, GFS, GFS2- Google colossus system, Hyper scale: Facebook Tectonic system	
Module 4	**8hrs**
Desirable Features of a Good Distributed File System, Goal of Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles, Trends in Distributed File system,	
Module 5	**8hrs**
Hadoop Distributed File System: The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop File System interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop Archives, Apache Storm, Spark, Oozie	

Course outcomes: Students will able to

CO1	Demonstrate Proficiency in understanding of Distributed file system
CO2	Analyze the Name services and Domain Name system.
CO3	Illustrate DFS its Motivation, GFS
CO4	Interpret File Accessing Models, Caching Schemes, Replication Models, sufficient Knowledge

	on File access.
CO5	Discussion about Hadoop Distributed File System, Hadoop File System interfaces
Textbooks:	
1	Distributed File Systems: Concepts and Examples" by Juraj Hromkovic
2	Distributed File Systems" by Sun Microsystems
3	Modern Distributed File Systems: Design and Implementation" by Ricardo Morin
Video links: http://acl.digimat.in/nptel/courses/video/106104189/lec4.pdf	

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**3**	**3**							**2**
CO2	**3**	**3**	**2**	**3**	**2**							**2**
CO3	**3**	**3**	**2**	**2**	**2**							**2**
CO4	**2**	**2**	**2**	**2**	**2**							**2**
CO5	**2**	**2**	**2**	**3**	**3**							**2**

Course Title	Introduction To DBMS	Semester	VII
Course code	MVJ22IS7551	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: ***This course will enable students to***

1. Provide a strong foundation in database concepts, technology, and practice.
2. Practice SQL programming through a variety of database problems.
3. Demonstrate the use of concurrency and transactions in database.
4. Design and build database applications for real world problems

Module 1	**8hrs**
Introduction to Databases: Introduction; An example; characteristics of the database approach; actors on the scene; workers behind the scene; advantages of using the DBMS approach; A brief history of database Applications; when Not to use a DBMS.	
Module 2	**8hrs**
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.	
Module 3	**8hrs**
SQL: Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL	
Module 4	**8hrs**
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce- Codd Normal Form,	
Module 5	**8hrs**
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.	

Course outcomes: Students will able to	
CO1	Identify, analyse and define database objects, enforce integrity constraints on a database using RDBMS.
CO2	Use Structured Query Language (SQL) for database manipulation.
CO3	Design and build simple database systems.
CO4	Apply the concepts of Normalization and design database which possess no anomalies.
CO5	Develop application to interact with databases
Textbooks:	
1	Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition,

	2017, Pearson
2	Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
3	Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, McGrawHill, 2013.

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**	**3**	**3**	**2**	**2**				**1**			**2**
CO2	**3**	**3**	**3**	**2**	**2**				**1**			**2**
CO3	**3**	**3**	**3**	**2**	**2**				**1**			**2**
CO4	**2**	**3**	**3**	**2**	**2**				**1**			**2**
CO5	**2**	**3**	**3**	**3**	**3**				**2**			**2**

Open Elective II
Semester 7th
INTRODUCTION TO ALGORITHMS

Course code	**MVJ22IS7552**	**CIE**	**50+50**
Total No. of Contact Hours	**3:0:0**	**SEE**	**50+50**
No. of Contact Hours/week	**40**	**Total**	**100**
Credits	**3**	**Exam. Duration**	**3**

COURSE OBJECTIVES: ***This course will enable students to***

1. Learn the basics Algorithms
2. Learn to write algorithms and its performance.
3. Learn the different functions of algorithms.
4. Understand the concept of recurrence algorithms
5. Understand probabilistic analysis.

Module 1	**8hrs**
The Role of Algorithms in Computing: Algorithms, kinds of problems are solved by algorithms, Algorithms as a technology, Efficiency, Data structures, Technique, Hard problems	
Module 2	**8hrs**
Getting Started Insertion sort, Analyzing algorithms, Analysis of insertion sort, Worst-case and average-case analysis, Designing algorithms	
Module 3	**8hrs**
Growth of Functions Growth of Functions, Asymptotic notation, Comparison of functions, Standard notations and common functions, Functional iteration	
Module 4	**8hrs**
Recurrences The substitution method, The recursion-tree method, The master method, Proof of the master theorem, The proof for exact powers	
Module 5	**8hrs**
Probabilistic Analysis and Randomized Algorithms The hiring problem, Indicator random variables, Randomized algorithms, Probabilistic analysis and further uses of indicator random variables	

Course outcomes: Students will able to

CO1	Explain the basic algorithm and its characteristics
CO2	Understanding of sorting algorithm
CO3	Analysis of algorithm and performance
CO4	Illustrate Recurrence algorithms
CO5	Interpret Probabilistic Analysis and randomized algorithms

Textbooks:

1	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
3	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).
4	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
5	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

Question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students must answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	-	-	--	-	3	1	3	1	1
CO2	3	2	3	3	2	-	2	2	2	3	2	3
CO3	3	2	3	3	2	2	2	3	3	3	2	3
CO4	3	3	3	3	2	2	3	3	3	3	2	3
CO5	3	2	2	2	2	2	3	3	3	3	2	3

COurse Title	Software Engineering	Semester	VII
Course code	MVJ22IS7553	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: This Course will enable the students to

1. Understand principles, concepts, methods, and techniques of the software engineering approach to producing quality software (particularly for large, complex systems).
2. Impart skills in the design and implementation of efficient software systems across disciplines.
3. Familiarize engineering practices and standards used in developing software products and components.
4. Gather knowledge on various software testing, maintenance methods.

Module 1	8hrs
FUNDAMENTALS OF SOFTWARE ENGINEERING AND REQUIREMENTS ENGINEERING Software Engineering Fundamentals; Software processes: Software life-cycle models; Software requirements and specifications: Requirements elicitation; Requirements analysis modeling techniques; Functional and non-functional requirements.	
Module 2	**8hrs**
Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models.	
Module 3	**8hrs**
SOFTWARE VALIDATION AND MAINTENANCE Software validation: Validation planning; Testing fundamentals, including test plan creation and test case generation; Black-box and white-box testing techniques; Unit, integration, validation, and system testing; Object-oriented testing; Inspections	
Module 4	**8hrs**
COMPONENT BASED SOFTWARE ENGINEERING Engineering of Component-Based Systems; The CBSE Process; Domain Engineering; Component Based Development; Classifying and Retrieving Components; Economics of CBSE	
Module 5	**8hrs**
SOFTWARE QUALITY PROCESS IMPROVEMENT Overview of Quality management and Process Improvement; Overview of SEI -CMM, ISO 9000, CMMI, PCMM, TQM and Six Sigma; overview of CASE tools. Software tools and environments: Programming environments; Project management tools;	

Course outcomes: Students will able to	
CO1	Comprehend software development life cycle and Prepare SRS document for a project
CO2	Apply software design and development techniques
CO3	Identify verification and validation methods in a software engineering project
CO4	Apply on Component based software development process.
CO5	Involve in continuous learning to solve issues of process and software product using the advanced CASE tools and techniques

Textbooks:	
1	Ian Sommerville, "Software Engineering", 9th Edition, Addison- Wesley, 2011
2	R. S. Pressman, Software Engineering, a practitioner's approach, McGraw Hill,7th Edition, 2010
3	Rajib Mall, “Fundamentals of Software Engineering”, PHI Publication, 3rd edition, 2009
4	Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

CIE Assessment:

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

SEE Assessment:

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CO-PO MAPPING

COPO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**2**	**2**	**-**			**1**	**2**		
CO2	**2**	**2**	**2**	**2**	**2**	**1**			**1**	**2**		
CO3	**2**	**2**	**2**	**2**	**2**	**1**			**1**	**2**		
CO4	**1**	**2**	**2**	**2**	**2**	**1**			**1**	**2**		
CO5	**1**	**2**	**2**	**1**	**2**	**1**			**2**	**2**		

Course Title	Cloud Computing	Semester	VII
Course code	MVJ22IS7554	CIE	50
Total No. of Contact Hours	3:0:0	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	3	Exam. Duration	3

COURSE OBJECTIVES: This Course will enable the students to

1.Understands cloud computing models and infrastructure for larger networks

2. Identify policies, mechanisms and scheduling for resource management, virtualization, and optimization of networks.

3. Compare multiple approaches to cloud system design and solve real world problems.

4. Illustrate storage concept and self-organizing capability for different cloud systems.

5. Understands cloud security and risk

Module 1	**8hrs**
Defining a Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing.	
Module 2	**8hrs**
Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples, Xen, VMware, Microsoft Hyper-V, Cloud Reference Model and Architecture, Infrastructure as a Service, Platform as a Service, Software as a Service, Types of Clouds, Economics of the Cloud, Open Challenges in Clouds	
Module 3	**8hrs**
Data-intensive computing Characterizing data-intensive computations, Challenges ahead, Historical perspective, Technologies for data-intensive computing – Storage systems, Programming platforms – Map Reduce. Public Cloud Infrastructures: Amazon Web Services - Compute, Storage, and Communication Services; Google App Engine – Architecture, Application Life-Cycle, Cost Model; and Microsoft Azure	
Module 4	**8hrs**
ECG Data Analysis on Cloud, Protein Structure Prediction, Satellite Image Processing; Business and Consumer Applications – CRM, Social Networks, Media Applications, and Multiplayer Online Gaming. Advanced Topics in Cloud Computing, Energy efficiency in clouds, Energy-efficient and green cloud computing architecture, Market-based management of clouds, Market-oriented cloud computing, A reference model for MOCC,3 Technologies and initiatives supporting MOCC, Observations	
Module 5	**8hrs**
Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor.	

Course outcomes: Students will able to	
CO1	Explore the basic concepts of cloud computing, cloud infrastructure, cloud models, cloud services, distributed computing, and other related concepts.
CO2	Understand Virtualization and working of some of industrially popular Virtualization technologies.
CO3	Apply Map Reduce programming model to solve some data-intensive computing applications over public or private cloud platforms.
CO4	Analyzing the security risks in cloud from different perspectives and study some of the available solutions.
CO5	Explain Operating system security, Virtual machine Security and Security of virtualization.
Textbooks:	
1	Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, 2013, McGraw Hill, New Delhi, India, ISBN-13: 978-1-25-902995-0. (Module 1, Module 2, Module 3, Module 4, Module 5)
2	Cloud Computing Theory and Practice, Dan C Marinescu, 1st Edition, 2013, Elsevier (MK), ISBN: 9780124046276. (Module 5)
3	Distributed Computing and Cloud Computing, from parallel processing to internet of things, Kai Hwang, GeofferyC. Fox, Jack J Dongarra, 1st Edition, 2012, Elsevier (MK), ISBN: 978-0-12-385880-1.

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CO2	3	3	3	2	3	-	-	-	-	2	3	3
CO3	3	3	2	2	3	-	-	-	-	2	3	3

CO4	3	3	2	2	3	-	-	-	-	2	3	3
CO5	2	2	-	2	2	-	-	-	-	-	-	-