FOR

MVJCE CURRICULUM

Department of Computer Science and Engineering (DATA SCIENCE)

(2022 Scheme)

V SEMESTER

Sl. No.	Course		Course Title	Teaching Department	Teaching Hours/Week				Examination				Credits
					Theory lecture	Tutorials	Practical/ Drawing	Self-Study Components	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
	Type	Code			L	T	P	S					
1	HSMC	MVJ22CD51	Software Engineering & Project Management	CD	3	0	0	-	03	50	50	100	3
2	IPCC	MVJ22CD52	Computer Networks	CD	3	0	2	Y	03	50	50	100	4
3	PCC	MVJ22CD53	Theory of Computation	CD	3	2	0	-	03	50	50	100	4
4	PCCL	MVJ22CDL54	Data Visualization Lab	CD	0	0	2	-	03	50	50	100	1
5	PEC	MVJ22CD55X	Professional Elective-I	CD	3	0	0	-	03	50	50	100	3
6	PROJ	MVJ22CDP56	Mini Project	CD	0	0	4	-	03	100	-	100	2
7	AEC	MVJ22RMI57	Research Methodology and IPR	CD	3	0	0	--	03	50	50	100	3
8	MC	MVJ22ENV58	Environmental Studies	CV	2	0	0		02	50	50	100	2
9	MC	MVJ22NS59	National Service Scheme (NSS).	NSS coordinator	0	0	2	-	-	100	-	100	0
		MVJ22PE59	Physical Education (PE) (Sports and Athletics).	PE Director									
		MVJ22YO59	Yoga.	Yoga Teacher									
				Total	**17**	**2**	**10**	**-**	**23**	**550**	**350**	**900**	**22**

Note: HSMC: Humanities, Social Science and Management Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **PEC:** Professional Elective Course, **PROJ:** Project /Mini Project, **AEC:** Ability Enhancement Course, **SEC:** Skill Enhancement Course, **M C:** Mandatory Course (Non-credit), **L:** Lecture, **T:** Tutorial, **P:** Practical **S:** Self Study, **SDA:** Skill Development Activity, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation.

Course Code	Professional Elective-I
MVJ22CD551	Computer Vision
MVJ22CD552	Data Warehousing
MVJ22CD553	Distributed File Systems
MVJ22CD554	NoSQL Databases

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Course Title	**Software Engineering and Project Management**	**Semester**	**V**
Course Code	**MVJ22CD51**	**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 is 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 of software testing practices and software evolution processes.
5. 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.

Video Link: https://onlinecourses.nptel.ac.in/noc19_cs70/preview

Module-1	**8 Hours**

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.
Textbook 1: Chapter 1: 1.1 to 1.3
Process Models: Prescriptive models, Waterfall model, Incremental process models, Evolutionary. process models, Specialized process models.
Textbook 1: Chapter 2: 2.1, 2.2, 2.4 to 2.7
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 (Sec 4.2)
Textbook 1: Chapter 3: 3.1 to 3.6, Textbook 5: Chapter 4: 4.2

Video Link https://www.youtube.com/watch?v=OT2O7uNldQk&list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt&index=6

Module-2	**8 Hours**

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
Textbook 2: Chapter 1,2,3

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.
Textbook 1: Chapter 8: 8.1 to 8.8

Video Link:
https://www.youtube.com/watch?v=PvYTyXJiwuo&list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt&index=25

Module-3	8 Hours

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.
Textbook 1: Chapter 13: 13.1 to 13.7
Agile Methodology & DevOps: Before Agile – Waterfall, Agile Development.
Self-Learning Section:
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.
Textbook 4: Chapter 2: 2.1 to 2.9

VideoLinkhttps://www.youtube.com/watch?v=_9bmWEMhGFU&list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt&index=43

Module-4	8 Hours

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.
Textbook 3: Chapter 1: 1.1 to 1.17

Video Link:
https://www.youtube.com/watch?v=gnkjcRDQkw0&list=PLLy_2iUCG87CBuNhvti0h6W54ZmqrSDMJ

Module-5	8 Hours

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.
Textbook 3: Chapter 6: 6.1 to 6.16
Software Economics**:** Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts
Textbook 3: Chapter 13: (13.1 to 13.6, 13.9, 13.11, 13.14)

Ref: (SPPM.pdf (nnrg.edu.in))

Course outcomes:

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 Hill.
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 of theory and problems of software engineering, David A. Gustafson, McGraw-Hill's
Reference books:	
1.	Law relating to Intellectual Property rights, B. L. Wadhera, 5th edition, Universal Law Publishing, 2011
2.	Principles of Management, P C Tripathi, P N Reddy, 5th edition, Tata Mc Graw Hill, 2012
3.	Dynamics of Entrepreneurial Development & Management, Vasant Desai, Himalaya publishing house, 2009

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars, and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests.

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

The 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 have to 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	3	2	3					2	3	3
CO2	1	3	3	2	2					2	3	3
CO3	2	2	2	2	3					2	3	3
CO4	2	2	2	2	2					2	3	3
CO5	1	2	3	2	2					2	3	3

3- HIGH 2- MODERATE 1- LOW

Course Title	Computer Network	Semester	V
Course code	MVJ22CD52	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 hours

Course objective is to: 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 Hours

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.

Video Link:
https://www.youtube.com/watch?v=O--rkQNKqls&list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up

Module-2	8 Hours

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 protocols.

Video Link:
https://www.youtube.com/watch?v=29Qdz0FmvmQ&list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up&index=3

Module-3	8 Hours

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.

Video Link:
https://www.youtube.com/watch?v=b6f9vh3cd6w&list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up&index=4

Module-4	8 Hours

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.

Video Link:
https://www.youtube.com/watch?v=8-3CSAkscYU&list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up&index=7

Module-5	8 Hours

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.

Video Link:
https://www.youtube.com/watch?v=5AHp0f0489E&list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up&index=6

LABORATORY EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, lookup and traceroute. Capture ping and traceroute 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.

CO1	To familiarize the student with the basic taxonomy and terminology.
CO2	Develop programs related to error detection, CRC-CCITT, distance vector algorithm etc
CO3	Know how network delivers the packets to destination network
CO4	Know how switch happing between mobile towers and Functions of mobile networks
CO5	Guess the problems in audio/video transfer through network

Textbooks	
1.	Computer Networks:5th ed by Andrew. S. Tanenbaum PHI Publication.
2.	Data Communications and Networks: 3rd ed by Behrouz A. Forouzan. TataMcGraw Hill publication.
Reference:	
3.	William Stallings, Data and Computer Communication, Tenth Edition, Pearson Education, 2013.
4.	James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach Featuring the Internet, 3rd Edition.

CIE Assessment:

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Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

The question paper for the SEE consists 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 have to answer five full questions. One question must be asked 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										
CO2			2								2	
CO3		2										2
CO4			2									
CO5				2								

3-HIGH 2- MODERATE 1- LOW

Course Title	Theory of Computation	Semester	V
Course code	MVJ22CD53	CIE	50
Total No.of Contact Hours	50	SEE	50
No.Of Contact Hours/week	4 (L: T : P :S: 4: 0: 0 : 0)	Total	100
Credits	4	Exam Duration	3 hours

Course objective is 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 Hours

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
Video link / Additional online information (related to module if any):
https://nptel.ac.in/courses/106/105/106105196/

Module-2	8 Hours

Laboratory Sessions/ Experimental learning:
Regular Expressions: Regular languages: Regular Expressions – Finite Automata and Regular Expressions –Applications of Regular Expressions - Regular Grammars.
Video link / Additional online information (related to module if any):
https://www.youtube.com/watch?v=OA8EY3HKZoc
Problems on CFG, pushdown automata

Module-3	8 Hours

Laboratory Sessions/ Experimental learning:
Regular Languages: Properties of regular languages: Pumping lemma for regular languages – Closure properties of regular languages –Equivalence and Minimization of Finite Automata. C
Video link / Additional online information (related to module if any):
https://www.youtube.com/watch?v=ganHwe4DU7A
Problems on Turing Machine, Halting Problem

Module-4	8 Hours

Laboratory Sessions/ Experimental learning:
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
Video link / Additional online information (related to module if any):
https://www.youtube.com/watch?v=FjGrU7vczyg
https://www.youtube.com/watch?v=b3OPl5wS4AQ
Problems on Computational Complexity

Module-5	8 Hours

Laboratory Sessions/ Experimental learning:
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.
Video link / Additional online information (related to module if any):
https://www.youtube.com/watch?v=IhyEGNn-7Uo
Problems on lexical analysis

Course outcomes:

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, Motwani R 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.

Reference Books:

3	Padma Reddy.A, ―Finite Automata and Formal Languages: A Simple Approach.
4	Raghavan V, Principles of Compiler Design, Third Edition, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2009

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars, and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests.

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

The 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 have to 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	0	2	0	0	0	0	0	0	0	0	2
CO2	2	1	2	0	0	0	0	0	0	0	0	0
CO3	1	0	2	0	0	0	0	0	0	0	0	2
CO4	1	0	2	0	0	0	0	0	0	0	0	2
CO5	1	0	2	0	0	0	0	0	0	0	0	2

Course Title	Data Visualization Lab	Semester	V
Course code	MVJ22CDL54	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:

- Effective use of Business Intelligence (BI) technology (Tableau) to apply data visualization
- To discern patterns and relationships in the data.
- To build Dashboard applications.
- To communicate the results clearly and concisely.
- To be able to work with different formats of data sets.

Sr.No	Experiment Name	RBT Level	Hours
1	Understanding Data, what is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?	L1	2
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.	L2	2
3	Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.	L3	2
4	Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view	L2	2
5	Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.	L1	2
6	Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.	L1	2
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.	L2	2
8	Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.	L2	2
9	Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and Exporting.	L3	2
10	Creating custom charts, cyclical data and circular area charts, Dual Axis charts.	L3	2

Course outcomes:	
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.

Reference Books:	
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.

Course Title	Computer Vision	Semester	V
Course code	MVJ22CD551	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: Computer Vision focuses on the development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Module-1:	**8 Hrs**
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:	**8 Hrs**
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:	**8 Hrs**
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:	**8 Hrs**
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:	**8Hrs**
Object recognition and shape representation: alignment, appearance-based methods, invariants, image eigenspaces	

Course outcomes:

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.

Reference Books:

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:

CIE is based on quizzes, tests, assignments/seminars, and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests.

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

The 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 a 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 have to 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	3	2	3					2	3	3
CO2	1	3	3	2	2					2	3	3
CO3	2	2	2	2	3					2	3	3
CO4	2	2	2	2	2					2	3	3
CO5	1	2	3	2	2					2	3	3

Course Title	Data Warehousing	Semester	V
Course code	MVJ22CD552	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 students to***

1. Understand and implement classical models and algorithms in data warehouses and data mining
2. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
3. Be familiar with mathematical foundations of data mining tools.
4. Master data mining techniques in various applications like social, scientific and environmental context.

Module-1:	**8 hrs**

Basic Concepts of Data Warehousing Introduction, Meaning and characteristics of Data Warehousing, Online Transaction Processing (OLTP), Data Warehousing Models, Data warehouse architecture & Principles of Data Warehousing Data Mining.

Module-2:	**8 hrs**

Building a Data Warehouse Project: Structure of the Data warehouse, Data warehousing and Operational Systems, Organizing for building data warehousing, Important considerations – Tighter integration, Empowerment, Willingness Business Considerations: Return on Investment Design Considerations, Technical Consideration, Implementation Consideration, Benefits of Data warehousing.

Module-3:	**8 hrs**

Managing and Implementing a Data Warehouse Project: Project Management Process, Scope Statement, Work Breakdown Structure and Integration, Initiating a data warehousing project Project Estimation, Analyzing Probability and Risk, Managing Risk: Internal and External, Critical Path Analysis.

Module-4:	**8hrs**

Data Mining What is Data mining (DM)? Definition and description, Relationship and Patterns, KDD vs Data mining, DBMS vs Data mining, Elements and uses of Data Mining, Measuring Data Mining Effectiveness : Accuracy,Speed & Cost Data Information and Knowledge, Data Mining vs. Machine Learning, Data Mining Models. Issues and challenges in DM, DM Applications Areas. Techniques of Data Mining Various Techniques of Data Mining Nearest Neighbour and Clustering Techniques, Decision Trees, Discovery of Association Rules, Neural Networks, Genetic Algorithm.

Module-5:	**8hrs**

OLAP Need for OLAP, OLAP vs. OLTP Multidimensional Data Model Multidimensional verses Multirelational OLAP Characteristics of OLAP: FASMI Test (Fast, Analysis Share, Multidimensional and Information), Features of OLAP, OLAP Operations Categorization of OLAP Tools: MOLAP, ROLAP

Course outcomes:

CO1	Understanding basic concept and terminology relating to Data Warehousing.
CO2	Demonstrate the data warehouse model. It also explains various types of multidimensional models and Schemas.
CO3	Discuss between classification and clustering solution.
CO4	Discuss Data mining concepts
CO5	Illustrating OLTP,OLAP, and its operations
TextBooks:	
1	Pieter Adriaans, Dolf Zantinge Data Mining, Pearson Education
2	George M. Marakas Modern Data Warehousing, Mining, and Visualization: Core Concepts, Prentice Hall, 1st edition

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experiments related to courses (8 Marks)

i. **SEE Assessment:**

ii. 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 have to 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	3	2	3					2	3	3
CO2	1	3	3	2	2					2	3	3
CO3	2	2	2	2	3					2	3	3
CO4	2	2	2	2	2					2	3	3
CO5	1	2	3	2	2					2	3	3

Distributed File Systems Semester -5th			
Course code	**MVJ22CD553**	**CIE**	**50**
Total No. of Contact Hours	**L:T:P:S:2:1:0:1**	**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 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 fileSystem: 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.
DFS Project

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, Statefulvs 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, Case study

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 Systems, Concepts and Design, George Coulouris, J Dollimore and Tim Kindberg, Pearson Education, Edition. 2009.
2	Distributed systems-principles and paradigms, Andrew S.Tanenbaum,Maarten va steen,PHI 2nd edition 2013 publication
3	Gordon Blair, firft edition. Pearson edition Distributed Systems Maarten van Steen , Andrew S. Tanenbaum PHI 3rd Edition Version Digital version on net
4	Pradeep. K. Sinha: Distributed Operating Systems: Concepts and Design, PHI, 2007.
5	Distributed Systems, Principles and Paradigms, Andrew S. Tanenbaum, Maarten Van Steen, 2nd Edition, PHI.
6	Distributed Systems, An Algorithm Approach, Sukumar Ghosh, Chapman&Hall/CRC, Taylor & Fransis Group, 2007.
7	Distributed system security Issues and solutions,Abhijitbelapurkar,AnirbanChakrabarti,Harigopal,Ponnapalli,NiranjaVaradarajan ,SrinivasanPadmanabhuni, Srikanth,Sunderrajan Willey online 2009 publication
8	Distributed computing,Sunita Mahajan, Seema Shah, Oxford university press ,2nd edition 2013.

Web Links:
https://www.educative.io/courses/grokking-the-principles-and-practices-of-advanced-system-design/introduction-to-distributed-file-systems

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 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	0	0	2	0	0	0	0	0	0	0	0	0
CO2	0	1	0	1	1	2	0	0	2	0	0	0
CO3	1	1	0	0	2	2	0	0	0	0	1	0
CO4	1	0	0	2	2	0	2	0	0	0	0	0
CO5	0	0	1	0	0	0	0	0	0	1	0	0

NoSQL Databases Semester -5th			
Course code	**MVJ22CD554**	**CIE**	**50**
Total No. of Contact Hours	**3:0:1**	**SEE**	**50**
No. of Contact Hours/week	**40**	**Total**	**100**
Credits	**3**	**Exam. Duration**	**3**

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

1. Define, compare and use the four types of NoSQL Databases (Document
2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column
3. Explain the detailed architecture, define objects, load data, query data and performance tune Document

Module 1	**8hrs**

Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access,

Textbook1

Module 2	**8hrs**

Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes

Textbook1

Module 3	**8hrs**

Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets

Textbook1

Module 4	**8hrs**

Document Databases, What Is a Document Database?, Features, Consistency, Transactions, 08 Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, ECommerce Applications, When Not to Use, Complex Transactions Spanning Dif erent Operations, Queries against Varying Aggregate Structure

Textbook1

Module 5	**8hrs**

Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use. **Textbook1**	
Course outcomes: Students will able to	
CO1	Define, compare and use the four types of NoSQL Databases (Document
CO2	Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column
CO3	Explain the detailed architecture, define objects, load data, query data and performance tune Document
CO4	Illustration of Ecommerce Applications and complex transactions
CO5	Describing Graph Database
Textbooks:	
1	Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012
2	Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-933255733
3	Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
4	Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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	1	1	-	-	-	-	-	-	-	-
CO2	-	-	-	1	1	1	-	-	1	-	1	1
CO3	-	2	-	2	1	1	-	-	1	-	1	1
CO4					1							
CO5				1								

Course Title	Essence of Research Methodology and IPR	Semester	V
Course Code	MVJ22RMI57	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 Learning Objectives: The students will be able to

1	Give an overview of the research methodology and explain the technique of defining a research problem.
2	Explain various research designs and their characteristics.
3	Explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections.
4	Explain several parametric tests of hypotheses.
5	Discuss leading International Instruments concerning Intellectual Property Rights.

Module1	8 Hrs

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Video link / Additional online information:

https://youtu.be/9IJscfF_irU

Module2	8 Hrs

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Reviewing the literature: Place of the literature review in research, bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed

Video link / Additional online information:

- https://youtu.be/Yzfl3rtF0SM

Module3	8 Hrs

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data.

Video link / Additional online information:

https://youtu.be/GVmQpGn-Zuo

Module4	8 Hrs

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis

Video link / Additional online information :

- https://youtu.be/IEP3swFeauE

Module5	8 Hrs

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Co, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.

Course Outcomes: After completing the course, the students will be able to

CO1	To give an overview of the research methodology and explain the technique of defining a research problem
CO2	To explain various research designs and their characteristics
CO3	To explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections
CO4	To explain several parametric tests of hypotheses
CO5	To discuss leading International Instruments concerning Intellectual Property Rights.

References:

1.	Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018
2.	Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013
3.	Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. The 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.

Semester End Examination (SEE):

Total marks: 50+50=100

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

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

High-3, Medium-2, Low-1

Course Title	Environmental Studies	Semester	V
Course code	MVJ22ENV58	CIE	50
Total No.of Contact Hours	26	SEE	50
No.Of Contact Hours/week	2 (L: T : P :S: 2: 0: 0 : 0)	Total	100
Credits	2	Exam Duration	3 hours

COURSE OBJECTIVES:

1. Relate interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences including geo-systems, biology, chemistry, economics, political science and international processes
2. Study drinking water quality standards and to illustrate qualitative analysis of water.
3. Critically evaluate the science and policy ramifications of diverse energy portfolios on air and water quality, climate, weapons proliferation, and societal stability.

Module-1	8 hrs

Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.
Ecosystems (Structure and Function): Forest, Desert, Rivers, Ocean **Biodiversity:** Types, Hot spots Threats and Conservation of biodiversity, Deforestation**.**

Video link: https://nptel.ac.in/courses/127/106/127106004/

Module-2	8 hrs

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, Tidal and Wind.
Natural Resource Management (Concept and case-study): Disaster Management, Sustainable Mining and Carbon Trading.

Video link: https://nptel.ac.in/courses/121/106/121106014/

Module-3	8 hrs

Environmental Pollution: Surface and Ground Water Pollution, Noise pollution, Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Waste, Solid waste, Hazardous waste and E-waste.
Video link:

- https://nptel.ac.in/courses/122/106/122106030/
- https://nptel.ac.in/courses/105/103/105103205/
- https://nptel.ac.in/courses/120/108/120108005/
- https://nptel.ac.in/courses/105/105/105105160/

Module-4	8hrs

Global Environmental Concerns (Concept, policies, and case-studies): Global Warming, Climate Change, Acid Rain, Ozone Depletion and Fluoride problem in drinking water.

Video link:

- https://nptel.ac.in/courses/122/106/122106030/
- https://nptel.ac.in/courses/120108004/

https://onlinecourses.nptel.ac.in/noc19_ge23/preview

Module-5	8hrs

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems.

Video link:

- https://nptel.ac.in/courses/105/102/105102015/

https://nptel.ac.in/courses/120/108/120108004/

Course outcomes:

CO1	Describe the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
CO2	Develop critical thinking and/or observation skills and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and Abiotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem
CO5	Describe the realities that managers face when dealing with complex issues.

TextBooks:

1	Raman Siva kumar, "Principals of Environmental Science and Engineering", 2nd Edition, Cengage learning, Singapur.
2	G.Tyler Miller, "Environmental Science – working with the Earth", 11th Edition, Jr. Thomson Brooks /Cole publications, California.
3	Pratiba Singh, Anoop Singh & Piyush Malaviya, "Environmental and Ecology", 1st Edition , ACME Learning Pvt. Ltd. New Delhi.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experiments related to courses (8 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 have to 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		3							
CO2		2		2								
CO3			2									
CO4	1		3	2			2					
CO5		1				2						

Sl. No.	Course		Course Title	Teaching Department	Teaching Hours/Week				Examination				Credits
					Theory lecture	Tutorials	Practical/ Drawing	Self-Study Components	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
	Type	Code			L	T	P	S					
1	IPCC	MVJ22CD61	Big Data Analytics	CD	3	0	2	Y	03	50	50	100	4
2	PCC	MVJ22CD62	Artificial Intelligence & Machine Learning	CD	3	0	0	-	03	50	50	100	3
3	PEC	MVJ22CD63X	Professional Elective-II	CD	3	0	0	-	03	50	50	100	3
4	OEC	MVJ22CD64X	Open Elective-I	CD	3	0	0	-	03	50	50	100	3
5	PROJ	MVJ22CDP65	Project Phase-I	CD	0	0	4	-	03	100	-	100	2
6	PCCL	MVJ22CDL66	Machine Learning lab	CD	0	0	2	-	03	50	50	100	1
7	AEC/SDC	MVJ22A6YY3	AEC Vertical Level 3	Respective Vertical	1	0	2	-	02	50	50	100	1
8	HMSC	MVJ22IKK68	Indian Knowledge System	CD	1	0	0	-	02	50	50	100	1
9	MC	MVJ22NS69	National Service Scheme (NSS).	NSS coordinator	0	0	2	-	-	100	-	100	0
		MVJ22PE69	Physical Education (PE) (Sports and Athletics).	Physical Education Director									
		MVJ22YO69	Yoga.	Yoga Teacher									
Total					**14**	**0**	**12**	**-**	**22**	**550**	**350**	**900**	**18**

Note: IPCC: Integrated Professional Core Course, **PCC**: Professional Core Course, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project /Mini Project, **PCCL**: Professional Core Course laboratory, **AEC**: Ability Enhancement Course, **MC**: Mandatory Course (Non-credit), **L:** Lecture, **T**: Tutorial, **P**: Practical **S:** Self Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Course Code	Professional Elective-II	Course Code	Open Elective-I
MVJ22CD631	Natural Language Processing	MVJ22CD641	Introduction to Data Structures
MVJ22CD632	Exploratory Data Analysis	MVJ22CD642	Fundamentals of Operating Systems
MVJ22CD633	Blockchain Technology	MVJ22CD643	Mobile Application Development
MVJ22CD634	Time Series Analysis	MVJ22CD644	Introduction to AI

Ability Enhancement Course / Skill Enhancement Course-V - MVJ22AXYYL (X is Semester, YY is vertical Number, L is level of the vertical)			
MVJ22A6013	Idea Box - Innovation	MVJ22A6073	IoT – Connecting the world
MVJ22A6023	Tomorrow's Engineers – Engineering Solution to Societal Problems	MVJ22A6083	FSIPD –Ideas to Product
MVJ22A6033	Tinkering Lab – Experiment and Conceptualize	MVJ22A6093	Software Development - Code your ideas
MVJ22A6043	UAV – Develop Drones	MVJ22A6103	LabVIEW – Graphical Programming
MVJ22A6053	Astronomy – Explore the space	MVJ22A6113	CNC Programming – Advanced Manufacturing
MVJ22A6063	Robotics and Industrial Automation Lab – Design Robots	MVJ22A6123	NCC

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

BIG DATA ANALYTICS Semester -6th			
Course code	**MVJ22CD61**	**CIE**	**50+50**
Total No. of Contact Hours	**40 L+26 P**	**SEE**	**50+50**
No. of Contact Hours/week	**L:T:P:S:3:0:1**	**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.

Textbook 1: Chapter 1 , Chapter 2

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.

Textbook 3: chapter 3 , 4 , 5
Textbook 1: chapter 2

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.

Textbook 1:chapter 3, 4

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.

Textbook 3: Chapter 11, Chapter 12, Chapter 13

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.

Textbook 4 : Chapter 13 , Chapter 14

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

Video links:

https://archive.nptel.ac.in/courses/106/104/106104189/
https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-big-data-and-hadoop

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 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							
CO2	2	1	1	2	3							
CO3	2	2	1	1	3							
CO4	2	-	1	2	2							
CO5	2	-	1	2	3							

Semester -6th

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course code	**MVJ22CD62**	**CIE**	**50+50**
Total No. of Contact Hours	**40**	**SEE**	**50+50**
No. of Contact Hours/week	**L:T:P:S: 3 : 0 : 0:0**	**Total**	**100**
Credits	**3**	**Exam. Duration**	**3**

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

1. Understand fundamental concepts in Artificial Intelligence.
2. Understand 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.

Module 1	**8hrs**

Introduction: What Is AI? The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art.
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), A* search, Memory bounded heuristic search, Heuristic functions.

Textbook 1: Chapter 1,2,3

Module 2	**8hrs**

Game Playing: Games, Minimax algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, Cutting of search. system in propositional logic, resolution refutation in propositional logic, Predicate logic, Logic programming.

Textbook 1: Chapter 6,10,11

Module 3	**8hrs**

Problem-solving paradigm: planning- types of planning systems, logic-based planning, Linear planning using a goal stack, Means-ends analysis, non–linear planning strategies.
Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning

Textbook 2: Chapter 1,2,3

Module 4	**8hrs**

Uncertainty Measure: Probability Theory, Bayesian Belief Networks, Machine Learning Paradigms: Machine learning system, supervised and unsupervised learnings, Inductive, deductive learning, Clustering
Textbook1: Chapter 8,9
Textbook2: Chapter 4,5,6

Module 5	**8hrs**

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.
ANN: Single Layer, Multilayer. RBF, Design issues in ANN, Recurrent Network(Project related).

Textbook2: Chapter 9,10,11

Project Based Learning :

1. Develop an AI agent to solve Maze using Depth Limited Search.
2. Design and implement A* search algorithm for finding Shortest Distance.
3. Compare the performance of BFS, DFS and A* search on graph based problems.
4. Develop a chess AI using minmax algorithm.
5. Create an AI opponent that employ logical reasoning to make strategic decisions.
6. Develop a mobile or web based puzzle game based on logical deduction.
7. Implement a reasoning engine that generates plans by performing logical interference.
8. Create a linear planning system that uses a gaol stack to guide the search.
9. Evaluate the system's performance on planning problems with different levels of goal complexity
10. Develop a tool for Probabilistic risk assessment in engineering systems.
11. Model an annotated text identification using ANN and evaluate the performance in text recognition.
12. Find the shortest path from start to destination using ANN model in a grid environment.

Course outcomes: Students will able to	
CO1	Define Artificial intelligence and identify problems for AI. Characterize the search techniques to solve problems and recognize the scope of classical search techniques
CO2	Define knowledge and its role in AI. Demonstrate the use of Logic in solving AI problems
CO3	Demonstrate handling of uncertain knowledge and reasoning in probability theory.
CO4	Have knowledge of Learning methods
CO5	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q.

Textbooks:	
1	Artificial Intelligence, E Rich, K Knight, and S B Nair Tata Mc-Graw Hill 3rd Ed, 2009.
2	Artificial Intelligence: Structures and Strategies for Complex Problem Solving, George F Luger Pearson Addison Wesley 6 th Ed, 2008.
3	Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig Prentice Hall 3rd, 2009.
4	Artificial Intelligence, Saroj Kaushik Cengage Learning 2014 Edition.

Video links:

https://onlinecourses.nptel.ac.in/noc22_cs56/preview

http://www.digimat.in/nptel/courses/video/106106126/L01.html

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 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

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

Semester -6th NATURAL LANGUAGE PROCESSING			
Course code	**MVJ22CD631**	**CIE**	**50**
Total No. of Contact Hours	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S: 3:0: 0:0**	**Total**	**100**
Credits	**3**	**Exam. Duration**	**3**

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

1. Analyse the natural language text.
2. Generate the natural language.
3. Demonstrate Text mining.
4. Apply information retrieval techniques.

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

Textbook 1: Chapter 1,2,3

Module 2	**8hrs**

Word Level And Syntactic Analysis: Ngrams Models of Syntax - Counting Words - Unsmoothed Ngrams- 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.

Textbook 1: Chapter 4,5,6

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.

Textbook1: Chapter 8,9

Module 4	**8hrs**

Semantics And Pragmatics: 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 RetrievalEvolving Explanatory Novel Patterns for Semantically Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.

Textbook2: Chapter 4,5,6

Module 5	**8hrs**

Language Generation And Discourse Analysis: 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).

Textbook 2: Chapter 7,8,9

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", MIT Press. Cambridge, MA:1999
3	Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.
4	Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S.Tiwary
5	Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.

Video links: http://www.digimat.in/nptel/courses/video/106101007/L01.html/

https://archive.nptel.ac.in/courses/106/105/106105158/

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 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					2	3	3
CO2	3		3	2		1				2		3
CO3		3	2					1			3	3
CO4	3	3		2						2		3
CO5	3		3	2	3					2	3	3

SEMESTER -6TH **EXPLORATORY DATA ANALYSIS**			
Course code	MVJ22CD632	**CIE**	**50**
Total No. of Contact Hours : L:T:P:S	**3:0:0:0**	**SEE**	**50**
No. of Contact Hours/week	**4**0	**Total**	**100**
Credits	**3**	**Exam. Duration**	**3**

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

1. Understand the core concepts and principles of exploratory data analysis (EDA), including its objectives and statistical relevance.
2. Differentiate between EDA and classical/Bayesian statistical methods, and use EDA techniques to properly summarize data.
3. Use graphical representations to explore and evaluate datasets, acknowledging the importance of graphics in identifying patterns and relationships within data.
4. Apply numerous EDA methodologies to different types of analysis problems, both quantitative and qualitative, and interpret the results correctly.
5. Participate in case studies and practical applications of EDA to obtain hands-on experience analysing real-world datasets and generating valuable insights from them.

Module 1	**8hrs**

INTRODUCTION: EDA Introduction, What is EDA? EDA vs Classical &Bayesian, EDA vs Summary, EDA Goals, The Role of Graphics, An EDA/Graphics Examples, General Problem Categories.

Textbook1

Module 2	**8hrs**

EDA Assumptions: Underlying Assumptions, Importance, Techniques for Testing Assumptions, Interpretation of 4-Plot

Textbook1

Module 3	**8hrs**

EDA Techniques: Introduction, Analysis Questions, Graphical Techniques: Alphabetical, Graphical Techniques: By Problem Category, Quantitative Techniques, Probability Distributions

Textbook1

Module 4	**8hrs**

Univariate Analysis: Introduction to single variables, Distribution variables, Numerical summaries of level and spread, scaling and standardizing, inequality.

Bivariate Analysis: relationship between two variables, Percentage tables, Analyzing contingency tables, Handling several batches, scatterplots and resistant lines.

Multivariate Analysis and Time Series Analysis- Reducing a third variable, causal explanations, Three variables. contingency tables , Fundamentals of TSA , Characteristics of TSA , Data Cleaning, Time based indexing , Visualizing, grouping, Resampling.

Textbook 2

Module 5	**8hrs**

EDA Case Study: Normal random numbers, Uniform random numbers, Random walk, Josephson Junction Cryothermometry, Beam Deflections , Filter Transmittance, Standard Resistor, Heat Flow Meter, Airplane Glass Failure Time, Ceramic Strength.

Textbook2

Course outcomes: Students will able to	
CO1	Show a thorough understanding of the underlying assumptions, testing procedures, and interpretation of graphical representations in EDA.
CO2	Use EDA approaches to successfully analyze data, design analysis questions, and correctly interpret the results.
CO3	Use probability distributions and quantitative approaches within the context of EDA to thoroughly analyze and understand datasets.
CO4	Participate in EDA case studies to demonstrate your ability to analyze complex datasets from multiple areas and produce useful insights
CO5	For EDA, use technologies like as R and Tableau, incorporating sophisticated analytics approaches to improve data exploration and visualization capabilities.
Textbooks:	
1	"Exploratory Data Analysis With R". Roger D. Peng
2	"Exploring Data: An Introduction to Data Analysis for Social Scientists", Catherine Marsh, Jane Elliott, Wiley Publications, 2nd Edition, 2008.
3	Exploratory Data Analysis: A Practical Guide, John W. Tukey

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**-**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**2**	**-**	**1**	**-**
CO3	**2**	**2**	**1**	2	**-**	**2**	**-**	**-**	**2**	**-**	**-**	**-**
CO4	**2**	**3**	**2**	**3**	**3**	**2**	**-**	**-**	**2**	**2**	**2**	**-**
CO5	**2**	**2**	**3**	**3**	**3**	**2**	**-**	**-**	**2**	**2**	**2**	**2**

SEMESTER -6TH
BLOCK CHAIN TECHNOLOGY

Course code	**MVJ22CD633**	**CIE**	**50**
Total No. of Contact Hours :	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S :3:0:0:0**	**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**

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. Applications: Telecommunications, finance universities

Video link / Additional online information (related to module if any):
https://coincentral.com/byzantine-generals-problem/
https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_database s.htm
https://blockonomi.com/merkle-tree/

Module 2	**8hrs**

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

Applications: Government, healthcare

Module 3	**8hrs**

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. **Applications:** Decentralized Applications Encrypted messaging applications **Video link / Additional online information (related to module if any):**
https://blockonomi.com/nakamoto-consensus/
https://cointelegraph.com/explained/proof-of-work-explained

Module 4	**8hrs**

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.
Applications: Peer - to - peer payment application.

Video link / Additional online information (related to module if any):
https://blockgeeks.com/guides/smart-contracts/

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.Video link / Additional online information (related to module if any):

https://www.water-io.com/iot-vs-wot

https://www.talend.com/resources/iot-cloud-architecture

Course outcomes: Students will able to

CO1	Basic Cryptography functions, digital signature, public key cryptosystems, zero-knowledge proof systems.
CO2	Policies and applications of Blockchain in Distributed databases
CO3	Explain the Nakamoto consensus, List and describe differences between proof-of- work and proof-of-stake consensus
CO4	Design, build, and deploy smart contracts and distributed applications
CO5	Cryptocurrency governance, regulations and applications.

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

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/ Experimentations related to courses (8 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**	**1**
CO2	**3**	**3**	**1**									
CO3	**3**	**3**	**1**	**2**							**1**	
CO4	**3**	**3**	**3**	**3**			**3**		**2**	**2**	**2**	
CO5	**3**	**3**	**3**	**3**			**2**	**2**	**3**	**2**		**3**

Semester: VI Professional Elective II			
Course Title	**Time Series Analysis**	**Semester**	**VI**
Course Code:	**MVJ22AI634**	**CIE Marks**	**50**
Total No. of Contact Hours	**40**	**SEE Marks**	**50**
No. of Contact Hours/week	**L: T:P:S: 3:0:0:0**	**TOTAL**	**100**
Credits	**3**	**EXAM DURATION**	**3 hrs**

Course Learning Objectives: The students will be able to

1	Understand the characteristics of time series data and their applications in different domains.
2	Learn various time series models and techniques for analyzing and forecasting time series data.
3	Develop skills in model identification, estimation, and diagnostic checking.
4	Apply time series analysis methods to real-world data sets using statistical software.
5	Interpret and communicate results obtained from time series analysis effectively.

Teaching-Learning Process Pedagogy (General Instructions):

Teachers can use the following strategies to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.

Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

Module-1	**8 Hrs**
Introduction to Time Series Analysis: Time series data definition, Qualities of time series information, Time series analysis applications, Time Series Elements, and (partially) Decomposition	
Module-2	**8 Hrs**
Stationarity and Time Series Components: Seasonality, cyclical elements, and trends, Methods of decomposition: multiplicative and additive models, The meaning of stationarity	
Module-3	**8 Hrs**
Time Series Modeling Autocorrelation function (ACF) and partial autocorrelation function (PACF): Models of moving averages (MAs), Models of Autoregressive (AR) ARIMA models, or autoregressive integrated moving averages, Model Determination and Approximation (In part)	
Module-4	**8 Hrs**
Forecasting and Model Evaluation: Jenkins-Box technique, Model selection standards: BIC and AIC, Estimating parameters and fitting models, Methods for Diagnostic Checking and Forecasting	
Module-5	**8 Hrs**
Advanced Topics and Applications: SARIMA models (seasonal ARIMA models), Transfer function models, extended memory functions, Uses and Examples, Examine and Combine	
Course Outcomes: After completing the course, the students will be able to	

CO1	Showcase your ability to analyze time series data using relevant statistical approaches such as decomposition, trend analysis, and seasonal adjustment.
CO2	Use several time series models, including as ARIMA, SARIMA, and exponential smoothing, to reliably estimate future values and assess the uncertainty of such projections.
CO3	Evaluate the stationarity of time series data and apply the appropriate modifications to accomplish it.
CO4	Implement time series models with statistical software such as R or Python, and effectively analyze the findings.
CO5	Utilize time series analysis techniques to analyze real-world datasets from a variety of fields, including environmental sciences, finance, and economics, and make intelligible findings to aid in decision-making.

Textbooks/Web Links

1.	"Time Series Analysis and Its Applications: With R Examples" by Robert H. Shumway and David S. Stoffer I**SBN:** 978-3319524511.
2.	"Time Series Analysis: Forecasting and Control" by George E.P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, and Greta M. Ljung **ISBN:** 978-1118675021

Reference Books

1.	"The Analysis of Time Series: An Introduction" by Chris Chatfield ISBN: 978-1584883173
2.	"Time Series: Theory and Methods" by Peter J. Brockwell and Richard A. Davis ISBN: 978-1441903198
3.	“Time Series Analysis: With Applications in R" by Jonathan D. Cryer and Kung-Sik Chan ISBN: 978-0387759586

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. The 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 tests, quizzes and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

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 must answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three subdivisions. 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.

SEMESTER -6TH
INTRODUCTION TO DATA STRUCTURES

Course code	**MVJ22CD641**	**CIE**	**50**
Total No. of Contact Hours :	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S:3:0:0:0**	**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.

Textbook 2 : chapter 2

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.

Textbook 2 : chapter 3

Module 3	**8hrs**

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

Textbook 1 : Chapter3:3.2.1, 3.2.2, 3.2.5, 3.2.6

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.

Textbook 1 : Chapter4:4.1-4.4-4.4.7, Chapter6:6.3,6.4

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.

Textbook 1 : Chapter9: 9.1-9.3,9.5 , Chapter 5	
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 based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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	V
Course code	MVJ22CD642	CIE	50
Total No.of Contact Hours	40	SEE	50
No.Of Contact Hours/week	L:T:P:S:3:0:0:0	Total	100
Credits	3	Exam Duration	3 hours

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.

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.

Textbook 1: Chapter 1: 1.1-1.4

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.

Textbook 1: Chapter 2: 2.1- 2.8, Chapter 3: 3.1-3.6

Module 3	8hrs

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

Textbook 1: Chapter 8: 8.3 – 8.8

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.

Textbook1: Chapter 3:3.3, Chapter 9: 9.1, 9.2

Module 5	8hrs

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

Textbook 1: Chapter 14:14.2- 14.7, 14.14

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 based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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							2
CO2	2	3	3	3	3							2
CO3	2	3	3	2	3							2
CO4	2	3	2	3	3							2
CO5	2	3	2	2	2							2

Course Title	Mobile Application Development	Semester	V
Course code	MVJ22CD643	CIE	50
Total No.of Contact Hours	40	SEE	50
No.Of Contact Hours/week	L:T:P:S:3:0:0:0	Total	100
Credits	3	Exam Duration	3 hours

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

1. Understand system requirements for mobile applications.
2. Generate suitable design using specific mobile development frameworks. Implement the design using specific mobile development frameworks.
3. 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.

Video link / Additional online information (related to module if any):
https://www.tutorialspoint.com/android/ Online

Module 2	**8hrs**

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

Applications: Design a Simple Calculator App

Video link / Additional online information (related to module if any):
http://www.androidhive.info/

Module 3	**8hrs**

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

Video link / Additional online information (related to module if any):
https://nptel.ac.in/courses/106/106/106106147/

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.

Video link / Additional online information (related to module if any):
http://developer.android.com/develop/index.htm

Module 5	**8hrs**

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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	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**

SEMESTER -6TH INTRODUCTION TO AI			
Course code	**MVJ22CD644**	**CIE**	**50**
Total No. of Contact Hours :	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S:3:0:0:0**	**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.
4. Design different learning algorithms for improving the performance of AI systems.
5. Implement projects using different AI learning techniques

Module 1	**8hrs**
What is artificial intelligence, Problems, Problem Spaces and search, Heuristic search technique. **Textbook 1 : Chapter 1,2**	
Module 2	**8hrs**
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules. **Textbook 1 : Chapter 3,4**	
Module 3	**8hrs**
Symbolic Reasoning under Uncertainty, Statistical reasoning, Weak Slot and Filter Structures **Textbook 1 : Chapter 5,6,7**	
Module 4	**8hrs**
Strong slot-and-filler structures, Game Playing. Application: Designing Smart Games. **Textbook 1 : Chapter 8,9,10**	
Module 5	**8hrs**
Learning, Expert Systems. **TextBook1: Ch 17 and 20 RBT: L1, L2**	

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	Discuss expert systems
CO5	Implement projects using different AI learning techniques.
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 based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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		2							
CO2	2	3	3	3	2							
CO3		2	2	2								
CO4		2	2	3								
CO5	3	3	3	3	3							

SEMESTER -6TH MACHINE LEARNING LAB			
Course code	**MVJ22CDL66**	**CIE**	**50**
Total No. of Contact Hours :	**20**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S:0:0:2:0**	**Total**	**100**
Credits	**1**	**Exam. Duration**	**3**

Course objective is to: ***This course will enable students to:***

Make use of Data sets in implementing the machine learning algorithms 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:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experiments related to courses (8 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	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

Sl. No.	Course		Course Title	Teaching Department	Teaching Hours/Week				Examination				ed
					Theory lecture	Tutorials	Practical/ Drawing	Self-Study Components	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
	Type	Code			L	T	P	S					
1	IPCC	MVJ22CD71	Scalable Computing	CD	3	0	2	-	03	50	50	100	4
	IPCC	MVJ22CD72	Statistical Machine Learning for Data Science	CD	3	0	2	Y	03	50	50	100	4
2	PCC	MVJ22CD73	Information & Network Security	CD	4	0	0	-	03	50	50	100	4
4	PEC	MVJ22CD74X	Professional Elective-III	CD	3	0	0	-	03	50	50	100	3
5	OEC	MVJ22CD75X	Open Elective-II	CD	3	0	0	-	03	50	50	100	3
6	PROJ	MVJ22CDP76	Major Project Phase II	CD	0	0	12	-	03	100	100	200	6
				Total	**16**	**0**	**16**	**-**	**18**	**350**	**350**	**700**	**24**

Note: IPCC: Integrated Professional Core Course, **PCC**: Professional Core Course, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project /Mini Project, **L:** Lecture, **T**: Tutorial, **P**: Practical **S:** Self Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Course Code	Professional Elective-III	Course Code	Open Elective-II
MVJ22CD741	IOT Analytics	MVJ22CD751	Introduction to DBMS
MVJ22CD742	Business Analytics	MVJ22CD752	Introduction to Algorithms
MVJ22CD743	Deep Learning	MVJ22CD753	Software Engineering
MVJ22CD744	Social Network Analytics	MVJ22CD754	Data Management

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (MVJ22CDP76): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.

(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.

(iii) To impart flexibility and adaptability.

(iv) To inspire team working.

(v) To expand intellectual capacity, credibility, judgment and intuition.

(vi) To adhere to punctuality, setting and meeting deadlines.

(vii) To install responsibilities to oneself and others.

(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

SEMESTER -7TH SCALABLE COMPUTING			
Course code	**MVJ22CD71**	**CIE**	**50**

Total No. of Contact Hours :	**40 L+ 26 P**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S:3:0:2:0**	**Total**	**100**
Credits	**4**	**Exam. Duration**	**3**

COURSE OBJECTIVES: This course will enable students to

1. Fundamentals of scalable computing and its importance in modern technology infrastructure.
2. Learn about different approaches to scalability, including vertical and horizontal scaling, as well as load balancing and clustering.
3. Gain hands-on experience designing and deploying scalable architectures for web applications, databases, and other large-scale systems.
4. Explore case studies of successful scalable computing implementations in industry and research settings.

Module 1	**8hrs**

Scalable Computing: Introduction, multicore and Many-core computing – Introduction, Architectural options for multicore systems, Multicore Architecture Examples, Programming Multicore Architectures, Many-core Architectures, examples.

Textbook 1 : Chapter 4

Module 2	**8hrs**

Scalable computing on large heterogeneous CPU/GPU supercomputers: Introduction, Heterogeneous Computing Environments, Scalable Programming Patterns for Large GPU clusters, Hybrid Implementations,
Diagnosability of Multiprocessor Systems: Introduction, Fundamental concepts, Diagnosability of (1,2)-MCNS under PMC Models

Textbook 1: Chapter 5 ,6

Module 3	**8hrs**

Modeling and algorithms for scalable systems: Introduction, Model based Hybrid Message passing interface, Power-Aware MPI task Aggregation Prediction.

Scalable Service Composition in Pervasive Computing: Introduction, Service Composition Framework, Approaches and Techniques for scalable service Composition in PvCE.

Textbook 1 : chapter 9, chapter 30

Module 4	**8hrs**

Modelling of Scalable Embedded systems: Introduction, Embedded system Applications, Hardware and Software, An Integral Part of the Embedded System Design Flow, Single and Multiunit Embedded system modelling.
Parallel Programming Models for Scalable Computing: Introduction to Parallel Programming Models,The Message-Passing Interface (MPI),Partitioned Global Address Space (PGAS) Models,Task-Parallel Programming Models,High-Productivity Parallel Programming Models

Textbook 1 : Chapter 29, Chapter 34

Module 5	**8hrs**

Scalable Runtime Environments for large scale parallel Applications: Introduction , goals of a Runtime Environments, Communication Infrastructure, Application Deployments, Fault Tolerance and Robustness , Case studies.
Textbook 1 : Chapter 26

Laboratory Experiments:

1.Introduction to Multicore and Many-core Computing
2.Introduction to GPU Programming
3.Hybrid Implementations in Heterogeneous Environments
4.Scalable Systems Modelling and Algorithms, Write and run MPI programs for parallel computing.
5.Embedded System Modelling:Model single and multiunit embedded systems, Simulate embedded system applications.
6.Fault-Tolerance Techniques: Implement hardware and software fault-tolerance techniques, Analyze the effectiveness of different fault-tolerance strategies.
7.Runtime Environment Setup: Set up a scalable runtime environment for parallel applications, Configure communication infrastructure and application deployment.
8.Case Study Implementation: Implement a case study focusing on fault tolerance and robustness.
9.Analyze the performance and fault tolerance of the implemented solution.
10.Capstone Project: Work on a comprehensive project that integrates concepts from the entire course, Design, implement, and test a scalable computing solution, Present and document the project outcomes.

Course outcomes: Students will able to	
CO1	Understand the basics of Scalable computing Architectures
CO2	Demonstrate Scalable programming patterns for large GPU, CPU
CO3	Analyse the scalable Approaches for Fault tolerance in computing
CO4	Interpret the embedded system modelling system
CO5	Learn the Run time Environments for parallel application

Textbooks:	
1	"Scalable Computing and Communications: Theory and Practice" by Massimo Villari, Ivan Ganchev, wiley series
2	"Scalable Computing and Communications: Theoretical and Practical Challenges" by Adjartey, David
3	"Scalable Computing" by Martin Serrano

Links:

https://archive.nptel.ac.in/courses/106/105/106105186/

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 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											
CO2	1		2	2			1			2	2	

CO3	**1**							**2**	**2**	**2**	**1**		
CO4	**1**	**2**				**2**						**2**	
CO5	**1**							**2**	**2**	**2**	**1**	**1**	

SEMESTER -7TH **STATISTICAL MACHINE LEARNING FOR DATA SCIENCE** **(Theory and Practice)**			
Course code	**MVJ22CD72**	**CIE**	**50**
Total No. of Contact Hours :	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S:3:0:2:0**	**Total**	**100**
Credits	**4**	**Exam. Duration**	**3**

COURSE OBJECTIVES: This course will enable students to

1. Understand the need of Data science
2. Demonstrating fundamental concepts, techniques of Statistical Learning.
3. Analyse machine learning algorithms of supervised model.
4. Illustrating Unsupervised Learning algorithms.
5. Learning Model Evaluation Techniques, how to evaluate the performance of machine learning models using appropriate metrics such as ROC curves

Module 1	**8hrs**

INTRODUCTION TO DATA SCIENCE: Data Science, Mathematics and Statistics, Domain Knowledge, Communication and Visualization, Hard and Soft Skill, Data Science Applications, Data Science Lifecycle, and the Maturity Framework Advanced Analytics in Data Science

Textbook1:Chapter 1

Module 2	8hrs
DATA EXPLORATION AND PREPARATION: Introduction to Data Exploration, Introduction to Data Preparation: Representative Sampling, Event-based Sampling, Partitioning Imputation Replacement, Transformation, Feature Extraction, Feature Selection, Model Selection, Model Generalization, Bias–Variance Tradeoff. Textbook 1: **Chapter 2**	
Module 3	**8hrs**
SUPERVISED MODELS: Statistical Approach---Classification and Estimation, Linear Regression, Logistic Regression, Decision Tree. Machine Learning Approach: Supervised Machine Learning Models, Ensemble of Trees, Neural Network **Textbook 1: Chapter 3,4,5**	
Module 4	**8hrs**
UNSUPERVISED MODELS: Structured Data, Clustering, Hierarchical Clustering, Centroid-based Clustering (k-means Clustering), Self-organizing Maps, Cluster Evaluation, Semi Structured Data: Association Rules Analysis, Sequence Analysis, Link Analysis, Path Analysis, Text Analytics. **Textbook 1: Chapter 6,7,8**	
Module 5	**8hrs**
MODEL ASSESSMENT AND MODEL DEPLOYMENT: Methods to Evaluate Model Performance, Speed of Training, Speed of Scoring Business Knowledge, Fit Statistics, Data Splitting K-fold Cross-validation, Goodness-of-fit Statistics, Confusion Matrix, ROC Curve, Model Evaluation, Model Deployment,Model Operationalization. **Textbook 1: Chapter 9**	
Laboratory Experiments: 1. Python program to demonstrate the different operators 2. Python program to demonstrate the matrices addition, subtraction, and multiplication 3. Implement the linear regression algorithm. 4. Implement the logistic regression algorithm. 5. Implement the K-nearest neighbour algorithm. 6. Implement the decision tree algorithm. 7. Implement the random forest algorithm. 8. Implement the support vector machine algorithm. 9. Implement the principal component analysis algorithm. 10. Implement the singular value decomposition algorithm. 11. Implement the k – means clustering algorithm.	

Course outcomes: Students will able to	
CO1	Understand the basics of data science
CO2	Demonstrate appropriate statistical methods to analyze data.
CO3	Analyse Reasoning and Uncertainty using Supervised models.
CO4	Analyse Prediction of data using Unsupervised models
CO5	Identify model performance

Textbooks:	
1	Carlos Andre Reis Pinheiro,Mike Patetta:Introduction to Statistical and Machine Learning Methods for Data Science, . Cary, NC: SAS Institute Inc.
2	Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Introduction to Statistical Machine Learning with Application in R, Springer, Second Illustrated Edition, 2021
3	Bishop, Christopher M,Pattern Recognition and Machine Learning, 2013.

Links:

https://nptel.ac.in/courses/117108048

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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	2	2			3	3	2	1
CO2	3	3	3	2	2				3	3	2	
CO3	3	3	2	3	3	3			3	3	3	2
CO4	3	3	2	3	3	3			3	3	3	3
CO5			3				2	3		3		

SEMESTER -7TH

INFORMATION AND NETWORK SECURITY

Course code	**MVJ22CD73**	**CIE**	**50**
Total No. of Contact Hours :	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S : 3:0:0:0**	**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.

Textbook 1: Chapter 1: 1.2-1.6, Chapter 2: 2.1-2.5, Chapter 3: 3.1-3.6

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.

Textbook 1: Chapter 4: 4.1-4.3, 4.5-4.6, Chapter 5: 5.1-5.5, Chapter 6: 6.3-6.5

Module 3	**8hrs**

Electronic Mail Security: Pretty Good Privacy**,** S/MIME 241, Domain Keys 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 Issues

Textbook 1: Chapter 7: 7.1-7.3, Chapter 8: 8.2-8.6, Chapter 9: 9.2-9.3, Chapter 11: 11.1, Chapter 12: 12.1, Chapter 13: 13.3-13.4

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

Textbook 2: Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5, Chapter 7: 7.1, Chapter 8: 8.1, Chapter 9: 9.3

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.

Textbook 2: Chapter 11:11.3, Chapter 12: 12.2-12.5, Chapter 13: 13.2-13.3

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

Links:

https://archive.nptel.ac.in/courses/106/106/106106129/

https://onlinecourses.nptel.ac.in/noc22_cs90/preview

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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									1	1
CO2	2	2		1							2	2
CO3	2	2									2	2
CO4	2	1									2	2
CO5	2	1				1	2	1				1

Iot Analytics			
Course Code	**MVJ22CD741**	**CIE Marks**	**50**
Teaching Hours/Week	**L: T:P: S:3:0:0:0**	**SEE Marks**	**50**
Total Hours	**40 hours**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**3**

Course objectives:

The course provides a detailed description of IoT analytics and the integration of big data into IoT. The course also has a detailed description on the tools that can be used for analytics

MODULE 1: IoT Analytics Enablers, IoT, Cloud and Big Data Integration for IoTAnalytics	**8 hrs**

Introduction, IoT data and big data, challenges of IOT analytics applications, IOT analytics lifecycle andtechniques, conclusions. IoT, Cloud and Big Data Integration for IoT Analytics

troduction, cloud based IOT platforms, data analytics for the IOT, Data collection using low power, Lawrence radios, WAZIUP software platform, iKaaS software platform

MODULE 2: Development tools for IOT analytics applications, Open-Source Framework	**8 hrs**

Introduction, VITAL architecture for IoT Analytics, VITAL development environment, Developm Examples.

Open-Source Framework

Introduction, Architecture for IoT Analytics- as-a-Service, Sensing - as-a-Service Infrastructure Anato Scheduling, Metering and Service Delivery, Sensing - as-a-Service Example, From Sensing - as-a-Servic IoT Analytics- as-a-Service.

MODULE 3: A Review of Tools for IoT Semantics and Data StreamingAnalytics	**8 hrs**
Introduction, Related Work, Semantic Analytics, Tools and Platforms, A Practical Use Case	

Module-4: IoT Analytics Application and Case Studies, Data Analytics in Smart Buildings	**8 hrs**

Data Analytics in Smart Buildings Introduction, Addressing Energy Efficiency in Smart Buildings, A prop of a general architecture for management systems of smart buildings, IoT based system for EnergyEfficie in Smart Buildings, Evaluation and Results

Module-5: IoT Analytics for Smart Cities	**8 hrs**

Introduction, Cloud based IoT Analytics, Cloud based city platform, new challenges towards Edge b solutions, Edge based IoT Analytics, Use case of Edge based data analytics

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars, and any other form of evaluation. Generally, will be Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks awarded will b the average of three tests.

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experiments related to courses (8 Marks)

SEE Assessment:

question paper for the SEE consists of two parts i.e. Part A and Part B. Part A is compulsory a 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 su division each carrying 16 marks. Students must answer five full questions.

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

Text Books And Reference Books:

1. John Soldatos (Editor), Building Blocks for IoT Analytics Internet of Things Analytics, River Publisher Series in Signal, Image and Speech Processing

BUSINESS ANALYTICS			
Course Code	**MVJ22CD742**	**CIE Marks**	**50**
Teaching Hours/Week	**L: T:P:S:3:0:0:0**	**SEE Marks**	**50**
Total Hours	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**3**

Course objectives:

1. Provide solutions, assessments, and validation to a broad range of situations by eliciting, planning,monitoring, and analyzing enterprise requirements.
2. Work as a professional maintaining high standards of practice, making ethical/legal judgments and decisions, and sustaining professional standing through a commitment to life-long learning.
3. Demonstrate effective use of written, verbal, and non-verbal communication, employing relevant knowledge, skills, and judgment in a business setting.

Module-1: Introduction To Business Analytics	**8 hrs**

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

Module-2: Business Intelligence	**8 hrs**

Data Warehouses and Data Mart – Knowledge Management -Types of Decisions – Decision Making Process – Decision Support Systems – Business Intelligence -OLAP – Analytic functions

Module-3:Hr & Supply Chain Analytics	**8 hrs**

Human Resources – Planning and Recruitment – Training and Development – Supply chain network – Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain – Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

Pedagogy	Chalk and Board, Problem-based learning

Module-4: Marketing & Sales Analytics	**8 hrs**

Marketing Strategy, Marketing Mix, Customer Behaviour -selling Process – Sales Planning -Analytics applications in Marketing and Sales – predictive analytics for customers' behaviour in marketing and sales.

Module-5: Decision support and Data Visualisation	8 hrs

DSS- Executive and enterprise support- Automated decision support - Web analytics- Datamining-Applied artificial intelligence - Visual analysis: Data concepts – Data Dashboards -Data exploration & visualization - Scorecards

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars, and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests.

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 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 thewhole syllabus.

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

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

TEXT AND REFERENCE BOOKS

1.R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017

2.R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016

3.Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016

4.VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.

5.Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.

6.Umesh R Hodeghatta and Umesha Nayak, Business Analytics Using R - A Practical ApproachApress, 2017

SEMESTER -7TH **Deep Learning**			
Course code	**MVJ22CD743**	**CIE**	**50**
Total No. of Contact Hours :	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S:3:0:0:0**	**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.

Video link :http://www.deeplearning.net

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

Video link :www.cs.toronto.edu/~fritz/absps/imagenet.pdf

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

Video link :https://www.youtube.com/watch?v=wPz3MPl5jvY

Module 4	**8hrs**

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

Video link :https://www.youtube.com/watch?v=W3_yaf3HvHU

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

Videolink: http://www.deeplearning.net

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 based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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	-									
CO2	2	2	-									
CO3	2	3	3	2								
CO4	2	2	1	-								
CO5	3	1	2	2								**1**

SEMESTER -7TH
Social Network Analytics

Course code	**MVJ22CD744**	**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 Social Networks.
2. Analyse what are nodes, Eigen Vector centrality and PageRank.
3. Discuss different concepts of graphs.
4. Recognize the influence propagation on networks.
5. Outline the usage of NLP in sentiment analysis.

Module 1	**8hrs**

Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples.
Graph theory basics: Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores.
Textbook 1: Chapter 2
Textbook 2: Chapter 7
Textbook 3: Chapter 2-2.1,2.3

Module 2	**8hrs**

Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS.
Textbook 2: Chapter 2

Module 3	**8hrs**

Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems.
Textbook 1: Chapter 10

Module 4	**8hrs**

Information and influence propagation on networks and Network visualization: Social Diffusion. 20082020/38 Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low -dimensional projections
Textbook 1: Chapter 19

Module 5	8hrs
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, retweets. **Textbook 2: Chapter 10.** **Textbook 1: Chapter 19**	
Course outcomes: Students will able to	
CO1	Demonstrate the use of Networks.
CO2	Understand the working of various Network structures and Nodes.
CO3	Apply various graph concepts in Networking.
CO4	Analyse Network Visualisation and usage of Graph sampling techniques.
CO5	Analyse real-time social networking sites for using Natural Language Processing.
Textbooks:	
1	" Networks, Crowds, and Markets: Reasoning About a Highly Connected World", David Easley and John Kleinberg Cambridge University Press 2010
2	"Statistical Analysis of Network Data with R", Eric Kolaczyk, Gabor Csardi Springer 2014
3	"Social Network Analysis. Methods and Applications" Stanley Wasserman and Katherine Faust Cambridge University Press 1994
Links: **https://onlinecourses.nptel.ac.in/noc22_cs117/preview** **https://www.coursera.org/learn/social-network-analysis**	
CIE Assessment: CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 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	

Course Title	**INTRODUCTION TO DBMS**	**Semester**	07
Course Code	**MVJ22CD751**	**CIE**	**50**
Total No. of Contact Hours	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S:3:0:0:0**		**100**
Credits	**3**	**Exam. Duration**	**3**

CO1	**2**	**3**	**2**	**2**	**3**					**2**	**1**	**2**
CO2	**2**	**3**	**3**	**3**	**3**					**1**	**2**	**2**
CO3	**2**	**3**	**3**	**2**	**3**					**2**	**3**	**3**
CO4	**2**	**3**	**2**	**3**	**3**					**3**	**2**	**1**
CO5	**2**	**3**	**2**	**2**	**2**					**3**	**2**	**1**

Course Learning Objectives: The students will be able to

- To learn the fundamentals of data models.
- To conceptualize and depict a database system using ER diagram.
- To make a study of SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure

Module-1	**Hours 8**

INTRODUCTION AND CONCEPTUAL MODELING:

Introduction to File and Database systems- Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model – Relational Model – Relational Algebra.IoT, Cloud and Big Data Integration for IoT Analytics

Module-2	Hours 8
RELATIONAL MODEL: SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependencies and Normalization for Relational Databases (up to BCNF).	
Module-3	**Hours 8**
NON RELATIONAL MODEL: Introduction to NOSQL Systems ,The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases	
Module-4	**Hours 8**
DATA STORAGE AND QUERY PROCESSING: Record storage and Primary file organization- Secondary storage Devices- Operations on FilesHeap File- Sorted Files- Hashing Techniques – Index Structure for files –Different types of Indexes- B-Tree - B+ Tree – Query Processing	
Module-5	**Hours 8**
TRANSACTION MANAGEMENT: Transaction management -Transaction Processing – Introduction- Need for Concurrency control- Desirable properties of Transaction- Schedule and Recoverability- Serializability and Schedules – Concurrency Control – Types of Locks- Two Phases locking- Deadlock- Time stamp based concurrency control – Recovery Techniques – Concepts- Immediate Update- Deferred Update - Shadow Paging.	

Course outcomes:	
CO1	To learn the fundamentals of data models
CO2	To conceptualize and depict a database system using ER diagram.
CO3	To make a study of SQL and relational database design.
CO4	To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
CO5	To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure

Text/Reference Books:	
1	**A**braham Silberschatz, Henry F. Korth and S. Sudarshan- “Database System Concepts”, Seventh Edition, McGraw-Hill, 2021

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO 1
CO1	3	1	-	-	-	-	-	1	-	2	-	-	2
CO2	3	2	2	1	-	-	-	-	-	2	-	1	2
CO3	2	3	1	3	-	1	1	1	-	1	-	2	2
CO4	3	2	2	1	-	2	-	-	-	-	2	1	2
CO5	2	2	3	3	-	1	2	1	2	-	1	2	2

SEMESTER -7TH Introduction to Algorithms			
Course code	**MVJ22CD752**	**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. 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**

Module 1: The Role of Algorithms in Computing: Algorithms, kinds of problems are solved by algorithms, Algorithms as a technology, Efficiency, Data structures, Technique, Hard problems
Textbook 1: Chapter 1

Module 2	**8hrs**

Module 2: Getting Started Insertion sort, Analyzing algorithms, Analysis of insertion sort, Worst-case and average-case analysis, Designing algorithms
Textbook 1: Chapter 2,3

Module 3	**8hrs**

Module 3: Growth of Functions Growth of Functions, Asymptotic notation, Comparison of functions, Standard notations and common functions, Functional iteration
Textbook 1: Chapter 4,5,6

Module 4	**8hrs**

Module 4: Recurrences The substitution method, The recursion-tree method, The master method, Proof of the master theorem, The proof for exact powers
Textbook 1 Chapter 7,8,9

Module 5	**8hrs**

Module 5: Probabilistic Analysis and Randomized Algorithms
The hiring problem, Indicator random variables, Randomized algorithms, Probabilistic analysis and further uses of indicator random variables
Textbook 1: Chapter 10,11

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	Probablilistic 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.

Links: https://archive.nptel.ac.in/courses/106/105/106105164/

CIE Assessment:

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Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 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

SEMESTER -7TH SOFTWARE ENGINEERING			
Course code	**MVJ22CD753**	**CIE**	**50**
Total No. of Contact Hours :	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S:3:0:0:0**	**Total**	**100**
Credits	**3**	**Exam. Duration**	**3**

COURSE OBJECTIVES: This course will enable students to

- Understand principles, concepts, methods, and techniques of the software engineering approach to producing quality software (particularly for large, complex systems).
- Impart skills in the design and implementation of efficient software systems across disciplines.
- Familiarize engineering practices and standards used in developing software products and components.
- 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.

Laboratory Sessions/ Experimental learning:

To write the SRS for the given real time application using report writing tools.

Applications: In Software development process.

Video link / Additional online information: https://nptel.ac.in/courses/106105182/

Module 2	**8hrs**

Software Design

Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models.

Laboratory Sessions/ Experimental learning:

Draw a class diagram, object diagram, Use case diagram, Sequence diagram and activity diagram for the given real time application using rational rose tool.

Applications: In Software development process.

Video link / Additional online information:
https://www.coursera.org/lecture/client-needs-and-software-requirements/3-2-4-use-cases-

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.

Laboratory Sessions/ Experimental learning:
Using Selenium IDE write a test suite containing minimum 4 test cases.
Applications: In Software development process.
Video link / Additional online information: https://www.youtube.com/watch?v=T3q6QcCQZQg

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

Laboratory Sessions/ Experimental learning: Create a project using MS projects for any real time scenario.

Applications: In Software development process.

Video link / Additional online information: https://youtu.be/tIZ1dg4pxCE

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;
Laboratory Sessions/ Experimental learning: Estimation of test coverage metrics using manual test metrics.
Applications: In Software development process.
Video link / Additional online information: https://nptel.ac.in/courses/110105039/

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 based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 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	2	2	-	-	1	2	2	2	-	2
CO2	2	2	2	2	1	-	1	2	2	2	1	2
CO3	2	2	2	2	1	-	1	2	2	2	-	2
CO4	1	2	2	2	1	-	1	2	2	2	1	1
CO5	1	2	1	2	1	2	1	2	2	2	2	1

SEMESTER -7TH
DATA MANAGEMENT

Course code	**MVJ22CD754**	**CIE**	**50**

Total No. of Contact Hours :	**40**	**SEE**	**50**
No. of Contact Hours/week	**L:T:P:S:3:0:0:0**	**Total**	**100**
Credits	**3**	**Exam. Duration**	**3**

COURSE OBJECTIVES: This course will enable students to

1. To provide in-depth knowledge of data management concepts and techniques.
2. To develop skills in designing, implementing, and managing databases.
3. To explore advanced database systems, data warehousing, and big data technologies.
4. To understand and apply data governance and data quality principles.
5. To master data integration and ETL processes.

Module 1	**8hrs**

Overview of Data Management Types of Data: Structured, Semi-Structured, Unstructured Importance and Applications of Data Management, Data Lifecycle Management,Introduction to DBMS: Components and Architecture of DBMS,Data Models: Hierarchical, Network, Relational, Object-Oriented,Database Design: ER Model, Normalization

Text book1: Chapter1,2

Module 2	**8hrs**

Complex SQL Queries: Joins, Subqueries, Views Indexing and Query,Optimization,Stored,Procedures, Functions, Triggers Transaction Management and Concurrency Control,Introduction to NoSQL Databases Types of NoSQL Databases: Key-Value, Document, Column-Family, Graph SQL vs. NoSQL: Use Cases and Comparisons Practical Implementation: MongoDB, Cassandra, Neo4j

Text book1: Chapter 3,4

Module 3	**8hrs**

Concepts of Data Warehousing,Data Warehouse Architecture,ETL Processes,Introduction to Data Lakes,Differences between Data Warehouses and Data Lakes,Data Governance Framework,Data Policies and Standards,Data Stewardship,Data Quality Dimensions,Tools for Data Quality Management

Textbook1: Chapter 5,6,7

Module 4	**8hrs**

Data Integration Techniques and Best Practices,ETL Processes and Tools: Informatica, Talend, Apache Nifi,Data Cleaning, Transformation, and Loading,Case Studies and Practical Applications

Textbook 1 : Chapter 8,9

Module 5	**8hrs**

Introduction to Big Data: Characteristics and Challenges Big Data Technologies: Hadoop, Spark, Kafka Data Storage Solutions: HDFS, S3, Hbase Big Data Processing and Analytics

Cloud Data Management., Data Virtualization, Data Management in IoT ,Machine Learning and Data Management

Text book1: Chapter 10,11

Course outcomes: Students will able to

CO1	Design and manage relational and NoSQL databases.
CO2	Write complex SQL queries and use advanced database features. Apply data governance principles and ensure data quality.
CO3	Implement data warehousing solutions and manage data lakes.
CO4	Integrate data from multiple sources using ETL processes.
CO5	Use data Analytic techniques in managing the data.

Textbooks:

1	Database System Concepts" by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan.

2	"SQL and PL/SQL for Oracle 11g Black Book" by P.S. Deshpande

Links:

https://www.academia.edu/44088198/Database_System_Concepts_6e_By_Abraham_Silberschatz_Henry_Korth_and_S_Sudarshan

https://www.coursera.org/browse/information-technology/data-management

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests
Quizzes/mini tests (4 marks)
Mini Project / Case Studies (8 Marks)
Activities/Experimentations related to courses (8 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.
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CO-PO MAPPING

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

VIII SEMESTER

Sl. No.	Course	Course Title	Teaching Department	Teaching Hours/Week	Examination	

					Theory lecture	Tutorials	Practical/ Drawing	Self-Study Components	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
	Type	Code			L	T	P	S					
1	PEC	MVJ22CD81X	Professional Elective-IV (Online Courses, NPTEL/SWAYAM)	CD	-	-	-	-	-	-	-	-	3
2	OEC	MVJ22CD82X	Open Elective-III (Online Courses, NPTEL/SWAYAM)	CD	-	-	-	-	-	-	-	-	3
3	INT	MVJ22CDI83	Internship (Industry/Research) (14-20 weeks)	CD	0	0	12	-	03	100	100	200	10
				Total	**0**	**0**	**12**	**-**	**03**	**100**	**100**	**200**	**16**

Note: PEC: Professional Elective Course, **OEC**: Open Elective Course, **INT:** Internship, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation,

Course Code	Professional Elective-IV	Course Code	Open Elective-III
MVJ22CD811	NPTEL/SWAYAM	MVJ22CD821	NPTEL/SWAYAM
MVJ22CD812	NPTEL/SWAYAM	MVJ22CD822	NPTEL/SWAYAM
MVJ22CD813	NPTEL/SWAYAM	MVJ22CD823	NPTEL/SWAYAM
MVJ22CD814	NPTEL/SWAYAM	MVJ22CD824	NPTEL/SWAYAM

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 Weeks. The internship shall be considered as a head of passing and shall be considered for the award of a Degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their Degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship. The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship

at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.
Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students by the respective board of studies well before starting of semester.

HOD **Dean Academics**