Course Title	**Mathematical Foundation of Computer Science**	**Semester**	01
Course Code	MVJ20SCS11	**CIE**	50
Total No. of Contact Hours	50	**SEE**	50
No. of Contact Hours/week	5 (L: T : P :: 3 : 2 : 0)	**Total**	100
Credits	4	**Exam. Duration**	3Hrs

Course objective is to:

This course will enable students to

- To understand probability, sampling and graph theory that serve as applications of computer and information sciences.
- To acquaint the students with mathematical/logical fundamentals an essential tool for including numerical techniques

Module-1	**L1,L2,L3**	**10Hrs**

Numerical Methods: Significant figures, Error definitions, Approximations and round off errors, accuracy and precision. Roots of Equations: Bairstow-Lin's Method, Graeffe's Root Squaring Method. Computation of eigen values of real symmetric matrices: Jacobi and Givens method

Applications:

1. Numerical analysis is needed to solve engineering problems that lead to equations that cannotbe solved analytically with simple formulas.
2. Used in Scientific computing Design and analysis of algorithms for numerically solving mathematical problems.

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

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

Module-2	**L1,L2,L3**	**10 Hrs**

Probability Theory: Probability mass function (p.m.f), density function (p.d.f), Random variable: discrete and continuous, Mathematical expectation, Sampling theory: testing of hypothesis by t -test and chi - square distribution.

Laboratory Sessions/ Experimental learning: NIL

Applications:

- Probability is used in the design and analysis of randomized algorithms.
- Probability helps in minimizing errors and optimises winning results.
- In Machine Learning they use probability distributions to "calibrate" algorithms and make the computer actually approach a desired performance.

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

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

Module-3	**L1,L2,L3**	**10Hrs**

Queuing Theory: Introduction of the queuing system, Various components of a queuing system, Pure Birth Process, Pure Death Process, Birth and Death Process- Single and multiple server queuing models (M/M/1/∞ , M/M/1/N, M/M/C)- Little's formula - Queues with finite waiting rooms.

Applications:

- Queuing theory can be applied to the analysis of waiting lines in healthcare settings.
- Queuing analysis can be used as short term measures, or for facilities and resource planning.

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

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

Module-4	**L1,L2,L3**	**10Hrs**

Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycle. Specialized techniques to solve combinatorial enumeration problems.

Laboratory Sessions/ Experimental learning: NIL

Applications:

- Graphs are used to model many types of relations and process dynamics in computer science.
- Many problems of practical interest can be represented by graphs.

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

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

Module-5	L1,L2,L3	10 Hrs

Vector Spaces: Vector spaces; subspaces; Linearly independent and dependent vectors; Bases and dimension; coordinate vectors-Illustrative examples. Linear transformations; Representation of transformations by matrices; linear functional; Non singular Linear transformations; inverse of a linear transformation- Problems.

Laboratory Sessions/ Experimental learning: NIL

Applications:

- Vector Spaces are very important in Data Science, in most Data Science problems the dataset in the form of m rows and n columns where each row is a datum, point or observation and each column is a feature or attribute.
- Vector spaces are used a lot in digital filter design, tracking, control systems, etc.

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

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

Course outcomes: Students will be able to	
CO1	Understand the numerical methods to solve and find the roots of the equations.
CO2	Use probability formulations for new predictions with discrete and continuous RV's.
CO3	To acquire skills in analysing queuing models.
CO4	To understand various graphs in different geometries related to edges.
CO5	Understand vector spaces and related topics arising in magnification and rotation ofimages

Text Books:	
1.	Steven C. Chapra and Raymond P Canale:" Numerical Methods for Engineers, 7th Edition, McGraw-Hill Publishers, 2015.
2.	T.Veerarajan: "Probability, Statistics and Random Process",3rdEdition,Tata Mc-Graw HillCo.,2016.
Reference Books:	
1.	Gross. D. and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student edition,2004.
2.	Jain, J.L., Mohanty, S.G. and Bohm, W. (2006): A Course on Queueing Models, Chapman & Hall/CRC.
3.	David C.Lay, Steven R.Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd., 2015

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

High-3, Medium-2, Low-1

Course Title	**Advanced Database Management Systems**	**Semester**	01
Course Code	MVJ20SCS12	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	5 (L: T : P :: 3 : 0 : 0)	**Total**	100
Credits	3	**Exam. Duration**	3Hrs

Course objective is to:

- Understand the basic concepts and terminology related to DBMS and Relational DatabaseDesign
- Explain basic concepts, principles of intelligent databases.
- Utilize the advanced topics of data warehousing and mining.
- Infer emerging and advanced data models.
- Extend knowledge in research topics of databases.

Module-1	**L1,L2,L3**	**8 Hrs**

Introduction: Database and XML, Structured Semi structure and unstructured data, XML hierarchical tree data model, Documents DTD and XML schema, XML Documents & Database, XML query and transformation, Storage of XML data, XML database applications, PL/SQL – Control Structures, Procedure, Triggers, Form design and report

Laboratory Sessions/ Experimental learning: To implement the PL/ SQL programming to execute the Control Structures, Procedure, Triggers

Applications: To create the Mini project for online driving license system by using the Visual Basic form design and generate the report

Video link/Additional online information:https://www.btechguru.com/training--databases--sql-server--triggers--triggers-part-1-video-lecture-- 11725--25--136.html

Module-2	**L1,L2,L3,L4**	**8 Hrs**

Postgre SQL, Important features and brief architecture, User Interfaces, SQL Variations and Extensions, Transaction Management, Storage and Indexing, Query Processing and evaluation and optimization

Laboratory Sessions/ Experimental learning: To implement the postgre SQL programming to execute the storing and Indexing

Applications: To create the project by using postgre SQL for online quiz system

Video link / Additional online information : https://www.youtube.com/watch?v=9PytdK6338U

Module-3	**L1,L2,L3**	**8 Hrs**

Relational Query Optimizer, Translating SQL queries into Relational Algebra; Estimating the cost of a plan; Relational algebra equivalences; Enumeration of alternative plans; Nested sub-queries; other approaches to query optimization. Physical Database Design and Tuning DBMS benchmarking

Laboratory Sessions/ Experimental learning: To create the employee database to ensurenormalization and implement by SQL queries

Applications: To Utilizes machine learning to learn to evaluate performance under various workloads

Video link / Additional online information: https://www.microsoft.com/en-us/research/video/isax-2-0-indexing-and-mining-one-billion-time- seriesdatabase-cracking-and-the-path-towards-auto-tuning-database-kernels/

Module-4	**L1,L2,L3**	**8 Hrs**

Guidelines for index selection, examples; Clustering and indexing; Indexes that enable index-only plans; Tools to assist in index selection; Overview of database tuning; Choices in tuning the conceptual schema; Choices in tuning queries and views; Impact of concurrency;

Laboratory Sessions/ Experimental learning: To create the employee database to ensurenormalization and implement by SQL queries

Applications: To Utilizes machine learning to learn to evaluate performance under various workloads

Video link / Additional online information: https://www.sqlshack.com/query-optimization-techniques-in-sql-server-database-design-and-architecture/

Module-5	**L1,L2,L3**	**8 Hrs.**

Emerging Database Models, Technologies and Applications Multimedia database, Temporal Databases, Spatial and Multimedia databases, Geography databases, Genome databases, Knowledge databases, deductive databases and semantic databases, Information visualization, Mobile databases, Web databases (JDBC, ODBC), Personal databases, Digital libraries, Data grids, Wireless networks and databases

Laboratory Sessions/ Experimental learning: To create the department database to ensure normalization and implement web databases by JDBC, ODBC

Applications: To understand the SQLite platform, accessed in Mobile database

Video link / Additional online information : https://www.youtube.com/watch?v=Lz8-fGmb5FE

Course outcomes: Students will be able to	
CO1	Select the appropriate high performance database like parallel and distributed database
CO2	Infer and represent the real world data using object oriented database
CO3	Interpret rule set in the database to implement data warehousing of mining
CO4	Discover and design database for recent applications database for better interoperability
CO5	Understand the concepts of Mobile Database, Multimedia Database.

Text Books:	
1.	R Elmasri, S Navathe, Fundamentals of Database Systems, 6th edition, Addison-Wesley, 2010.
2.	R Ramakrishnan, J Gehrke, Database Management Systems, 3rd Ed., McGraw-Hill, 2002.

Reference Books:	
1.	A Silberschatz, H Korth and S Sudarshan, Database System Concepts, 6th Ed., McGraw-Hill, 2010.
2.	H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book, 2nd Ed.,Prentice-Hall, 2008.

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

High-3, Medium-2, Low-1

Course Title	**Internet of Things**	**Semester**	01
Course Code	MVJ20SCS13	**CIE**	50
Total No. of Contact Hours	50 L: T : P :: 40 : 0 : 20	**SEE**	50
No. of Contact Hours/week	5 (L: T : P :: 3 : 2 : 0)	**Total**	100
Credits	4	**Exam. Duration**	3 Hrs

Course objective is to:

- Learn fundamentals of IoT and related technologies
- Learn about various IOT-related protocols
- Build simple IoT Systems using Arduino and Raspberry Pi.
- Understand data analytics and cloud in the context of IoT
- Develop IoT infrastructure for popular applications

Module-1	**L1,L2**	10 Hrs.

FUNDAMENTALS OF IoT : Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of anIoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

Laboratory Sessions/ Experimental learning: Create an M3 Node(blinking of LED)

Applications: Industrial IOT

Video link :https://nptel.ac.in/courses/106/105/106105166/

Module-2	**L1,L2,L3**	**10 Hrs.**

IoT PROTOCOLS : IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

Laboratory Sessions: Experiment on HTTP-to-CoAP semantic mapping Proxy in IoT Toolkit.

Applications: Telecomunications

Video link :https://www.youtube.com/watch?v=h0gWfVCSGQQ

Module-3	**L1,L2,L3**	**10 Hrs.**

DESIGN AND DEVELOPMENT : Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

Laboratory Sessions/ Experimental learning: Excercise on working principle of Rasberry Pi.

Applications: Microprocessor

Video link :https://www.youtube.com/watch?v=h0gWfVCSGQQ

Module-4	L1,L2,L3	10 Hrs
DATA ANALYTICS AND SUPPORTING SERVICES : Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG. **Laboratory Sessions/ Experimental learning:** Word count program in hadoop **Applications:** Data Science **Video Link:**https://www.youtube.com/watch?v=LaNZ6jOfoQ&list		
Module-5	**L2,L3,L4**	**10 Hrs.**
CASE STUDIES/INDUSTRIAL APPLICATIONS : Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting,Smart Parking Architecture and Smart Traffic Control **Laboratory Sessions:** Automation of Traffic Signal**Applications:** Smart Traffic **Video link/Additional online information:** https://www.youtube.com/watch?v=p7kYStiASLo&list=PLbRMhDVUMngdcLdH4-YF1uJI4IuhcDZPR		

Course outcomes: Students will be able to	
CO1	Gain extensive knowledge about the fundamental concept of IoT
CO2	Learn and analyze various protocols for IoT.
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino
CO4	Apply data analytics and use cloud offerings related to IoT.
CO5	Analyze applications of IoT in real time scenario

Text Books:	
1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press,2017
2.	Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach‖, Universities Press,2015
3.	Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols‖, Wiley, 2012 (for Unit2).

Reference Books:

1.	Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier 2014.
2	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things Springer,2011.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Data Warehousing and Data Mining	Semester	01
Course Code	MVJ20SCS14	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	5(L: T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Develop the abilities of critical analysis to data mining systems and applications.
- Implement practical and theoretical understanding of the technologies for data mining
- Understand the strengths and limitations of various data mining models

Module-1	L1,L2,L3	8 Hrs

Data Warehousing: Introduction Data Warehousing: Evolution of Data Warehousing, Data Warehousing concepts, Benefits of Data Warehousing, Comparison of OLTP and Data Warehousing, Problems of Data Warehousing.

Data Warehousing Architecture: Architecture: Operational Data and Datastore, Load Manager, Warehouse Manager, Query Manager, Detailed Data, Lightly and Highly summarized Data, Archive/Backup Data, Meta-Data, architecture model, 2-tier, 3-tier and 4-tier data warehouse, End user Access tools.

Laboratory Sessions/ Experimental learning: Design OLTP model for supermarket and compare with conventional database.

Applications: Banking, Airline

Video link / Additional online information : https://www.youtube.com/watch?v=CHYPF7jxlik

Module-2	L1,L2,L3,L4	8 Hrs

Data mining Overview and Advanced Pattern Mining: Data mining tasks – mining frequent patterns, associations and correlations, classification and regression for predictive analysis, cluster analysis, outlier analysis; advanced pattern mining in multilevel, multidimensional space – mining multilevel associations, mining multidimensional associations, mining quantitative association rules, mining rare patterns and negative patterns.

Laboratory Sessions/ Experimental learning: Design and write a program for mining the Frequent Sequential Patterns from dataset using pattern mining algorithm.

Applications: software repositories, traces, log files, cheminformatics, bioinformatics, industrial applications

Video link / Additional online information: https://www.guru99.com/data-mining-tutorial.html, https://www.softwaretestinghelp.com/data-mining-examples/.		
Module-3	**L1,L2,L3**	**8 Hrs**
Advance Classification: A Classification by back propagation, support vector machines, classification using frequent patterns, other classification methods – genetic algorithms, roughest approach, fuzz set approach. **Applications:** weather forecasting **Video link / Additional online information :**https://www.youtube.com/watch?v=1NxnPkZM9bc, https://www.youtube.com/watch?v=pS5gXENd3a4 The topics like SVM and Genetic algorithms will help Civil, Mechanical and ECE students to identify and solve optimization problem in their specialized domains.		
Module-4	**L1,L2,L3**	**8 Hrs**
Advance Clustering: IDensity – based methods –DBSCAN, OPTICS, DENCLUE; Grid-Based methods – STING, CLIQUE; Exception – maximization algorithm; clustering High- Dimensional Data; Clustering Graph and Network Data. **Applications:** Biology-taxonomy living things, City planning. **Video link / Additional online information:** https://www.youtube.com/watch?v=C0g201grDtc, https://www.youtube.com/watch?v=2QTeuO0C-fY The clustering methods will help ECE, EEE and Mechanical Students to solve problems in their domain.		
Module-5	**L1,L2,L3**	**8 Hrs**
Temporal and Spatial Data Mining: Mining of complex Types of Data- Mining of Spatial Databases, Multimedia Databases, Text databases, Temporal Data Mining – Temporal Association Rules, Time Series Analysis, Spatial Mining – Spatial Mining Tasks, Spatial Clustering. Data Mining Applications **Laboratory Sessions/ Experimental learning:** Write a program using Time series analysis to identify image differences. **Applications:** Remote Sensing. **Video link :**https://www.youtube.com/watch?v=0aV6HHwJuo4		

Course outcomes: Students will be able to	
CO1	Understand the concepts of Data Mining.
CO2	Classification by various techniques
CO3	Prediction and Classifier accuracy enhancement
CO4	Perform clustering by various methods
CO5	Understand the Applications and Trends in Data Mining

Text Books:	
1.	Data Mining Concepts and Techniques, Jiawei Hang Micheline Kamber, Jian pei, Morgan Kaufmannn.Data Mining Techniques – Arun K pujari, Universities Press.
2.	Antroduction to Data Mining – Pang-Ning Tan, Vipin kumar, Michael Steinbach, Pearson.

Reference Books:	
1.	Data Mining Principles & Applications – T.V Sveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier.

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

High-3, Medium-2, Low-1

Course Title	Advanced Cloud Computing	Semester	1
Course Code	MVJ20SCS15	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	5 (L: T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Define and Cloud, models and Services.
- Compare and contrast programming for cloud and their applications
- Explain virtuaization, Task Scheduling algorithms.
- Apply ZooKeeper, Map-Reduce concept to applications.

Module-1	L1,L2,L3	8 Hrs

Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Opensource software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

Laboratory Sessions/ Experimental learning: Study and implementation of Infrastructure as a Service.

Applications: Google Cloud Platform, Amazon Web Services.

Video link / Additional online information: https://www.youtube.com/watch?v=uYGQcmZUTaw

Module-2	L1,L2,L3	8 Hrs

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

Laboratory Sessions/ Experimental learning:

1. Installation and Configuration of Hadoop.
2. Case Study: PAAS(Facebook, Google App Engine)

Applications: Facebook,Twitter

Video link / Additional online information:

https://www.tutorialspoint.com/zookeeper/zookeeper_overview.htm

Module-3	L1,L2,L3	8 Hrs

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

Laboratory Sessions/ Experimental learning:

1. Implementation of Para-Virtualization using VM Ware‘s Workstation/ Oracle‘s Virtual Box and Guest O.S
2. Installation and Configuration of virtualization using KVM.

Applications: Hardware Virtualization,Operating system Virtualization,Server Virtualization,Storage Virtualization.

Video link / Additional online information: https://www.javatpoint.com/virtualization-in-cloud-computing

Module-4	**L1,L2,L3**	**8 Hrs**

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

Laboratory Sessions/ Experimental learning: Create an application (Ex: Word Count) using Hadoop Map/Reduce.

Applications: Jiffle,presdo,Schedule book

Video link / Additional online information:

https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6809331

Module-5	**L1,L2,L3**	**8 Hrs**

Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

Laboratory Sessions/ Experimental learning:

1. Google app engine program to validate user; create a database login(username, password)in mysql and deploy to cloud.
2. Create your resume in a neat format using google and zoho cloud Programs on PaaS

Applications:

Amazon EC2-Virtual IT,Apple icloud-Network Storage,Google Apps and Microsoft office online-saas,Digital Ocean,DropBox,IBM.

Video link / Additional online information:

https://www.tutorialspoint.com/amazon_web_services/amazon_web

Course outcomes: Students will be able to	
CO1	Compare the strengths and limitations of cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Apply suitable virtualization concept.
CO4	Choose the appropriate cloud player
CO5	Address the core issues of cloud computing such as security, privacy and interoperability

Text Books:	
1.	Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.
2.	RajkumarBuyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.

Reference Books:	
1.	John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

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

High-3, Medium-2, Low-1

Course Title	Advanced DBMS Laboratory	Semester	01
Course Code	MVJ20SCSL16	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P ::0:2 : 2)	Total	100
Credits	2	Exam. Duration	3Hrs

Course objective is to:

- Create and maintain tables using PL/SQL
- Design and implement a database schema for a given problem-domain
- Populate and query a database
- Prepare reports
- Application development using PL/SQL & front end tools.

S No	Experiment Name	RBT Level	Hours
1	**Control Structure** PL/SQL Control Structure provides conditional tests, loops, flow control and branches that let toproduce well-structured programs 1. To write a PL/SQL block for Addition of Two Numbers 2. To write a PL/SQL block for IF Condition 3. To write a PL/SQL block for IF and else condition 4. To write a PL/SQL block for greatest of three numbers using IF AND ELSEIF 5. To write a PL/SQL block for summation of odd numbers using for LOOP	**L3**	**3**
2	**Procedures** PL/SQL block to display the student name, marks whose average mark is above 60% in theStudent database 1. To write a PL/SQL Procedure using Positional Parameters 2. To write a PL/SQL Procedure using notational parameters 3. To write a PL/SQL Procedure for cursor implementation 4. To write a PL/SQL Procedure for explicit cursors implementation **5.** To write a PL/SQL Procedure for implicit cursors implementation	**L3**	**3**
3	**Trigger** Develop and execute a Trigger for Before and After update, Delete, Insert operations on aEmployee Database table.	**L3**	**3**

	1. To write a Trigger to pop-up the DML operations. 2. To write a Trigger to check the age valid or not Using Message Alert. 3. Create a Trigger for Raise appropriate error code and error message. 4. Create a Trigger for a table it will update another table while inserting values		
4	**Menu Design & Report design** 1. To design a simple Note Pad Application menu using Visual Basic. **2.** To design a Stock Maintenance report using Visual Basic.	**L3**	**3**
5	**Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.** 1. Write a binary large object (BLOB) to a database as either binary or character (CLOB). data, depending on the type of the field in your data source. To write a BLOB value to the database, issue the appropriate INSERT or UPDATE statement and pass the BLOB value as an input parameter. If your BLOB is stored as text, such as a SQL Server text field, pass the BLOB as a string parameter. If the BLOB is stored in binary format, such as a SQL Server image field, pass an array of type byte as a binary parameter. 2. Once storing of BLOB and CLOB objects is done, retrieve them and display the results accordingly.	**L3**	**3**

Mini Project (any title can be chosen by student)

Implementation of Inventory Control System, Hospital Management System, Railway Reservation System, Passport Registration System, Personal Information System, Time table Management system and Hotel Management system.

Course outcomes: Students will be able to

CO1	Work on the concepts of PL/SQL programming and ADBMS at the practical level
CO2	Populate, query Database and carry out the software testing process inefficient way
CO3	Establish a quality environment as specified in standards for developing quality software
CO4	Embed the rules set in the database to implement various features of ADBMS
CO5	Choose, design and implement recent applications database for better interoperability

CO-PO Mapping

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

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

High-3, Medium-2, Low-1

Course Title	Internet of Things Laboratory	Semester	01
Course Code	MVJ20SCSL17	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3(L : T : P ::0:2 :2)	Total	100
Credits	2	Exam. Duration	3Hrs

Course objective is to:

- To learn basic programming in Python and basic programming concepts
- To learn basic Installation of IDE of Arduino & Raspberry Pi
- To write programming in Arduino & Raspberry Pi for different applications
- To study the advanced concepts in data connectivity for IoT application.
- To implement IoT protocols for applications.

S No	Experiment Name	RBT Level	Hours
1	Transmit a string using UART	**L3**	**3**
2	Point-to-Point communication of two Motes over the radio frequency.	**L3**	**3**
3	i. Study and Implement RFID, NFC using Arduino. ii. Write program for Blink LED & RGB LED using Arduino.	**L3**	**3**
4	I2C protocol study Reading Temperature and Relative Humidity value from the sensor	**L3**	**3**
5	Multi-point to single point communication of Motes over the radio frequency.LAN(Subnetting)	**L3**	**3**
6	Write a program to implement MQTT protocol using Arduino.	**L3**	**3**
7	Controlling LED's blinking pattern through UART.	**L3**	**3**
8	Transmitting the measured physical value from the UbiSense over the AIR	**L3**	**3**
	Mini Projects:(Any one from the list can be implemented by student) 1. IOT based smart agriculture monitoring system. 2. IOT based Smart Classrooms (Eg: lights,fans) 3. IOT based health monitoring system. 4. Automated traffic management 5. IOT based Green house gas monitoring system		

Course outcomes: Students will be able to

CO1	Write various applications using Python for different IoT Applications

CO2	Configure various virtualization tools such as Arduino IDE & Raspberry Pi
CO3	Develop distributed applications using Arduino IDE.
CO4	Create mobile applications using. Raspberry Pi.
CO5	Implement data sets and protocols for real time applications

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

High-3, Medium-2, Low-1

Course Title	**Research Methodology And IPR**	**Semester**	01
Course Code	MVJ20IPR18	**CIE**	50
Total No. of Contact Hours	30	**SEE**	50
No. of Contact Hours/week	2 (L : T : P :: 2 : 0 : 0)	**Total**	100
Credits	2	**Exam. Duration**	3Hrs

Course objective is to:

- Give an overview of the research methodology and explain the technique of defining a research problem.
- Explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs and their characteristics.
- Explain the details of sampling designs, and also different methods of data collections.To explain the art of interpretation and the art of writing research reports.

Module-1	**L1,L2**	**4Hrs.**

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

Applications: Research and Its Applications

Video link / Additional online information : https://www.youtube.com/watch?v=IZLn9_PA_4s

Module-2	**L1,L2**	**5Hrs.**

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed

Laboratory Sessions/ Experimental learning: Design & develop conceptual framework**Applications:** Mathematical modeling

Video link / Additional online information: https://www.youtube.com/watch?v=cC_enLNr1DA

https://www.youtube.com/watch?v=fwG4vVdGxaI

Module-3	**L1,L2**	**6 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. Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Applications: Architectural designs of technical and technical fields.

Video link / Additional online information: https://www.youtube.com/watch?v=WY9j_t570LY

Module-4	**L1,L2**	**7 Hrs.**

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout Interpretation and Report Writing (continued): of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Video link / Additional online information: https://www.cleverism.com/qualitative-and-quantitative-data-collection-methods/

Module-5	**L1,L2,L3**	**8Hrs.**

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, CopyrightAct,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, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial 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 withoutAuthorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.

Video link / Additional online information: https://nptel.ac.in/courses/109106137/

Course outcomes: Students will be able to

CO1	Discuss research methodology and the technique of defining a research problem.

CO2	Explain the functions of the literature review in research, carrying out a literature search,developing theoretical and conceptual frameworks and writing a review.
CO3	Explain various research designs and their characteristics.
CO4	Explain the art of interpretation and the art of writing research reports.
CO5	Knowledge about various IT acts and IP rights

Reference Books:	
1.	Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science &engineering students"
2.	Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
3.	Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
4	Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5	Mayall, "Industrial Design", McGraw Hill, 1992. Niebel, "Product Design", McGraw Hill,1974.

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

High-3, Medium-2, Low-1

Course Title	**Data Analytics**	**Semester**	02
Course Code	MVJ20SCS21	**CIE**	50
Total No. of Contact Hours	50	**SEE**	50
No. of Contact Hours/week	5 (L : T : P :: 3 : 2 : 0)	**Total**	100
Credits	4	**Exam. Duration**	3Hrs

Course objective is to:

- Understand the competitive advantages of big data analytics
- Understand the big data frameworks
- Learn data analysis methods
- Learn stream computing
- Gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for bigdata analytics

Module-1	**L1,L2,L3**	**10Hrs.**

INTRODUCTION TO BIG DATA : Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools.

Laboratory Sessions/ Experimental learning: Usage of data analytic tools like Excel, BI Tools: Tableau, Power BI, Fine Report, R & Python.

Applications: Healthcare, Education, E-Commerce, Media and Entertainment, Finance etc.

Video link :https://nptel.ac.in/courses/106104189/

Module-2	**L1,L2,L3**	**10 Hrs.**

HADOOP FRAMEWORK: Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN

Laboratory Sessions/ Experimental learning: Various Programs using Map Reduce Algorithm

Applications: Hadoop Frameworks mainly for distributed applications.

Video link :https://nptel.ac.in/courses/106104189/

Module-3	**L1,L2,L3**	**10 Hrs.**

DATA ANALYSIS: Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R

Laboratory Sessions/ Experimental learning: Experiment to analyze structured data and unstructured data.

Applications: Twitter ,facebook data, Transaction logs etc.

Video link :https://nptel.ac.in/courses/106104189/		
Module-4	**L1,L2,L3,L4**	**10 Hrs.**
MINING DATA STREAMS: Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. **Laboratory Sessions/ Experimental learning:** Implementation of various case studies. **Applications:** computer network traffic, phone conversations, ATM transactions, web searches, **andsensor data.** **Video link :**https://nptel.ac.in/courses/106104189/		
Module-5	**L1,L2,L3**	**10 Hrs.**
BIG DATA FRAMEWORKS: Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries **Laboratory Sessions/ Experimental learning:**Various case studies to differentiate SQL and NOSQL Databases **Applications:** Column store, Document store, Key value store, Graph store, Object store, XML store,and other data store modes. **Video link :**https://nptel.ac.in/courses/106104189/		

Course outcomes:	
CO1	Understand how to leverage the insights from big data analytics
CO2	Understand HADOOP framework
CO3	Analyze data by utilizing various statistical and data mining approaches
CO4	Perform analytics on real-time streaming data
CO5	Understand the various NoSql alternative database models

Text Books:	
1.	Bill Franks, ―Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.
2.	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3.	Michael Berthold, David J. Hand, ―Intelligent Data Analysis‖, Springer, Second Edition,2007.

Reference Books:	
1.	Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2.	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	**Advanced Computer Networks**	**Semester**	02
Course Code	MVJ20SCS22	**CIE**	50
Total No. of Contact Hours	50	**SEE**	50
No. of Contact Hours/week	5 (L : T : P :: 3 : 2 : 0)	**Total**	100
Credits	4	**Exam. Duration**	3Hrs

Course objective is to:

- Understand the state of the art in network protocols, network architecture, and networkedsystems.
- Develop a strong understanding of the core concepts of computer networks
- Gain practice of reading the research papers and critically understanding the research ofothers.
- Engage ourselves in networking research.

Module-1	**L1,L2**	**10 Hrs.**

HIGH SPEED NETWORKS: Packet Switching Vs Cell Switching - ATM Networks: ATM Protocol Architecture – Logical Connections - ATM Cells - Service Categories - ATM Adaptation Layer - Traffic and Congestion Control In Frame Relay and ATM Networks. High-Speed LANS - Fast Ethernet - Gigabit Ethernet.

Laboratory Sessions/ Experimental learning:

Simulate the congestion control algorithms in networks

Applications: Active Traffic Management (ATM) Implementation and Operations: https://youtu.be/HK0ayP3XBbkx0060

Module-2	**L1,L2,L3**	**10 Hrs.**

Software Defined Networks (SDNs): SDN Controllers, Network Programmability, Network Function Virtualization, SDN Frameworks, Use cases for traffic monitoring & classification, bandwidth scheduling and monitoring

Laboratory Sessions/ Experimental learning: Study about open DayLight tool

Applications: Deploying Security and Cloud with Cisco SD-WAN

Module-3	**L1,L2,L3**	**10 Hrs.**

WIRELESS NETWORKS: Wireless Networks: Cellular Networks: GSM - UMTS - 3G,4G,LTE and 5G Networks – IEEE 802.11 - Bluetooth - WIMAX – Zigbee-Xbee- WSN- Characteristics - Architecture – Applications, Adhoc Networks- Vehicular Networks

Laboratory Sessions/ Experimental learning: Simulate the various versions of wireless networks.

Applications: IoT Wireless Networks,Wireless Network Security

Video Links : https://www.coursera.org/lecture/iot-wireless-cloud- computing/3-1-iot-wireless-networks-VkkkG

https://youtu.be/d4vSD1zamRY

Module-4	L1,L2,L3	10 Hrs.
Security in Computer Networks: Principles of cryptography-Message Integrity and Digital Signatures-End-Point Authentication-Securing E-Mail-Securing TCP Connections- Network Layer Security: IPSec and Virtual Private Networks-Securing Wireless LANs-Operational Security: **Laboratory Sessions/ Experimental learning:** Simulate the Packet Sniffing techniques using Wireshark **Applications:** Cyber Security: https://youtu.be/MvK3lIDR3ms		
Module-5	**L1,L2,L3**	**10 Hrs.**
Applications: Name Service (DNS)- Domain Hierarchy- Name Servers- Name Resolution. Traditional Applications- Electronic Mail (SMTP, MIME, IMAP)- World Wide Web (HTTP)- Network Management (SNMP). Multimedia Applications- Real-time Transport Protocol (RTP)- Session Control and Call Control (SDP, SIP, H.323)- Overlay Networks- Routing Overlays- Peer-to- Peer Networks- Content Distribution Networks. **Laboratory Sessions/ Experimental learning:** Simulate the application layer protocols in networks **Applications:** Internet Application Layer Protocols **Video Links:** https://youtu.be/CMBQFmEuOO0		

Course outcomes:	
CO1	Illustrate the fundamental concepts of High Speed Networks
CO2	Analyze the requirements for a given SDN Controllers and Frameworks
CO3	Ability to recognize and resolve issues in Mobile and Wireless Networks
CO4	Apply appropriate security schemes in networks
CO5	Identify and describe the various applications in networks.

Text Books:	
1.	Kurose James F and Keith W. Ross: Computer Networking: A Top-Down Approach 7th edition.
2.	L. Peterson and B. Davie, Computer Networks: A Systems Approach, 5th Edition 2012.
3.	Andrew S Tanenbaum, “Computer Networks”, Prentice Hall, USA, 2010.

Reference Books:	
1.	William Stallings, “High-Speed Networks and Internets: Performance and Quality of ServiPearson Education, India, 2002.

2.	Holger Karl , Andreas Willig, “Protocol and Architecture for Wireless Sensor Networks”, JWiley Publication, 2002.

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

High-3, Medium-2, Low-1

Course Title	Machine Learning	Semester	02
Course Code	MVJ20SCS23	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	5 (L : T : P :: 3 : 2 : 0)	Total	100
Credits	4	Exam. Duration	3Hrs

Course objective is to:

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

Module-1	L1,L2,L3	10 Hrs.

INTRODUCTION, CONCEPT LEARNING AND DECISION TREES

Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm

Laboratory Session : Program to implement Find-S Algorithm

Applications: Concept Learning and Decision Tree learning helps in implementing classification Algorithms

Video link / Additional online information: https://www.youtube.com/watch?v=KBWZ_fDWiqw

https://www.youtube.com/watch?v=x6Q_LUCzm-I

Module-2	L1,L2,L3	10 Hrs.

NEURAL NETWORKS Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms –

EVALUATING HYPOTHESES – Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms

Laboratory Session: Program to implement Perceptron

Application : Artificial Neural network can be used for text classification, information extraction, semantic parsing, question answering, paraphrase detection, language generation, multi-document summarization, machine translation, and speech and character recognition.

Video link / Additional online information: https://www.youtube.com/watch?v=WtdJyjub7TQ

Module-3	L1,L2,L3	10 Hrs.

BAYESIAN LEARNING – Bayes theorem, Concept learning, Maximum Likelihood and Lear squared hypothesis, Bayes Optimal Classifier, Naïve Bayes classifier, Learning to classify text, Bayesian belief networks, EM algorithm; **INSTANCE-BASED LEARNING –** k-Nearest Neighbor Learning, Locally Weighted Regression,Radial basis function networks, Case-based learning **Laboratory Session:** Program to implement K Nearest Neighbor Algorithm **Applications:** Bayesian Learning can be used for implementing Gene Regulatory Network,Diagnosis of medicines, Bio monitoring **Video link / Additional online information:** https://www.youtube.com/watch?v=NIPYS64BNZg https://www.youtube.com/watch?v=pG3-x_n4J1I

Module-4	**L1,L2,L3**	**10 Hrs.**
COMPUTATIONAL LEARNING THEORY – Sample Complexity for Finite Hypothesis spaces,Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning Laboratory Session: Implement WEIGHTED MAJORITY Algorithm Applications: Helps to design and analyze machine learning algorithms. Video link / Additional online information: https://www.youtube.com/watch?v=doxaZA4-Imo		

Module-5	**L1,L2,L3**	**10 Hrs.**
Genetic Algorithms – Genetic Algorithms, Illustrative example-Hypothesis Space Search – Genetic Programming– Models of Evolution and Learning. Reinforcement Learning: Introduction, Learning Task, Q Learning **Lab Session:** Program to implement Q Learning **Applications:** Genetic Algorithms are mainly used in Optimization problems, DNA Anaysis,Parallelization etc **Video link / Additional online information:** https://www.youtube.com/watch?v=Z_8MpZeMdD4		

Course outcomes:	
CO1	Applying concept learning and decision trees
CO2	Illustrate the mechanism of evaluating hypothesis, understanding neural networks.
CO3	Understanding Bayesian learning and instance based learning
CO4	Apply the concepts of computational learning
CO5	Understanding and applying genetics algorithm.

Text Book:	
1.	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:	
1.	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical

	Learning, 2nd edition, springer series in statistics.
2.	Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.Wesley JChun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

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

High-3, Medium-2, Low-1

Course Title	Advance Storage area networks	Semester	2
Course Code	MVJ20SCS24	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	5(L: T : P :: 3 : 2 : 0)	Total	100
Credits	4	Exam. Duration	3Hrs

Course objective is to:

- Define and contrast storage centric and server centric systems
- Define metrics used for designing storage area networks
- Illustrate RAID concepts
- Demonstrate, how data centers maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems.

Module-1	**L1,L2**	**10 Hrs**

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

Laboratory Sessions/ Experimental learning: Implement different RAID levels**Applications:**Client-proxy server, Replicated servers

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

Module-2	**L1,L2,L3**	**10 Hrs**

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

Laboratory Sessions/ Experimental learning: Students will articulate the knowledge of IP Storage

Applications: Customer support organizations

Video link : https://www.youtube.com/watch?v=80_SakydJTY

Module-3	**L1,L2,L3**	**10 Hrs**

Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level;Storage virtualization on various levels of the storage Network;

Symmetric and Asymmetric storage virtualization in the Network. **Laboratory Sessions/ Experimental learning:** To develop and demonstrate storage virtualizationusing various tools **Applications:** Virtual base, VM ware **Video link :** https://www.youtube.com/watch?v=YX6TJf3YGJE		
Module-4	**L1,L2,L3**	**10 Hrs**
SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs. **Laboratory Sessions/ Experimental learning:** Demonstrate SAN hardware**Applications:** Data Migration **Video link :** https://www.youtube.com/watch?v=csdJFazj3h0		
Module-5	**L1,L2,L3**	**10 Hrs**
Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary **Laboratory Sessions/ Experimental learning:** To demonstrate simulation and compare the performance of SNMP,CIM and WBEM **Applications:** Cloud computing **Video link :** https://www.youtube.com/watch?v=liBB_Q7Go5k		

Course outcomes: Students will be able to	
CO1	Identify the need for performance evaluation and the metrics used for it
CO2	Apply the techniques used for data maintenance.
CO3	Realize strong virtualization concepts
CO4	Develop techniques for evaluating policies for LUN masking, file systems
CO5	Understand the management of Storage Network

Text Books:	
1.	Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India,2013.
2.	Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011.

Reference Books:	
1.	Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
2.	Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

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

High-3, Medium-2, Low-1

Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	5 (L : T : P :: 3 : 2 : 0)	**Total**	100
Credits	3	**Exam. Duration**	3Hrs

Course objective is to:

- Design wireless sensor network system for different applications under consideration.
- Understand the hardware details of different types of sensors and select right type of sensorfor various applications.
- Understand radio standards and communication protocols to be used for wireless sensor.

Module-1	**L1,L2,L3**	**8 Hrs.**

Introduction: Sensor Mote Platforms, WSN Architecture and Protocol Stack (Chap. 1Text 1)

WSN Applications: Military Applications, Environmental Applications, Health Applications, Home Applications, Industrial Applications, (Chap. 2 Text 1)

Laboratory Sessions/ Experimental learning: Implement and Simulate a wireless sensor network using NS2.

Applications: WSN can play an effective role in the monitoring of the remote areas for applications like military surveillance, seismic activity monitoring, earthquake detection and disaster relief operations.

Video link / Additional online information: https://www.youtube.com/watch?v=urWv-_EqS9M
https://www.youtube.com/watch?v=1fn4NRE7IxI
http://www.infocobuild.com/education/audio-video-courses/computer-science/WirelessSensorNetworks-IIT-Kharagpur/lecture-01.html

Module-2	**L1,L2,L3**	**8 Hrs.**

Factors Influencing WSN Design: Hardware Constraints Fault Tolerance Scalability Production Costs WSN Topology, Transmission Media, Power Consumption, (Chap. 3 Text 1)

Physical Layer: Physical Layer Technologies, Overview of RF Wireless Communication, Channel Coding (Error Control Coding), Modulation, Wireless Channel Effects, PHY Layer Standards (Chap.4 of Text 1)

Laboratory Sessions/ Experimental learning: Implement and Simulate a RFID platform on NS-2

Applications: Biomedical applications. Examples of applications are the wireless electroencephalogram (EEG) which is expected that will provide a breakthrough in the monitoring, diagnostics, and treatment of patients with neural diseases.

Video link / Additional online information: https://www.youtube.com/watch?v=hYMAh2gc4Ao

https://slideplayer.com/slide/5825061/

https://www.youtube.com/watch?v=pSDTyUh9cLo

Module-3	**L1,L2,L3**	**8 Hrs.**

Medium Access Control: Challenges for MAC, CSMA Mechanism, Contention-Based Medium Access, Reservation-Based Medium Access, Hybrid Medium Access (Chap. 5 of Text 1)

Network Layer: Challenges for Routing, Data-centric and Flat-Architecture Protocols, Hierarchical Protocols, Geographical Routing Protocols (Chap. 7 of Text 1)

Laboratory Sessions/ Experimental learning: Demonstrate the operation of the Ethernet network. The simulation in this lab will help you examine the performance of the Ethernet network under different scenarios.

Applications: Medium access control protocols for safety applications in Vehicular Ad-Hoc Network (VANET) is seen as an emerging solution to improve road safety, highway assistance and traveler comfort accounting to vivid applications including safety, non-safety and infotainmentapplications.

Video link / Additional online information:

https://www.youtube.com/watch?v=uEkQI-gWhZQ

https://www.youtube.com/watch?v=iKn0GzF5-IU

https://www.microsoft.com/en-us/research/video/improving-routing-scalability-through-mobile-geographic-hashing-in-manets/

Module-4	**L1,L2,L3**	**8 Hrs.**

Transport Layer: Challenges for Transport Layer, Reliable Multi-Segment Transport (RMST)Protocol, Pump Slowly, Fetch Quickly (PSFQ) Protocol, Congestion Detection and Avoidance(CODA) Protocol, Event-to-Sink Reliable Transport (ESRT) Protocol, GARUDA (Chap. 8 Text 1) Application Layer: Source Coding (Data Compression), Query Processing, Network Management (Chap. 9 Text 1)

Laboratory Sessions/ Experimental learning: Design and implementation of PSFQ, and evaluatethe protocol using the NS2.

Design and implementation of ESRT, and evaluate the protocol using the NS2.

Applications: Applications emerging in wireless sensor networks that require reliable data delivery. One such application that is driving our research is the reprogramming or “re-tasking” of groups of sensors.

Video link / Additional online information:

https://www.youtube.com/watch?v=8-3CSAkscYU

https://www.youtube.com/watch?v=8_dAkVyVjCo

Module-5	**L1,L2**	**8 Hrs.**

Time Synchronization: Challenges for Time Synchronization, Network Time Protocol, Timing- Sync Protocol for Sensor Networks (TPSN), Reference-Broadcast Synchronization (RBS), AdaptiveClock Synchronization (ACS)(Chap. 11 of Text1)

Localization: Challenges in Localization, Ranging Techniques, Range-Based Localization Protocols, Range-Free Localization Protocols. (Chap. 12 Text 1)

Laboratory Sessions/ Experimental learning: Demonstrate how to use NTP to control and synchronize your system clock.

Applications: Time Synchronization in Servers, Routers, Switches for IT security. Communication equipment like Communication processors, protocol translators. NTP is used in some embedded systems. RBS is used to maintain the co-ordination among different nodes during execution.

Video link / Additional online information:

https://www.meinbergglobal.com/english/info/time-synchronization-electrical-systems.htm https://www.akadia.com/services/ntp_synchronize.html https://www.frontiersin.org/articles/420014 https://slideplayer.com/slide/4287121/

Course outcomes:	
CO1	Acquire knowledge of characteristics of mobile/wireless communication Channels.
CO2	Apply statistical models of multipath fading
CO3	Understand the multiple radio access techniques
CO4	Understand various protocols and process involved in Transport Layer.
CO5	Analyse synchronisation and localization

Text /Reference Books:	
1.	Ian F. Akyildiz and Mehmet Can Vuran "Wireless Sensor Networks",John Wiley & Sons Ltd. ISBN 978-0-470-03601-3 (H/B),2010.
2.	Ananthram Swami, et. Al., Wireless Sensor Networks Signal Processing and communications Perspectives", John Wiley & Sons Ltd. ISBN 978-0-470-03557-3 2007.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Mobile Application Development	Semester	02
Course Code	MVJ20SCS252	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	5(L: T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Demonstrate their understanding of the fundamentals of Android operating systems
- Demonstrate their skills of using Android software development tools
- Demonstrate their ability to develop software with reasonable complexity on mobile platform

Module-1	L1,L2	8 Hrs.

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools. Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

Laboratory Sessions/ Experimental learning: Familiarization about android and iOS to develop the mobile apps.

Applications: Android devices

Video link / Additional online information: https://www.youtube.com/watch?v=deq8mkt_cxQ

Module-2	L1,L2	8 Hrs.

Android User Interface: Measurements – Device and pixel density independent measuring units Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

Laboratory Sessions/ Experimental learning: To develop and demonstrate mobile applications using various tools.

Applications: Text view, Edit view ,radio buttons,etc.

Video link / Additional online information: https://www.youtube.com/watch?v=PJ3RdfJ4Np8

Module-3	L1,L2	8 Hrs.

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity,Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toast.

Laboratory Sessions/ Experimental learning: Students will articulate the knowledge of GSM,CDMA and BLUETOOTH technologies

Applications: Bluetooth

Video link / Additional online information: https://www.youtube.com/watch?v=8FJ3oOpHszc

Module-4	**L1,L2**	**8 Hrs**

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

Laboratory Sessions/ Experimental learning: To demonstrate simulation and compare the performance of wireless LAN.

Applications: Magnetic media and other storage devices.

Video link / Additional online information: https://www.youtube.com/watch?v=Oa1mlObffiA

Module-5	**L1,L2,L3**	**8 Hrs**

Advanced Topics: Alarms – Creating and using alarms Using Internet Resources – Connecting to internet resource, using download manager Location Based Services – Finding Current Location and showing location on the Map, updating location

Laboratory Sessions/ Experimental learning: To implement mobile node discovery and route maintains

Applications: residential, commercial areas.

Video link / Additional online information :https://www.youtube.com/watch?v=hhfNO-yD5xE

Course outcomes:	
CO1	Understand the fundamentals of Android operating systems
CO2	Understand various layouts and designing UI.
CO3	Understand major Android components intents, broadcasting and notifications.
CO4	Understand basic concepts of SQLite database.
CO5	Understand how to utilize Location based services.

Text/ Reference Books:	
1.	Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013
2.	Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.
3.	Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.

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

High-3, Medium-2, Low-1

Course Title	**Trends in Artificial intelligence & Soft Computing**	**Semester**	02
Course Code	MVJ20SCS253	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	5 (L : T : P :: 3 : 0 : 0)	**Total**	100
Credits	3	**Exam. Duration**	3Hrs

Course objective is to:

- Describe Artificial Intelligence its utility and intelligent agents
- Describe a problem as a state space
- Use and implement search techniques
- Use knowledge representation techniques for problem solving
- Solve AI problems using symbolic reasoning and game theory
- Describe and apply GA to different problem domains

Module-1	**L1,L2**	**8 Hrs.**

Role of AI in Engineering, AI in daily life, Intelligence and AI, Different Task Domains of AI, History and Early Works of AI, History of AI, Programming Methods, Limitations of AI, Agent, Performance Evaluation, Task environment of an Agent, Agents Classification, Agent Architecture Logic Programming, Logic Representation, Propositional Logic, Predicate Logic and Predicate Calculus, Horn Clauses, Well formed Formula, Computable functions and predicate, Quantifiers, Universe of discourse, Applications of Predicate Logic, Unification, Resolution, Conjunctive NormalForm, conversion to normal form or clausal form

Laboratory Sessions/ Experimental learning:

1. Write predicate to converts centigrade temperatures to Fahrenheit
2. Write predicates to check if a temperature is below freezing.

Applications: Circuit design, Discrete mathematics

Video link :https://nptel.ac.in/courses/106/102/106102220/

https://www.youtube.com/watch?v=5cyocztOtq4

Module-2	**L1,L2**	**8 Hrs.**

Fundamental Problem of Logic: Logic Inadequacy: Fundamental Problem of Logic Monotonicity wuith "Flying Penguin" example, General disadvantage of monotonicity property in logic , logic in search space problem, logic in decidability and Incompleteness, Logic in Uncertainty Modelling, Knowledge representation: Knowledge, Need to represent knowledge, Knowledge representation with mapping scheme, properties of a good knowledge base system, Knowledge representation issues, AND-OR graphs, Types of knowledge, Knowledge representation schemes, semantic nets, Frames, conceptual graphs, conceptual dependence theory, script, weak and strong slot filler

Laboratory Sessions/ Experimental learning: 1. Program for implementing AND-OR graph

Applications: Anthropology, Biomedical informatics

Video link :

- https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-cs04/
- https://www.digimat.in/nptel/courses/video/106106140/L01.html
- https://www.digimat.in/nptel/courses/video/106106140/L02.html

Module-3	**L1,L2**	**8 Hrs..**

Search Techniques: Search, Representation techniques, Categories of Search, Disadvantage of state space search, Issues in design of search programs, General Search examples, Classification of search diagram representation, Hill climbing method and Hill climbing search ,Simulates Annealing, Best- First Search, Branch and Bound Search, A* search Game Playing: Two player games, Minmax Search, Complexity of Minmax algorithm, Alpha-Beta Pruning

Planning: Necessity of planning, Components of Planning, Planning Agents, Plan Generating schemes, Algorithm for planning, Planning Representation with STRIPS, BlOCKS WORLD, difficulties with planning

Laboratory Sessions/ Experimental learning:

1. Solve 8-puzzle problem using best first search
2. Laboratory session for implementing Min-Max Algorithm
3. Laboratory session on alpha-beta pruning

Applications: Telecommunication maintenance, Game theory

Video link : https://nptel.ac.in/courses/106/102/106102220/

Module-4	**L1,L2**	**8 Hrs.**

Fuzzy Sets and Uncertainties: Fuzzy set and fuzzy logic, set and fuzzy operators, , Extended fuzzy operations, Fuzzy relations, Properties of fuzzy relations, Fuzzy system and design, Linguistic hedges, Syntax for IF and Then rules, , Types of fuzzy rule based system, Fuzzy linguistic controller, Fuzzy Inference, Graphical techniques of Inference, How, Fuzzy logic is used, Fuzzification, De- fuzzification. Unique features of Fuzzy Logic, Application of Fuzzy Logic, Fuzzy logic uncertainty and probability, Advantages and Limitations of Fuzzy logic and Fuzzy Systems

Laboratory Sessions/ Experimental learning: Implementation of Fuzzy operations **Applications:** Automobile industry, facial pattern recognition, chemical industry **Video link :** https://nptel.ac.in/courses/106/105/106105173/

Module-5	**L1,L2,L3**	**8 Hrs.**

Advancement of AI: Expert System, Expert System structure, Knowledge acquisition, Knowledge representation, Inference control mechanism, User interface, Expert System Shell, Knowledge Representation, Inference Mechanism, Developer Interface and User Interface, Characteristics of Expert system, Advantages of an expert system, Production System, Artificial Neural Networks, Characteristics of Neural Networks, Architecture of neural networks, Types of neural networks, Application of neural networks.

Laboratory Sessions/ Experimental learning: Laboratory session to implement simple neuralnetwork

Applications: Aviation, Medical diagnosis

Video link:

- https://www.youtube.com/watch?v=lyrFcgqFmIk
- https://www.youtube.com/watch?v=xbYgKoG4x2g

Course outcomes:	
CO1	Design intelligent agents for problem solving, reasoning, planning, decision making.
CO2	Apply AI technique to current applications.
CO3	Apply Problem solving, knowledge representation, reasoning, and learning techniques to solve real world problems
CO4	Design and build expert systems for various application domains.
CO5	Apply Soft Computing techniques such as neural networks, fuzzy logic to solve problems in various application domains

Text Books:	
1.	Anindita Das Battacharjee, Artificial Intelligence and Softcomputing for Beginners, Shroff Publishers, 2nd edition
2.	Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013

Reference Books:	
1.	Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition
2.	Neural Networks, Fuzzy Logic and Genetic Algorithms by S. Rajasekaran, G. A VijayalakshmiPai, PHI publication

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	3	3	3	-	-	-	-	-	-	-	2	2
CO2	3	3	3	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	-	-	-	-	-	-	2	2
CO4	3	3	3	-	-	-	-	-	-	-	2	2
CO5	3	3	3	-	-	-	-	-	-	-	2	2

High-3, Medium-2, Low-1

Course Title	**Virtual Reality**	**Semester**	02
Course Code	MVJ20SCS254	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	5(L : T : P :: 3 : 0 : 0)	**Total**	100
Credits	3	**Exam. Duration**	3Hrs

Course objective is to:

- This course will provide each student with an exposure to crucial aspects of virtual reality.
- Virtual reality is a very powerful and compelling computer application by which humans can interface and interact with computer-generated environments in a way that mimics real life and engages all the senses.
- Through virtual reality scientists can triple the rate of oil discovery, pilots can dogfight numerically-superior "bandits," and surgeons can improve their skills on virtual (rather than real) patients.
- Pre-requisites: Computer Graphics, Multimedia System, Distributed System

Module-1	**L1,L2**	**8 Hrs**

Short history of early virtual reality, Early Commercial VR Technology, Five Classic components of a VR System, Input Devices: Trackers, Navigation and gesture Interfaces, Three – Dimensional Position trackers, Tracker performance Parameters, Mechanical Trackers, Magnetic Trackers, Ultrasonic Trackers, Optical Trackers, Hybrid Inertial Trackers, Navigation and Manipulation Interfaces, Tracker- Based Navigation/Manipulation Interfaces, Trackballs, Three Dimensional Probes, Gesture Interfaces, The Pinch Glove, Output Devices: Graphics, Three- Dimensional Sound, And Haptic Displays, Graphics Displays, Human Virtual System, Personal Graphics Displays, Large – Volume Displays, Sound Displays, Human Auditory System, Speaker – Based Three- Dimensional Sound

Applications: Medical

Video link: https://www.youtube.com/watch?v=MC6MmIbhJkM&feature=youtu.be

Module-2	**L1,L2**	**8 Hrs**

Computing Architecture for VR : The Rendering pipeline, Graphical Rendering Pipeline, The Haptic Rendering Pipeline, PC Graphics Architecture, PC Graphics Accelerators, Graphics Banchmarks, Workstation- Based Architectures, Sun Blade 1000 Architecture, SGI Infinite Reality Architecture, Distributed VR Architecture, Multi pipeline Synchronization, Distributed Virtual Environments Applications: Engineering

Video link: https://www.youtube.com/watch?v=MC6MmIbhJkM&feature=youtu.be

Module-3	**L1,L2**	**8 Hrs**

Modelling: Geometric Modeling, Virtual Object Shape, Object Visual Appearance, Kinematics Modeling, Homogeneous Transformation Matrices, Object Position, Transformation Invariants, Object Hierarchies, Physical modeling – (Collision Detection, Surface Deformation, Force Computation, Force Smoothing and Mapping, Haptic Texturing), Behavior Modeling, Model Management - Level of Detail Management, Cell Segmentation Applications: Fashion, Business **Video link:** https://www.youtube.com/watch?v=MC6MmIbhJkM&feature=youtu.be

Module-4	**L1,L2,**	**8 Hrs**
VR Programming : Toolkits and Scene Graphs, WorldToolKit – (Model Geometry and Appearance, WTK Scene Graph, Sensors and Action Functions, WTK Networking), Java 3D – (Model Geometry and Appearance, Java 3D Scene Graph, Sensor and Behavior, Java 3D Networking, WTK and Java 3D Performance Comparison), General Haptics Open Software Toolkit – (GHOST Integration withthe Graphics Pipeline, The GHOST Haptics Scene Graph, Collision Detection and Response) Applications: Media, Films **Video link:** https://www.youtube.com/watch?v=MC6MmIbhJkM&feature=youtu.be		

Module-5	**L1,L2,L3**	**8 Hrs**
Human Factors In VR: Methodology and terminology – (Data Collection and Analysis, Usability Engineering Methodology), User Performance Studies – (Testbed Evaluation of Universal VR Tasks, Influence of System Responsiveness on User Performance, Influence of Feedback Multimodality), VR Health and Safety Issues- (Direct Effort Of VR Simulation on Users, Cybersickness, Adaptation and After-effects, Guidelines for Proper VR Usage), VR and Society – (Impact on Professional Life, Impact on Private Life, Impact on Public Life) **Applications:** Fire safety training **Video link:** https://www.youtube.com/watch?v=QzmKCk4UjG4&feature=youtu.be		

Course outcomes:	
CO1	Virtual reality is a technology that allows students to explore and manipulate computer-generated, 3-dimensional, multimedia environments in real time.
CO2	There is substantial research reporting computer simulations to be an effective approach for improving students' learning. Three main learning outcomes have been addressed:Conceptual change, Skill development and Content area knowledge.
CO3	Total immersion virtual reality environments are presented on multiple, room-size screens or through a stereoscopic, head-mounted display unit.
CO4	Additional specialized equipment such as a DataGlove (worn as one would a regular glove)enable the participant to interact with the virtual environment through normal body movements.
CO5	Sensors on the head unit and DataGlove track the viewer's movements during exploration and provide feedback that is used to revise the display enabling real-time, fluid interactivity.

Reference Books:	
1.	Grigore C Burdea abd Philippe Coiffet, Virtual Reality Technology, 2nd Eds., Wiley Interscience, 2003.
2.	Mihelj, Matjaž, Novak, Domen, Beguš, Samo, "Virtual Reality Technology and Applications", Springer Series: Intelligent Systems, Control and Automation: Science and Engineering, Vol. 68, ISBN 978-94-007-6910-6.
3.	Gerard Jounghyun Kim, Designing Virtual Reality Systems, the Structured Approach, Springer London, 2005
4.	John Vince, Introduction in Virtual Reality, Springer, 2004.

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

High-3, Medium-2, Low-1

Course Title	COMPUTER FORENSICS SECURITY	Semester	3
Course Code	MVJ20SCS261	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	5 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Provide an understanding of computer forensics fundamentals
- Analyse various computer forensics technologies.
- Identify methods for data recovery.
- Apply the methods for preservation of digital evidence
- Learn about the types of attacks and remedial actions in the context of systems, networks, images and videos.

Module-1	L1,L2,L3	8 Hrs

INCIDENT AND INCIDENT RESPONSE- Introduction to Security Threats: Introduction – Computer Crimes – Computer Threats and Intrusions – Phishing – Identity Theft – Cyber Terrorism and Cyber War – Need for Security: Information Security – OS Security – Database Security – Software Development Security – Introduction to Incident – Incident Response Methodology – Steps Activities in Initial Response Phase After Detection of an Incident.

Activities: Survey of forensics tools such as WinHex, EnCase, FTK, or ProDiscover.

External learning - Demonstrate some of the mechanisms used by malicious attackers as well as forensic experts to disrupt computer networks and manipulate information access.

Module-2	L1,L2,L3	8 Hrs

FILE STORAGE AND DATA RECOVERY- File Systems – FAT, NTFS, NTFS Encrypting File System – Forensic Analysis of File Systems – Storage Fundamentals – Initial Response & Volatile Data Collection from Windows System – Initial Response & Volatile Data Collection from Unix system – Forensic Duplication – Tools – Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events – Networks.

Activities: Practical - Experiments with USB disk and hard disk using FTK or other tool.

External learning - Tools for data storage and access, bypassing filtered [blocked]

ports, reviewing Internet activity, open source forensic tools for file storage and data recovery will be introduced.

Module-3	L1,L2,L3	8 Hrs

NETWORK AND EMAIL FORENSICS- Network Evidence – Types of Network Monitoring –Setting Up a Network Monitoring System – Network Data Analysis – Email Clients – Email Tracing – Internet Fraud – Spam Investigations – Mobile Forensics – Subscriber Identity Module (SIM)Investigations – Wireless Device Investigations – PDA Investigations.

Activities: External learning - Familiarizing with port redirection tools: Quick 'n Easy FTP Server, FPIPE and FPORT.

Practical - Study of the forensics tools.

Module-4	**L1,L2,L3**	**8 Hrs**

SYSTEM FORENSICS-Data Analysis: Analysis Methodology – Investigating Live Systems(Windows & Mac OS) – Hacking: Investigating Hacker Tools – Ethical Issues – Cybercrime. Forensic and Investigative tools – Forensic Equipment's for evidence collection – Post exploitation.

Activities: Demonstration on MD5Hash tool.

Practical - IE activity analysis.

Module-5	**L1,L2,L3**	**8 Hrs**

IMAGE AND VIDEO FORENSICS-Recognizing a Graphics File – Data Compression – Locating and Recovering Graphics Files – Identifying Unknown File Formats – Copyright Issues with Graphics – Fraud using image and video – Detection of Fraud in images and video.

Activities: External learning - Survey on image file formats steganography tools.

Practical - JPHS tool for steganography

Course outcomes:	
CO1	Summarize various cybercrimes, incident response methodology, forensics duplication.
CO2	Explain the working of DOS and Windows systems
CO3	Produce various computer forensic tools and email forensic tools to develop their zeal for research in computer forensics
CO4	Analyze and validate forensic data using various techniques
CO5	Explains the usage of computers in forensics and how to use various forensic tools for a wide variety of investigations.

Text Books:	
1.	Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGraw Hill, 2006.
2.	Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.

Reference Books:	
1.	Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning
2.	Real Digital Forensics by Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison- Wesley Pearson Education
3.	Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.

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

High-3, Medium-2, Low-1

Course Title	High Performance Computing	Semester	02
Course Code	MVJ20SCS262	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	5 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Learn about Modern Processors and concepts
- Understand the concepts of optimizations.
- Learn about Parallel Computers and Programming
- Study about Memory Parallel Programming using OpenMP and MPI

Module-1	**L1,L2**	**8 Hrs.**

MODERN PROCESSORS: Stored Program Computer Architecture-General purpose cache-based microprocessor Performance based metrics and benchmarks-Moore's Law- Pipelining- Superscalarity-SIMD Memory Hierarchies Cache-mapping-prefetch-Multicore processors- mutithreaded processors, Vector Processors- Design Principles- Maximum performance estimates- Programming for vector architecture

Applications: used in modems, telephone, digital telephone sets,Laser Printers.

Video link: https://www.youtube.com/watch?v=1jYOBr-orpk&list=PL2F82ECDF8BB71B0C

Module-2	**L1,L2**	**8 Hrs**

BASIC OPTIMIZATION TECHNIQUES FOR SERIAL CODE: Scalar profiling- Function and line-based runtime profiling- Hardware performance counters- Simple measures large impact-Eliminationof common sub expressions- Avoiding branches- Using SIMD instruction sets- The role of compilers – General optimization, In lining – Aliasing- Computational Accuracy- Register optimizations Using compiler logs- C++ optimizations – Temporaries

Video link: https://www.youtube.com/watch?v=1jYOBr-orpk&list=PL2F82ECDF8BB71B0C

Module-3	**L1,L2**	**8 Hrs**

PARALLEL COMPUTERS: Taxonomy of parallel computing paradigms- Shared memorycomputers- Cache 1oherence- UMA Distributed-memory computers- Hierarchical systems- Networks Basic performance characteristics- Buses- Switched and fattree networks- Mesh networks.

Applications: climate modeling, agriculture estimates, financial risk management, video color correction

Video link: https://www.youtube.com/watch?v=1jYOBr-orpk&list=PL2F82ECDF8BB71B0C

Module-4	**L1,L2,**	**8 Hrs**

SHARED MEMORY PARALLEL PROGRAMMING WITH OPENMP: Introduction to OpenMP – Parallel execution – Data scoping OpenMP work sharing for loops- Synchronization – ReductionsLoop Scheduling – Tasking – Case Study: OpenMP

Applications: OpenMP is a library for parallel programming in the SMP (symmetric multi-processors,

Video link: https://www.youtube.com/watch?v=1jYOBr-orpk&list=PL2F82ECDF8BB71B0C

Module-5	**L1,L2,L3**	**8 Hrs**

DISTRIBUTED-MEMORY PARALLEL PROGRAMMING WITH MPI: Message passing – Introduction to MPI- Messages and point-to-point communication-Nonblocking point-to-point communication- Virtual topologies – MPI parallelization of Jacobi solver, performance properties Efficient MPI programming: MPI performance tools- communication parameters

Applications: To execute your program on remote hosts

Video link: https://www.youtube.com/watch?v=1jYOBr-orpk&list=PL2F82ECDF8BB71B0C

Course outcomes:	
CO1	The learner will be able to design, formulate, solve and implement high performance versions of standard processors.
CO2	The learner will know and will be able to demonstrate the optimization techniques for compiler and registers
CO3	The learner will be able to design programs to extract maximum performance in a multicore, shared memory execution environment processor
CO4	The learner will be able to give optimizing solutions for scheduling using parallel programming with MPI.
CO5	Understand Kalman Filter theory and design discrete Kalman filters

Text Books:	
1.	Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists Engineers", Chapman & Hall / CRC Computational Science series, 2011.
2.	John Levesque, Gene Wagenbreth, "High Performance Computing: Programming Application" CRC Press,2010.

Reference Books:	
1.	Kai Hwang, Zhiweixu "Scalable Parallel Computing: Technology, Architecture, Programming McGraw Hill International, 2000
2.	Charles Severance, Kevin Dowd, "High Performance Computing", O'Reilly Media, 2nd Edi 1998

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	**Advanced Operating System**	**Semester**	02
Course Code	MVJ20SCS263	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	5 (L : T : P :: 3 : 0 : 0)	**Total**	100
Credits	3	**Exam. Duration**	3Hrs

Course objective is to:

- Learn the fundamentals of Operating Systems
- Gain knowledge on Distributed operating system concepts that includes architecture,Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- Gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- Know the components and management aspects of real time , mobile and embedded operating systems

Module-1	**L1,L2**	**8 Hrs**

PROCESS SCHEDULING & PROCESS SYNCHRONIZATION: Overview, Process scheduling, Operations on process, Interprocess communication, Process scheduling criteria, process scheduling algorithms. Process Synchronization: Background, Hardware Support to Process Synchronization, Semaphores, Monitors - Memory Management Techniques. Case study: process scheduling in Linux. Laboratory Sessions/ Experimental learning: installation of OS, process scheduling in different OS

Applications: All branch students should know about basics of OS as everyone is using computer,phones. Used in almost all areas like DBMS, Networks, Security etc.

Video link / Additional online information : https://nptel.ac.in/courses/106/106/106106144/

https://nptel.ac.in/courses/106102132/

https://nptel.ac.in/courses/106/105/106105172/

Module-2	**L1,L2**	**8 Hrs**

DISTRIBUTED OPERATING SYSTEMS: Issues in Distributed Operating System – Architecture Communication Primitives –Lamport's Logical clocks – Causal Ordering of Messages – DistributedMutual Exclusion Algorithms – Centralized and Distributed. Deadlock Detection Algorithms –Agreement Protocols - Case Study: Remote Procedure call in Distributed xComputing Environment.

Laboratory Sessions/ Experimental learning: solving deadlock avoidance problems using single resource allocation graph algorithm, Banker's algorithm and deadlock detection problems using waitfor graph, several instance of resource type algorithm.

Applications: DBMS to solve transactions deadlock, real world applications based on deadlock-ex.traffic management

Video link / Additional online information:

https://nptel.ac.in/courses/106106168/

https://nptel.ac.in/courses/106/106/106106144/

https://www.youtube.com/watch?v=Y14b7_T3AEw

Module-3	**L1,L2**	**8 Hrs**

DISTRIBUTED RESOURCE MANAGEMENT: Distributed File Systems – Design Issues - Distributed Shared Memory –Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection.

Laboratory Sessions/ Experimental learning: solving problems for implementing distributed shared memory using algorithms. Implement two phase commit protocols.

Applications: DBMS ,online transaction processing applications

Video link / Additional online information: https://nptel.ac.in/courses/106102132/

https://www.youtube.com/watch?v=gr29JiWlTH8

https://www.youtube.com/watch?v=ipm5hDz9zG0

Module-4	**L1,L2**	**8 Hrs.**

REAL TIME AND MOBILE OPERATING SYSTEMS: Basic Model of Real Time Systems – Characteristics - Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –Microkernel Design -Client Server Resource Access – Processes and Threads - Memory Management - File system

Laboratory Sessions/ Experimental learning: Experiments to connect two system for client and server and establish communication.(ex.socket).Develop mini projects on android applications.

Applications: develop a mini projects for client server application

Video link / Additional online information: https://nptel.ac.in/courses/106/105/106105172/

https://www.youtube.com/watch?v=HlU5cYqGLZE

Module-5	**L1,L2,L3**	**8 Hrs.**

EMBEDDED OPERATING SYSTEMS: Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits. case study - iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

Laboratory Sessions/ Experimental learning: develop mini projects for providing security using different security mechanism. Experiments on creating a virus and antivirus.

Applications: Information security.

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

- https://www.youtube.com/watch?v=hELr9-7aAG8
- https://www.youtube.com/watch?v=9NAIG2Pmzfg
- https://nptel.ac.in/courses/106106141/

Course outcomes:	
CO1	Discuss the various synchronization, scheduling and memory management issues
CO2	Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of
CO3	Distributed operating system
CO4	Discuss the various resource management techniques for distributed systems
CO5	Identify the different features of real time and mobile operating systems

Text Books:	
1.	Mukesh Singhal, Niranjan Shivaratri, "Advanced Concepts in Operating Systems", McGrawHill,2011
2.	William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

Reference Books:	
1.	Nancy A Lynch, "Distributed Algorithms", Morgan Kaufmann Series, Elsevier, 1996.
2.	Hagit Attiya, Jennifer Welch, "Distributed Computing: Fundamentals, Simulations and Advanced Topics", McGraw-Hill,2004.
3.	Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson, 2006.

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

CO3	3	2	2	1	-	-	-	-	-	-	3	2
CO4	3	3	2	1	-	-	-	-	-	-	3	3
CO5	3	3	2	1	-	-	-	-	-	-	3	3

High-3, Medium-2, Low-1

Course Title	**Digital Video Processing**	**Semester**	02
Course Code	MVJ20SCS264	**CIE**	50
Total No. of Contact Hours	40	**SEE**	50
No. of Contact Hours/week	5(L : T : P :: 3 : 0 : 0)	**Total**	100
Credits	3	**Exam. Duration**	3Hrs

Course objective is to:

- Provide students with a theoretical as well as practical understanding of digital videoprocessing
- Provide a good understanding of motion detection & restoration.
- Understand video segmentation and basic transformation of video.

Module-1	**L1,L2**	**8 Hrs**

Introduction to digital video processing, Video sampling and interpolation

Laboratory Sessions/ Experimental learning: Analog and digital video implementaion

Applications: Geometric and photometric image formation

Video link / Additional online information:

https://www.academia.edu/8281534/Digital_video_processing_Tekalp

Module-2	**L1,L2**	**8 Hrs**

Motion detection and estimation, Video enhancement and restoration

Laboratory Sessions/ Experimental learning: Two-Dimensional Motion Estimation

Applications: Photoshops and 2D animations

Video link/Additional online information:

https://www.academia.edu/8281534/Digital_video_processing_Tekalp

Module-3	**L1,L2**	**8 Hrs**

Video stabilization and mosaicing

Applications: Spatio-Temporal Sampling, Image Filtering.

Video link / Additional online information:

https://www.academia.edu/8281534/Digital_video_processing_Tekalp

Module-4	**L1,L2**	**8 Hrs.**

Video segmentation motion tracking in video

Laboratory Sessions/ Experimental learning: Three-Dimensional Motion Estimation and Segmentation

Applications: Stereo And Motion Tracking

Video link / Additional online information:

https://www.academia.edu/8281534/Digital_video_processing_Tekalp

Module-5	**L1,L2,L3**	**8 Hrs.**

Basic transform video coding, MPEG4 and H.264/AVC. **Laboratory Sessions/ Experimental learning:** Video Compression **Applications:** Movies and short films **Video link / Additional online information:** https://www.academia.edu/8281534/Digital_video_processing_Tekalp

Course outcomes:	
CO1	Outline the concepts of video processing and explain sampling
CO2	Demonstrate video processing algrothms for detection, estimation, enhancement, restoratios, stabilization, masaicing
CO3	Illustrate segmentation and motion tracking algorithms
CO4	Outline MPEG4 and H-254 coding techniques
CO5	Identify the different features of videocoding

Text/ Reference Books:	
1.	The Essential Guide to Video Processing, Al Bovik, Elsevier 2001
2.	Digital Video Processing ,A.Murat Tekalp University of Rochester

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

High-3, Medium-2, Low-1

Course Title	**Data Analytics & Machine Learning Laboratory**	**Semester**	02
Course Code	MVJ20SCSL27	**CIE**	50
Total No. of Contact Hours	30	**SEE**	50
No. of Contact Hours/week	3(L : T : P :: 0 : 2: 2)	**Total**	100
Credits	2	**Exam. Duration**	3Hrs

Course objective is to:

- Implement Map Reduce programs for processing big data
- Realize storage of big data using H base, Mongo DB
- Analyze big data using linear models
- Analyze big data using machine learning techniques such as SVM / Decision treeclassification and clustering

S No	Experiment Name	RBT Level	Hours
1	**Laboratory Experiments for Data Analytics** Implement word count / frequency programs using MapReduce	**L3**	**3**
2	Implement an MR program that processes a weather dataset	**L3**	**3**
3	Implement Linear and logistic Regression	**L3**	**3**
4	Implement SVM / Decision tree classification techniques	**L3**	**3**
5	Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.	**L3**	**3**
6	**Laboratory Experiments for Machine Learning** For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	**L3**	**3**
7	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use anappropriate data set for building the decision tree and apply this knowledge to classify a new sample.	**L3**	**3**
8	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	**L3**	**3**
9	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.	**L3**	**3**
10	Implement the genetic algorithm optimization technique to maximize Output using appropriate datasets.	**L3**	**3**

Course Outcomes
• Process big data using Hadoop framework
• Build and apply linear and logistic regression models
• Perform data analysis with machine learning methods
• Apply appropriate data sets to the Machine Learning algorithms.
• Identify and apply Machine Learning algorithms to solve real world problems.

CO-PO Mapping

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

High-3, Medium-2, Low-1