

Course Title	Artificial Intelligence	Semester	VI
Course Code	MVJ20IS61	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	3 Hours

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

Identify the problems where AI is required and the different methods available.

Compare and contrast different AI techniques available.

Define and explain learning algorithms.

Design different learning algorithms for improving the performance of AI systems.

Implement projects using different AI learning techniques.

Module-1

L1,L2,L3

12
Hours

Syllabus Content:

What is artificial intelligence, Problems, Problem Spaces and search, Heuristic search technique.

Application:

Solving various AI based problems.

Video Link:

<http://www.nptelvideos.in/2012/11/artificial-intelligence.html>

<https://www.cualit.com/artificial-intelligence-practical-use-cases/>

Module-2

L1,L2,L3

12
Hours

Syllabus Content:

Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules.

Application:

Developing information about the objects

Video Link:

<http://www.nptelvideos.in/2012/11/artificial-intelligence.html>

<https://www.cualit.com/artificial-intelligence-practical-use-cases/>

Module-3

L1,L2,L3

12
Hours

Syllabus Content:

Symbolic Reasoning under Uncertainty, Statistical reasoning, Weak Slot and Filter Structures.

Application:

Connecting one concept to another , combining ideas about data.

Video Link:

<http://www.nptelvideos.in/2012/11/artificial-intelligence.html>

<https://www.cualit.com/artificial-intelligence-practical-use-cases/>

Module-4

L1,L2,L3

12
Hours

Syllabus Content:

Strong slot-and-filler structures, Game Playing.

Application:

Designing Smart Games

Video Link:

<http://www.nptelvideos.in/2012/11/artificial-intelligence.html>

<https://www.cualit.com/artificial-intelligence-practical-use-cases/>

Module-5

L1,L2,L3

12
Hours

Syllabus Content:

Natural Language Processing, Learning, Expert Systems.

Application:

Sentiment analysis

Video Link:

<http://www.nptelvideos.in/2012/11/artificial-intelligence.html>

<https://www.cualit.com/artificial-intelligence-practical-use-cases/>

Course outcomes:

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

Text/Reference Books:

1.	E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.
2.	Stuart Russel, Peter Norvig, "Artificial Intelligence: A Modern Approach" , 2nd Edition, Pearson Education, 2003.
3.	Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.
4.	G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002.

CIE Assessment:

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

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

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

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

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

High-3, Medium-2, Low-1

Course Title	Internet of Things	Semester	VI
Course Code	MVJ20IS62	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	3 Hours

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

Assess the genesis and impact of IoT applications, architectures in real world.

Illustrate diverse methods of deploying smart objects and connect them to network.

Compare different Application protocols for IoT.

Infer the role of Data Analytics and Security in IoT.

Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

Module-1

L1,L2,L3

12
Hours

Syllabus Content:

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

Application:

Connecting Smart Things

Video Link:

1. <https://www.postscapes.com/internet-of-things-technologies/>

2. <https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT>

3. <https://www.iotforall.com/iot-ebooks/>

Module-2

L1,L2,L3

12
Hours

Syllabus Content:

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

Application:

Designing Smart Circuits

Video Link:

1. <https://www.postscapes.com/internet-of-things-technologies/>

2. <https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT>

3. <https://www.iotforall.com/iot-ebooks/>

Module-3

L1,L2,L3

12
Hours

Syllabus Content:

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

Application:

Data transmission using wireless technology

Video Link:

1. <https://www.postscapes.com/internet-of-things-technologies/>

2. <https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT>

3. <https://www.iotforall.com/iot-ebooks/>

Module-4

L1,L2,L3

12
Hours

Syllabus Content:

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment

Application:

Designing Smart Systems

Video Link:

1. <https://www.postscapes.com/internet-of-things-technologies/>

2. <https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT>

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Module-5		L1,L2,L3	12 Hours
Syllabus Content:			
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.			
Application:			
Securing and handling Smart systems			
Video Link:			
1. https://www.postscapes.com/internet-of-things-technologies/ 2. https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT 3. https://www.iotforall.com/iot-ebooks/			
Course outcomes:			
CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.		
CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.		
CO3	Appraise the role of IoT protocols for efficient network communication.		
CO4	Elaborate the need for Data Analytics and Security in IoT.		
CO5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.		
Text/Reference Books:			
1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for		

	the Internet of Things”, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2.	Srinivasa K G, “Internet of Things”,CENGAGE Learning India, 2017
3.	Vijay Madiseti and ArshdeepBahga, “Internet of Things (A Hands-on- Approach)”, 1stEdition, VPT, 2014. (ISBN: 978-8173719547)
4.	Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

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CO-PO Mapping

CO/P	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
O	1	2	3	4	5	6	7	8	9	0	1	2
CO1	2	2	3		2							
CO2	2	3	3	3	2							
CO3		2	2	2								
CO4		2	2	3								
CO5	3	3	3	3	3							

High-3, Medium-2, Low-1

Course Title	Data Mining	Semester	VI
Course Code	MVJ20IS631	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Gather and analyze large sets of data to gain useful business understanding

Understand the data mining functionalities, technologies and steps in pre-processing the data

Learn data mining algorithms, methods and tools

Module-1

L1, L2, L3

12
Hours

Raw data to valuable information-Lifecycle of Data - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data marts - Overview of the components - Metadata in the data warehouse - Basic elements of data warehousing - Principles of dimensional modelling: Star schema, Snowflake schema and Galaxy schema.

Application:

Identify the potential risk of default and manage and control collections

Performance analysis of each product, service, interchange, and exchange rates

Store and analyze information about faculty and students

Maintain student portals to facilitate student activities

Video Link:

<https://www.youtube.com/watch?v=8IHpioyvSng>

Module-2

L1,L2,L3

12
Hours

Introduction to Data Mining Systems, Knowledge Discovery Process -Data Objects and attribute types, Statistical description of data, Data Preprocessing- Data Cleaning, Data Integration and Transformation, Data Reduction.

Application:

Financial Analysis
 Telecommunication Industry.
 Intrusion Detection
 Retail Industry
 Higher Education

Video Link:
<https://www.youtube.com/watch?v=QRZIYzxEFDg>

Module-3	L1,L2,L3	12 Hours
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Market Basket Analysis, Frequent Item sets, Closed Itemsets, Association Rules, Frequent Itemset Mining Methods- Apriori algorithm, Generating Association rules from Frequent Itemsets, A Pattern- Growth Approach for mining frequent Itemsets, Mining Frequent Itemsets using the Vertical Data Format.

Application:
 Market Basket Analysis
 Medical Diagnosis:
 Census Data
 Protein Sequence

Video Link:
<https://www.youtube.com/watch?v=RiFrbyiYpRs>

Module-4	L1,L2,L3	12 Hours
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Classification and Prediction ,Basic Concepts, Decision Tree Induction, Bayesian Classification ,Rule Based Classification, Classification by Back propagation , Support Vector Machines, Lazy learners.

Application:
[Sentiment Analysis](#)
[Email Spam Classification](#)

[Document Classification](#)

[Image Classification](#)

Video Link:

https://www.youtube.com/watch?v=gkagE_fE2sk

Module-5

L1,L2,L3

12
Hours

Types of Data in Cluster Analysis , Data similarity and dissimilarity measures ,A Categorization of Major Clustering Methods -Partitioning Methods-K-means, K-medoids , Hierarchical Methods-Agglomerative vs Divisive, Distance measures, BIRCH, Clustering High-Dimensional Data- Outlier Analysis and Detection.

Application:

Clustering analysis

In the field of biology, it can be used to derive plant and animal taxonomies.

Identification of areas of similar land use in an earth observation database.

Video Link:

<https://www.youtube.com/watch?v=2QTeuO0C-fY>

Experimental Part:

Apriori Algorithm for market Basket Analysis

Bayesian Classification

Decision Tree Induction Algorithm

Frequent Pattern-Growth Algorithm

Course outcomes:

CO1	Design data warehouse by applying principles of dimensional modelling and ETL concepts
CO2	Analyze various data pre-processing techniques for efficient data mining.
CO3	Apply association rule mining for finding hidden and interesting patterns in data.
CO4	Apply statistical procedure, machine learning and neural network based classification algorithms for data prediction
CO5	Apply clustering algorithms for the application and generalizations for real time problems

Text/Reference Books:	
1.	Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2.	Paulraj Ponniah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley, 2010
3.	Alex Berson, Stephen J Smith, Data warehousing, Data mining, and OLAP, Tata McGraw Hill edition, 2007
4.	Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson Education, 2007
5.	G. K. Gupta ,Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006

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

CO-PO Mapping												
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	3	3	3	3		2					
CO2	3	3	3	3	3		2					
CO3	3	3	3	3	3	3						3
CO4	3	3	3	3	3	3		3				3
CO5	3	3	3	3	3	3						3

High-3, Medium-2, Low-1

Course Title	Web Technology	Semester	VI
Course Code	MVJ20IS632	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 0 : 1)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Teach students HTML and CSS for designing web pages.

Introduce students to the basics of JavaScript as a programming language.

Familiarize students with the Document Object Model and enable them to create dynamic web pages that react to user input.

Teach students about installing and configuring Apache Server and incorporating backend support for their web pages.

Introduce students to the newer features available as part of the HTML standard

Module -1	L1,L2,L3	12 Hours
<p>Introduction, UI Design and UX : Internet, WWW, Web Servers and Browsers, URLs, MIME, HTTP, Basic Markup, Images, Hyperlinks, Lists, Tables, Forms, DataList, Canvas, Audio and Video, Geo-Location, Local Storage, Web Workers, Offline Web Applications, Drag and Drop.HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats</p> <p>Application: To deliver data (HTML files, image files, query results) on the World Wide Web.</p> <p>Video Link:</p> <p>https://www.freecodecamp.org/</p> <p>https://developer.mozilla.org/en-US/docs/Web/CSS</p>		
Module -2	L1,L2,L3	12 Hours
<p>Style Sheets: CSS Introduction to Cascading Style Sheets-Features-Core Syntax-Style</p>		

Sheets and HTML Style Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. Client- Side Programming:

Application: Describing the presentation of Web pages, including colors, layout, and fonts

Video Link:

<https://www.vogella.com/tutorials/CSS/article.html>

<https://nptel.ac.in/courses/106/105/106105084/>

Module - 3

L1,L2,L3

12
Hours

JavaScript: Introduction to Client-Side Scripting, JavaScript Basics, Screen Input and Keyboard Output, Functions, Objects, Inheritance, Hoisting, Arrays, JavaScript Objects, Accessing and Modifying DOM, Events and Event Handlers - Load, Mouse, Synthetic Events, Key and Form Related Events, Event Bubbling, Cookies.

Application: Web Sites, Web Server Applications, Mobile Apps, Games Platform

Video Link:

<https://www.udemy.com/courses/development/web-development/>

<https://javascript.info/hello-world#modern-markup>

Module-4

L1,L2,L3

12
Hours

PHP Arrays and Superglobals, Arrays, \$_GET and \$_POST Superglobal Arrays, \$_SERVERArray, \$_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions, PHP Error Reporting, PHP Error and Exception Handling

Application: e-Commerce Applications. Web Pages and Web-Based Applications

Video Link:

<http://www.nptelvideos.com/video.php?id=2142&c=27>

<http://www.nptelvideos.com/video.php?id=2131&c=27>

<http://www.nptelvideos.com/video.php?id=2116&c=27>

Module-5

L1,L2,L3

12
Hours

Bootstrap: Grid Systems, Layout, Tables and Forms, Buttons and Images, Progress Bar, Navigations. jQuery: Usage, Selecting DOM Elements, Getting and Setting Attributes, Changing Styles, File Handling and System Calls, Arrays, Cookies, Sessions, Database Access.

Application: Bootstrap is a front-end framework used to create modern websites and web apps

Video Link:

<https://getbootstrap.com/docs/4.5/examples/>

https://www.w3schools.com/bootstrap/bootstrap_buttons.asp

Practical Experiments:

Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information for the web pages.

JavaScript to design a simple calculator

Java script to Validate the Registration, user login, user profile and payment by credit card pages

PHP program to display a digital clock which displays the current time of the server..

PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors

Course outcomes:

CO1	Outline the basic concepts of information and web architecture.
CO2	Design solutions for programming questions using JavaScript
CO3	Study Hyper Text markup language and create websites using HTML, CSS Codes.
CO4	Setup a web server and host a website with back end support.
CO5	Incorporate the latest HTML features in the web pages designed by them with fallback options wherever required.

Text/Reference Books:

1.	Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2.	Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education

3.	Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
4.	Marty Hall and Larry Brown, "Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001
5.	Bates, "Developing Web Applications", Wiley, 2006.

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Mini Project / Case Studies (8 Marks)

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CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	Information Storage Management	Semester	VI
Course Code	MVJ20IS633	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Understand data creation, the amount of data being created, the value of data to a business, challenges in data storage and data management

Understand solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

Understand the storage architecture and available technologies.

Learn to establish & manage data center.

Learn security aspects of storage & data center.

Module-1	L1,L2,L3	12 Hours
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Introduction to Information Storage- Information Storage, Data, Types of Data, Big Data, Information, Storage, Evolution of Storage Architecture, Data Centre Infrastructure, Core Elements, Key characteristics for Data Centre Elements, Managing Data center, Virtualization and Cloud Computing. Data Centre Environment -Application, DBMS, Host, OS, Memory Virtualization, Device Driver, Volume Manager, File System, Compute Virtualization, Connectivity Physical Components of Connectivity, Interface protocols- IDE/ATA and Serial ATA, SCSI and Serial SCSI, Fiber Channel, Internet Protocol, Storage Application:

Identifying information storage systems

Video Link:

<https://nptel.ac.in/courses/106/108/106108058/>

Module-2	L1,L2,L3	12 Hours
<p>Data Protection: RAID - Implementation of RAID, Software RAID, Hardware RAID, RAID Array Components, RAID Techniques- Striping, Mirroring, Parity; RAID Levels RAID 0, RAID 1, Nested RAID, RAID 3, RAID 4, RAID 5, RAID 6, RAID Impact on Disk Performance, Application IOPS and RAID Configurations, RAID Comparison, Hot Spares.</p> <p>Application: Configuration of RAID Models</p> <p>Video Link: https://nptel.ac.in/courses/106/108/106108058/</p>		
Module-3	L2,L3	12 Hours
<p>Intelligent Storage System - Components of an Intelligent Storage System, Front End, Cache- Structure of Cache, Read Operation with Cache, Write Operation with Cache, Cache Implementation, Cache management, Cache Data Protection, Back End, Physical Disk, Storage Provisioning- Traditional Storage Provisioning, LUN Expansion: Meta LUN, Virtual Storage Provisioning, LUN Masking, Types of Intelligent Storage Systems- High end Storage Systems, Mid Range Storage Systems.</p> <p>Application: Working of cache memory</p> <p>Video Link: https://nptel.ac.in/courses/106/108/106108058/</p>		
Module-4	L2,L3	12 Hours
<p>Network-Attached Storage - General-Purpose Servers vs. NAS Devices, Benefits of NAS, File Systems and Network File Sharing- Accessing a File System, Network File Sharing; Components of NAS, NAS I/O Operations, NAS Implementations- Unified NAS, Unified NAS Connectivity, Gateway NAS, Gateway NAS Connectivity, Scale Out NAS, Scale Out NAS Connectivity, NAS File-Sharing Protocols- NFS, CIFS; Factors Affecting NAS Performance, File Level Virtualization.</p>		

<p>Application: Storage devices as servers.</p> <p>Video Link: https://nptel.ac.in/courses/106/108/106108058/</p>		
Module-5	L2,L3	12 Hours
<p>Backup Purpose- Disaster Recovery, Operational Backup, Archival, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments- Server Based and Server less Backup, NDMP- Based Backup; Backup Targets- Backup to Tape, Physical Tape Library, Limitations of Tape; Backup to Disk, Backup to Virtual Tape, Data Deduplication for Backup- Data Deduplication Methods, Data Deduplication Implementation, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture</p> <p>Application: Data Backup to avoid data loss.</p> <p>Video Link: https://nptel.ac.in/courses/106/108/106108058/</p>		
CASE STUDY	L3	20 Hours
<p>cloud computing Parallel SCSI Remote Replication Securing and Managing Storage Infrastructure Exploring AWS</p>		
Course outcomes:		
CO1	Select from various storage technologies to suit for required application.	
CO2	Apply security measures to safeguard storage & farm	
CO3	Analyse QoS on Storage.	
CO4	Describe the different role in providing disaster recovery and business continuity capabilities.	
CO5	Distinguish different remote replication technologies.	

Text/Reference Books:	
1.	Information Storage and Management, Second Edition, EMC Education Services, Wiley India Edition
2.	Storage Networks Explained, Ulf Tropan, Rainer Erkens, Wolfgang Muller, Wiley, ISBN: 9788126518326
3.	Robert Spalding, –Storage Networks: The Complete Reference–, Tata McGraw Hill , Osborne, 2003.

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CO2		3	3	2	2	2		2		2	2	2
CO3		3	3	2	2	2		2		3	2	2
CO4		3	3	2	2	2		2		3	2	2
CO5		3	3	2	2	2		2		2	2	2

High-3, Medium-2, Low-1

Course Title	LAW FOR ENGINEERS	Semester	VI
Course Code	MVJ20IS634	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 0 : 1)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

Outline the commercial context for engineering processes and business models that are socially responsible and environmentally sustainable.

Channelize thinking towards basic understanding of the legal concepts and its implications for engineers.

Acquaint with latest intellectual property rights and innovation environment with related regulatory framework

Module-1

L1,L2,L3

8 Hours

Origin of Environmental Law, Concept of Pollution – Sources of Pollution, Types of Pollution, and Effects of pollution. Nature and Scope of Environmental Law – Importance. Case Study.

Application: Environmental Law:

Video Link:<https://www.digimat.in/nptel/courses/video/110106081/L01.html>

Module-2

L2,L3

8 Hours

Provisions of various labor laws – workmen's compensation Act 1923; Disablement, Total Permanent disablement, Temporary disablement, Formula for compensation; Minimum wages act, 1948; Payment of bonus act, 1965; Weekly holidays Act, 1942; Payment of wages Act, 1936; employees Insurance Act, 1948.

Application: Labour Law

Video Link:<https://www.digimat.in/nptel/courses/video/110106081/L01.html>

Module-3		L2,L3	8 Hours
A brief introduction to criminal liability of Engineers as per the Indian Penal Code. Application: Indian Penal Code Video Link: https://www.digimat.in/nptel/courses/video/110106081/L01.html			
Module-4		L2,L3	8 Hours
IPR and Law of Torts: Definition, categories of torts, Breach of Duty and Damages. Concept of Property, Types of Property; Introduction to IPR; Types of IPR: Copyrights, Patents, Trademarks, Designs, Trade Secrets, Plant Varieties and Geographical Indications; Infringement of IPRs and Remedies available under the Indian Law. Application: IPR Video Link: https://www.digimat.in/nptel/courses/video/110106081/L01.html			
Module-5		L2,L3	8 Hours
Business Organizations and E-Governance: Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development. Applications: G2C, G2B,G2G Video link / Additional online information (related to module if any): https://www.digimat.in/nptel/courses/video/110105083/L01.html			
Course outcomes:			
CO1	Enumerate the principles of sustainable development		
CO2	Discuss the significance of various legislations pertaining to engineers		
CO3	Understand legal systems relevant for engineering		
CO4	Understand codes of conduct, conflicts of interest and other ethical dilemmas		
CO5	Correlate role of engineers with different organizations and governance models		

Text/Reference Books:

1.	B.S. Patil, Legal Aspects of Building and Engineering Contracts
2.	Ratanlal and Dhirajlal: The Law of Torts.
1	S. Shantha Kumar- Introduction to Environmental Law.
2	Cornish W. R. (2008), Intellectual Property Rights, Patents, Trademarks, Copyrights & Allied Rights, Sweet & Maxwell
3	Madhavan Pillai - Labour and Industrial Laws.
4	Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, https://www.meity.gov.in/writereaddata/files/eGovernance_Project_Lifecycle_Participant_Handbook-5Day_CourseV1_20412.pdf

CIE Assessment:

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

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

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

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

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

CO-PO Mapping												
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	2	2	2	3	3	2	-	-	-	-	3
CO2	3	2	2	2	3	3	2	-	-	-	-	3
CO3	3	2	2	1	3	3	2	-	-	-	-	3
CO4	3	2	2	2	3	3	2	-	-	-	-	3
CO5	3	2	2	1	3	3	2	-	-	-	-	3

High-3, Medium-2, Low-1

Course Title	Unix System Programming	Semester	VI
Course Code	MVJ20IS641	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Explain the fundamental design of the Unix operating system.

Familiarize with the systems calls provided in the Unix environment.

Design and build an application/service over the Unix operating system.

Familiarize with signals and daemon process characteristics.

Explain inter-process communication.

Module-1	L1,L2,L3	12 Hours
<p>UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO, C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristic.</p> <p>Application: Operating system</p> <p>Video Link: https://www.youtube.com/watch?v=hy4OeVCLGZ4</p>		
Module-2	L1,L2,L3	12 Hours
<p>File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking, Directory File, APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.</p> <p>Application: Organizing and storing large data</p> <p>Video Link: https://www.youtube.com/watch?v=HIXzJ3Rz9po</p>		
Module-3	L1,L2,L3	12 Hours

The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups
 Application: booting of the system
 Video Link: <https://www.youtube.com/watch?v=4bfzEyB4YD0>

Module-4	L1,L2,L3	12 Hours
<p>The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.1b Timers.</p> <p>Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.</p> <p>Application: Communication Video Link: https://www.youtube.com/watch?v=X8VDJHzrHRE</p>		
Module-5	L1,L2,L3	12 Hours
<p>Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores, Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.</p> <p>Application: Data flow, Communication Video Link: https://www.youtube.com/watch?v=W0BX6geRCDQ</p>		

Practical Experiments: program to demonstrates inter-process communication. Programs using mkfifo, open, read, write and close APIs. program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region with an exclusive lock, read the last 50 bytes and unlock the region. program to illustrate the race condition.	L3	20 Hours
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Course outcomes:

CO1	Understand and reason out the working of Unix system and POSIX standards
CO2	Understand the UNIX file system and build an application/service over the Unix operating system
CO3	Demonstrate the Unix process environment and process control
CO4	Explain signals and daemon process characteristics.
CO5	Understand and write UNIX programs on inter-process communication.

Text/Reference Books:

1.	Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
2	Advanced Programming in the UNIX Environment - W.Richard Stevens, Stephen A. Rago, 3rd Edition, Pearson Education / PHI, 2005.
3	Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005.
4	The Design of the UNIX Operating System - Maurice.J.Bach, Pearson Education / PHI, 1987.
5	Unix Internals - Uresh Vahalia, Pearson Education, 2001.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the

semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

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

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

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

CO-PO Mapping

CO/P O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1		2									2	
CO2			2									
CO3				2								2
CO4			2									
CO5		2										

High-3, Medium-2, Low-1

Course Title	Virtual Reality	Semester	VI
Course Code	MVJ20IS642	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Explain this technology, underlying principles, its potential and limits

Knowledge about devices involved

Learn about the criteria for defining useful applications.

Illustrate process of creating virtual environments

Applications of Virtual Reality

Module-1	L1,L2,L3	12 Hours
<p>Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.</p> <p>Application: Students can understand the basics of Virtual Reality.</p> <p>Video Link: https://nptel.ac.in/courses/106/106/106106138/</p>		
Module-2	L1,L2,L3	12 Hours
<p>Output Devices: Graphics displays, sound displays & haptic feedback.</p> <p>Application: Students can get knowledge about the hardware involved in virtual reality.</p> <p>Video Link: https://www.youtube.com/watch?v=Z1jQ62VDVSo</p>		
Module-3	L1,L2,L3	12 Hours
<p>Modeling: Geometric modelling, kinematics modeling, physical modeling, behaviour modeling, model management</p> <p>Application: Students will get the knowledge about various modeling techniques.</p>		

Video Link: https://www.youtube.com/watch?v=dF4QEfj61XQ		
Module-4	L1,L2,L3	12 Hours
<p>Human Factors: Methodology and terminology, user performance studies, VR health and safety issues.</p> <p>Application: Students will learn impact of virtual reality of real life.</p> <p>Video Link: https://www.youtube.com/watch?v=8DvwtzdNK5U</p>		
Module-5	L1,L2,L3	12 Hours
<p>Medical applications, military applications, robotics applications</p> <p>Application: Students can get the knowledge about the applications of virtual reality.</p> <p>Video Link: https://www.youtube.com/watch?v=fJES5HYMOg0</p>		
<p>Practical Experiments/Research paper Study:</p> <p>Mobile Augmented Reality Based Experiments</p> <p>Simulating Educational Physical Experiments in Augmented Reality</p> <p>Web based Virtual Reality</p>	L3	20 Hours
Course outcomes:		
CO1	Illustrate technology, underlying principles	
CO2	Explain process of creating virtual environments	
CO3	Explain its potential and limits and to learn about the criteria for defining useful applications.	
CO4	Simulate physical experiments	
CO5	Explain future research scope of virtual reality	

Text/Reference Books:	
1.	Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons

CIE Assessment:

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

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

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

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

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

CO-PO Mapping

CO/P O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	2	1	2	2						1	2	2
CO2	2	2	2	1						1		
CO3	2	1	1	1		1	1	1	1			1
CO4	3	2	1	1		1	1	1	1			2
CO5	1	1	1	2						1	1	

High-3, Medium-2, Low-1

Course Title	Cryptography and Information Security	Semester	VI
Course Code	MVJ20IS643	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 0 : 1)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Understand the basics of computer security concepts.

Understand the security risk and prepare the plans to avoid security exploitation.

Understand the cryptography and various algorithms.

Learn various cloud security for data protection.

Understand various kinds of wireless communication and its threat.

Module-1

L1,L2,L3

12 Hours

Overview: Computer Security Concepts, Requirements, Architecture, Trends, Strategy. Perimeter Security: Firewalls, Intrusion Detection, Intrusion Prevention Systems, Honeypots. User Authentication: Password, Password - Based, Token - Based, Biometric, Remote User Authentication. Access Control: Principles, Access Rights, Discretionary Access Control, UNIX File Access Control, Role Based Access Control. Internet Authentication Applications: Kerberos, X.509, PKI.

Application: Authentication

Video Link: https://www.youtube.com/watch?v=_44CHD3Vx-0

Module-2

L1,L2,L3

12 Hours

Human Factors: Security Awareness, Training and Education, Organization Security Policy, Employment Practices and Policy. IT Security Management and Risk Assessment: IT Security Management, Risk Assessment, Analysis of IT Security Controls. Plans and Procedures: IT Security Management Implementation, Security Controls, Plan, Implementation of Controls.

Application: Prevention of application security defects and vulnerabilities

Video Link: https://www.youtube.com/watch?v=fXbC_IFrhuE

Module-3	L1,L2,L3	12 Hours
<p>Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Digital Signatures, Random Numbers, Symmetric Encryption. Message Confidentiality: DES, AES, Stream Ciphers, Cipher Block Modes of Operation, Key Distribution. Public Key Cryptography and Message Authentication: Asymmetric Encryption, Secure Hash Functions, HMAC, RSA, Diffie Hellman Algorithm. Internet Security Protocols: SSL, TLS, IPSEC, S/ MIME.</p> <p>Application: Authentication, Confidentiality, Security Token</p> <p>Video Link: https://www.youtube.com/watch?v=h8YRvQY7lcs</p>		
Module-4	L1,L2,L3	12 Hours
<p>Cloud Security: Cloud Computing Service Models and Layers, Security Issues in Cloud Computing. Bluetooth Security: Bluetooth Protocol Stack, Multiple Security Modes. Mobile Security: Security Concepts, Requirements, Architecture.</p> <p>Application : Web access</p> <p>Video Link : https://www.youtube.com/watch?v=36zducUX16w</p>		
Module-5	L1,L2,L3	12 Hours
<p>Wireless Network Security: Wireless Communications and 802.11 WLAN Standards Wireless Protected Access (WPA), IEEE 802.1x, 802.11i/ WPA2, Wireless Network Threats, ZigBee Security, Wireless Mesh Network Security.</p> <p>Application: Access control, transmission of data over long distance</p> <p>Video Link: https://www.youtube.com/watch?v=yBgcYT1riz8</p>		
Practical Experiments:	L3	20 Hours
<p>program to perform encryption and decryption</p> <p>program to implement the BlowFish algorithm logic</p> <p>Case Study: Digital Signature</p> <p>Case Study: Java Security Features/ Matlab Security Features</p> <p>Case Study: Authentication in Kerberos</p>		
Course outcomes:		

CO1	Explain authentication and its application.
CO2	Choose Cryptography Algorithms based on the application domain of the network.
CO3	Write code to implement various Encryption/ Decryption algorithms.
CO4	Explain Bluetooth security and mobile security.
CO5	Apply Authentication Protocols and Processes.

Text/Reference Books:

1.	Computer Security: Principles and Practice”, William Stallings, Lawrie Brown, Indian Edition, Pearson, 2010.
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CIE Assessment:

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Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

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

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

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

CO-PO Mapping

CO/P O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1		2										2
CO2			2								2	
CO3			2									
CO4				2								
CO5					2							

High-3, Medium-2, Low-1

Course Title	GREEN COMPUTING	Semester	VI
Course Code	MVJ20IS644	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 0 : 1)	Total	100
Credits	3	Exam. Duration	3 Hours

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

Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.

Skill in energy saving practices in their use of hardware.

Examine technology tools that can reduce paper waste and carbon footprint by user and to understand how to minimize equipment disposal requirements

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Module-1

L1,L2,L3

12
Hours

FUNDAMENTALS: Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

Real Time Applications: how they keep data safe while in transit

Video link / Additional online information:

<https://nptel.ac.in/courses/106/104/106104182/>

<https://www.youtube.com/watch?v=350Rb2sOc3U>

Module-2

L1,L2,L3

12
Hours

GREEN ASSETS AND MODELING : Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

Real Time Applications: climate-smart agriculture, land restoration, groundwater

<p>management, ecosystem-based adaptation</p> <p>Video link / Additional online information:</p> <p>https://nptel.ac.in/courses/110/107/110107128/</p> <p>https://nptel.ac.in/courses/110/107/110107093/</p>		
Module-3	L1,L2,L3	12 Hours
<p>GRID FRAMEWORK : Virtualizing of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.</p> <p>Real Time Applications: ChessBrain</p> <p>Video link / Additional online information:</p> <p>https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee42/</p> <p>https://onlinecourses.nptel.ac.in/noc19_ee64/preview</p>		
Module-4	L1,L2,L3	12 Hours
<p>GREEN COMPLIANCE : Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.</p> <p>Real Time Applications: Addressing Inconsistent Date Formats, Reducing False Positives in PEP Screening, Integrating Screening with Credit Card Approval Processes.</p> <p>Video link / Additional online information:</p> <p>https://onlinecourses.nptel.ac.in/noc19_ee64/preview</p>		
Module-5	L1,L2,L3	12 Hours
<p>CASE STUDIES : The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.</p> <p>Real Time Applications: The energy consumption in Torrent systems with malicious</p>		

content, The use of thin client instead of desktop PC

Video link / Additional online information:

<https://nptel.ac.in/courses/106/105/106105195/>

<https://nptel.ac.in/courses/106/104/106104182/>

Practical Experiments:

Naive Blockchain construction,

Memory Hard algorithm

Hashcash implementation,

Direct Acyclic Graph,

Play with Go-ethereum,

Smart Contract Construction,

Toy application using Blockchain,

Mining puzzles

Course outcomes:

CO1	Learn design principles of Bitcoin and Ethereum and Nakamoto consensus.
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CO2	Explain the Simplified Payment Verification protocol.
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CO3	Interact with a blockchain system by sending and reading transactions.
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CO4	Design, build, and deploy a distributed application.
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CO5	Evaluate security, privacy, and efficiency of a given blockchain system.
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Text Books:

1.	Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011
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2.	Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.
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Reference Books

1	Bhuvan Unhelkar, Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.
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2	Woody Leonhard, Katherine Murray, Green Home computing for dummies, August 2012.
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3	Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM rebook, 2011.
4	Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
5	Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

CIE Assessment:

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

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

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

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

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

CO-PO Mapping

CO/P O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3				1							2
CO2	3	3	3						1		1	2
CO3	2	2	2	1	3						1	3
CO4	3	2	3							2	3	2
CO5	3	2	3							2	3	2

High-3, Medium-2, Low-1

Course Title	Wireless Sensor & Adhoc Network	Semester	VI
Course Code	MVJ20IS651	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 1 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

Understand the design issues in ad hoc and sensor networks.

Learn the different types of MAC protocols.

Be familiar with different types of ADHOC routing protocols.

Be expose to the TCP issues in ADHOC networks.

Learn the architecture and protocols of wireless sensor networks.

Module-1	L1,L2,L3	12 Hours
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Syllabus Content:

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

Application: Television remote control, Wi-Fi, Cell phones, wireless power transfer, computer interface device

Video Link: <http://coset.tsu.edu/lab35/>

Module-2	L1,L2,L3	12 Hours
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Syllabus Content:

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based

protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11 Application: Enhancing Learning Using Modular Wireless Sensor Networking (WSN) Video Link: http://faculty.cs.tamu.edu/ajiang/sensor.pdf		
Module-3	L1,L2,L3	12 Hours
Syllabus Content: Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks. Application: Video Link: https://link.springer.com/chapter/10.1007/978-3-642-11723-7_34		
Module-4	L1,L2,L3	12 Hours
Syllabus Content: Single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4 Application: An Experimental Study of Low-Power Wireless Sensor Networks Video Link: https://hal.inria.fr/hal-01147346/file/main.pdf		
Module-5	L1,L2,L3	12 Hours
Syllabus Content: Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization- absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design- Synchronization-Transport Layer issues. Application: Research study on choosing an experimentation platform for wireless sensor networks Video Link: https://www.youtube.com/watch?v=3V19nPxpMp8&lc=Ugij232bvNB14ngCoAEC		

Practical Experiments:

An Experimental Study of Low-Power Wireless Sensor Networks

Enhancing Learning Using Modular Wireless Sensor Networking (WSN)

Research study on choosing an experimentation platform for wireless sensor networks

Course outcomes:

CO1	Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
CO2	Analyze the protocol design issues of ad hoc and sensor networks
CO3	Design routing protocols for ad hoc networks with respect to some protocol design issues
CO4	Design routing protocols for wireless sensor networks with respect to some protocol design issues
CO5	Evaluate the QoS related performance measurements of ad hoc and sensor networks

Text/Reference Books:

1.	C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008, 89
2.	Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
3.	Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication - 2002.
4.	Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005
5.	Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.

CIE Assessment:

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

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

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

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

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	TCP/IP Protocol Suit	Semester	VI
Course Code	MVJ20IS652	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 1 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

Protocols and standards

Know about host resolving protocols and packet deliver

To understand the functions of UDP, TCP protocols

To get the knowledge about network management protocols

To get the knowledge about FTP

Module-1

L1,L2,L3

12
Hours

Syllabus Content:

Standards – Internet – History- OSI model – Protocol suite – Addressing – Transmission media – Local Area and Wide Area Networks – Switching – Connecting devices – IP addressing

Application: Identify the IP address of an existing web check

Video Link: <https://www.youtube.com/watch?v=Jlc4E5zxCHQ>

Module-2

L1,L2,L3

12
Hours

Syllabus Content:

Subnetting – Supernetting – IP packets – Delivery – Routing – Routing model – Routing table – Datagram – Fragmentation – Checksum – IP Design – ARP – RARP – Internet control message protocol – Internet group management protocol

Application: Relieve network congestion

Video Link: <https://www.youtube.com/watch?v=Ct4PU6CyyTQ>

Module-3	L1,L2,L3	12 Hours
<p>Syllabus Content:</p> <p>User Datagram protocol – UDP operation – Use – UDP design – TCP services – Flow control – Error control – TCP operation and design – connection – Transition diagram – Congestion control.</p> <p>Application: Routing update protocols</p> <p>Video Link: NPTEL: https://www.youtube.com/watch?v=f1y25BfOH9I</p>		
Module-4	L1,L2,L3	12 Hours
<p>Syllabus Content:</p> <p>Concurrency – BOOTP – DHCP – Domain name system – Name space – Distribution – Resolution – Messages – Telnet – Rlogin – Network Virtual Terminal – Character Set – Controlling the server – Remote login.</p> <p>Application: Automate the process of configuring devices on IP networks</p> <p>Video Link: NPTEL: https://www.youtube.com/watch?v=8LegAH_ppsA</p>		
Module-5	L1,L2,L3	12 Hours
<p>Syllabus Content:</p> <p>File Transfer Protocol – Connections – Communication – Simple Mail Transfer Protocol – Simple Network Management Protocol – Hyper Text Transfer Protocol – Transaction – Request and Response messages.</p> <p>Application: Network protocol for transferring files between computers over a TCP/IP</p> <p>Video Link: NPTEL: https://www.youtube.com/watch?v=6uzEsZNUfmk</p>		
<p>Hands on experiment :</p> <p>Implementation of Client server technology.</p> <p>Implementation of online result system(Using tomcat server/servlet)</p> <p>Demo using remote file access.</p>		

CCNA – certification course	
Course outcomes:	
CO1	Importance of standards for data transmission
CO2	Know about how the node to node data transmission occur
CO3	Get knowledge about where and how to use TCP and UDP protocols
CO4	Get the knowledge about Network administration
CO5	How to use FTP for transfer files between systems.

Text/Reference Books:	
1.	Behrouz A. Forouzan, "TCP/IP Protocol Suite", Tata McGraw Hill Edition 2000.
2.	Douglas E. Comer, David L. Stevens, "Internetworking with TCP/IP – Volume I, II and III", Prentice-Hall of India Pvt. Ltd., 2nd Edition 1994

CIE Assessment:
<p>CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests</p> <p>Quizzes/mini tests (4 marks)</p> <p>Mini Project / Case Studies (8 Marks)</p> <p>Activities/Experimentations related to courses (8 Marks)</p>
SEE Assessment:
<p>Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.</p> <p>Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.</p> <p>One question must be set from each unit. The duration of examination is 3 hours</p>

CO-PO Mapping												
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1		2										2
CO2			2									
CO3		2			2						2	
CO4				2								
CO5						2						

High-3, Medium-2, Low-1

Course Title	Programming Language Principles	Semester	VI
Course Code	MVJ20IS653	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 1 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Learn constructs in a language.

Understand data, data types, and basic statements and understand call-return Statements, ways of implementing them.

Design a new construct/ language.

Choose appropriate language for real world problem solving, based on the required features.

Evaluate various language design features considering the programming paradigm.

Module -1

L1,L2,L3

**12
Hours**

Reasons for Studying, Concepts of Programming Languages, Programming Domains, Language Evaluation Criteria, Influences on Language Design, Language Categories, Programming Paradigms – Imperative, Object Oriented, Functional Programming, Logic Programming, Programming Language Implementation – Compilation and Virtual Machines, Programming Environments. Names, Binding, Type Checking and Scopes: Names, Variables, Binding of Attributes to Variables, Type Bindings, Type Inferencing, Type Checking, Strong Typing

Application: Developing application or System Software's.

Video Link:

<https://www.freecodecamp.org/news/what-exactly-is-a-programming-paradigm/>

<https://nptel.ac.in/courses/106/102/106102067/>

Module -2	L1,L2,L3	12 Hours
<p>Type Equivalence, Scope, Scope and Lifetime, Referencing Environments. Data types: Introduction, Primitives, Character, User Defined, Array, Associative, Record, Union, Pointer and Reference Types, Design and Implementation Issues Related to These Types, Names, Variable, Concept of Binding, Type Checking, Strong Typing, Type Compatibility, Named Constants, Variable Initialization. Expressions and Statements: Short Circuit Evaluation, Mixed Mode Assignment, Assignment Statements, Cascading Operators.</p> <p>Application: Developing application or System Software's</p> <p>Video Link: https://www.digimat.in/nptel/courses/video/106102067/L40.html</p>		
Module - 3	L1,L2,L3	12 Hours
<p>Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, Guarded Commands. Subprograms and Blocks: Fundamentals of Subprograms, Scope and Lifetime of Variable, Static and Dynamic Scope, Design Issues of Subprograms and Operations, Local Referencing Environments, Parameter Passing Methods, Overloaded Subprograms, Generic Subprograms, Parameters that are Subprogram Names.</p> <p>Application: Developing application or System Software's</p> <p>Video Link: https://www.digimat.in/nptel/courses/video/106102067/L22.html</p>		
Module-4	L1,L2,L3	12 Hours
<p>Design Issues for Functions, User Defined Overloaded Operators, Co-Routines and Function Closures. Abstract Data types: Abstractions and Encapsulation, Introduction to Data Abstraction, Design Issues, Object Oriented Concepts with Reference to Java and Python.</p> <p>Application: Developing application or System Software's</p> <p>Video Link: https://nptel.ac.in/courses/106/105/106105153/</p>		

Module-5	L1,L2,L3	12 Hours
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Exception handling: Exceptions, Specifications, Exception Propagation. Logic Programming Language: Introduction and Overview of Logic Programming, Basic Elements of Prolog, Application of Logic Programming. Functional Programming Languages: Introduction, Fundamentals of FPL, Applications of Functional Programming Languages and Exploration of the Features, Comparison of Functional and Imperative Languages.

Application: Developing application or System Software's

Video Link:

<https://nptel.ac.in/courses/106/105/106105191/>

https://www.vssut.ac.in/lecture_notes/lecture1424085009.pdf

Practical Experiments:

Programs on Array

Programs on Function

Programs on Control Structure

Programs on overloaded operators

Programs on Object Oriented Concepts with Reference to Java and Python.

Course outcomes:

CO1	Choose a particular language for problem solving depending on the application domain.
CO2	Analyze and compare programming language concepts.
CO3	Analyze the implementation issues related to a language design.
CO4	Identify the language design features of any language and evaluate them.
CO5	Identify language features required for supporting various paradigms.

Text/Reference Books:

1.	Concepts of Programming Languages", Robert W Sebesta, Pearson Education, 10th Edition, 2012
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2.	Programming Language Pragmatics”, Michael L Scott, Elsevier, 3rd Edition, 2009.
3.	Programming Languages Design and Implementation”, Pratt, Zelkowitz, Prentice Hall/ Pearson Education, 4th Edition, 2001.

CIE Assessment:

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

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

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

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

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

CO-PO Mapping

CO/P	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
O	1	2	3	4	5	6	7	8	9	0	1	2
CO1	3	3	3	2	3					2		
CO2	3	3	3	2	3					2		
CO3	3	3	2	2	3					2		
CO4	3	3	2	2	3					2		
CO5	3	3	3	2	3					2		

High-3, Medium-2, Low-1

Course Title	Free and Open-Source Software	Semester	VI
Course Code	MVJ20IS654	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Learn about Open Source Software

Open Source Software Licensing

Legal Issues and Software Licensing

Software Development models in Open Source Software

Open Source Software Practice

Module -1	L1,L2,L3	12 Hours
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Open Source Licensing, Contract, and Copyright Law: Basic Principles of Copyright Law - Contract and Copyright - Open Source Software Licensing - Issues with Copyrights and Patents - The Open Source Definition – Warranties.

The MIT, BSD, Apache, and Academic Free Licenses: The MIT (or X) License - The BSD License - The Apache License, v1.1 and v2.0 17 - The Academic Free License - Application and Philosophy.

The GPL, LGPL, and Mozilla Licenses: GNU General Public License -

GNU Lesser General Public License - The Mozilla Public License 1.1 (MPL 1.1) - Application and Philosophy

Application: Make the informed decision to choose the right budget friendly software to meet the required need by understanding open source rules and copyrights.

Video Link:

<https://www.gnu.org/licenses/license-list.en.html>

Module -2	L1,L2,L3	12 Hours
<p>The Q Public License - Artistic License (Perl) - Creative Commons Licenses. Non-Open Source Licenses: Classic Proprietary License - Sun Community Source License - Microsoft Shared Source Initiative</p> <p>Application: Make the informed decision to choose the right budget friendly software to meet the required need for office automation, web design, content management</p> <p>Video Link: https://doc.qt.io/qt-5/licenses-used-in-gt.html</p>		
Module - 3	L1,L2,L3	12 Hours
<p>Entering Contracts - Statutory Developments Related to Software Contracts - The Self-Enforcing Nature of Open Source and Free Software Licenses - The Global Scope of Open Source and Free Software Licensing - The "Negative Effects" of Open Source and Free Software Licensing - Community Enforcement of Open Source and Free Software Licenses - Compatible and Incompatible Licensing: Multiple and Cross Licensing</p> <p>Application: Make the informed decision to choose the right budget friendly software to meet the required need by understanding complete legal terms and conditions and its impact if a open source software is selected.</p> <p>Video Link: https://resources.whitesourcesoftware.com/blog-whitesource/open-source-licenses-explained</p>		
Module-4	L1,L2,L3	12 Hours
<p>Models of Open Source and Free Software Development – Forking - Choosing an Open Source or Free Software License - Drafting Open Source Licenses</p> <p>Application: Make the informed decision to choose the right budget friendly software to meet the required need by understanding complete legal terms and</p>		

conditions and its impact if a open source software is selected for software development and its commercial use.

Video Link:

<https://mogod.com/understanding-open-source-and-free-software-licensing/>

Module-5	L1,L2,L3	12 Hours
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MySQL – Open Source Tools: - Joomla-components-themes-template-webpage design.

Programming Language: Intro to Python Data types-data structures- Subroutines- Python-files-object oriented programming using Python.

Application: Office automation, web design, content management ,Data Science

Video Link:

https://eprints.qut.edu.au/13673/1/open_source_book.pdf

Practical Experiments:

Hands-On (Linux software installation)

Hands-On training - Python

Hands-On (My Sql install ,create a schema, Create Table etc)

Develop Web Application with MVC Architecture Using only Open Source Software or Tools.

Do a market Survey and arrive top 3 most used open source Databases and Scripting Languages also list down five pros and cons for each open source Software.

Course outcomes:

CO1	Distinguish the different between Free and Non-Free Software
CO2	Licensing about open source software
CO3	Consequences of pirated software
CO4	Open source software development models
CO5	Can develop database and programming using Python.

Text/Reference Books:	
1.	Andrew M. St. Laurent, Understanding Open Source and Free Software Licensing, O'relly media, 2011.
2.	Larry Ullman, PHP and MySQL for Dynamic Web Sites: Visual QuickPort Guide, 2011, 4th Edition, Peachpit Press.
3.	Dr. Martin Jones, Python for complete beginners, 2015, First edition, Create Space Independent Publishing Platform.
4.	Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", Sixth Edition, O'Reilly Media, 2009.

CIE Assessment:
<p>CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests</p> <p>Quizzes/mini tests (4 marks)</p> <p>Mini Project / Case Studies (8 Marks)</p> <p>Activities/Experimentations related to courses (8 Marks)</p>
SEE Assessment:
<p>Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.</p> <p>Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.</p> <p>One question must be set from each unit. The duration of examination is 3 hours.</p>

CO-PO Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	3	3	2	3					2		
CO2	3	3	3	2	3					2		
CO3	3	3	2	2	3					2		
CO4	3	3	2	2	3					2		
CO5	3	3	3	2	3					2		

High-3, Medium-2, Low-1

Course Title	Artificial Intelligence Laboratory	Semester	VI
Course Code	MVJ20ISL66	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

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

Demonstrate PROLOG in AI

Compare and contrast different AI techniques available.

Demonstrate learning algorithms

Design different learning algorithms for improving the performance of AI systems.

Implement projects using different AI learning techniques.

Sl No	Experiment Name	RBT Level	Hours
1	Study of PROLOG.	L3	4
2	Write simple fact for the statements using PROLOG.	L3	4
3	Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below	L3	4
4	Write a program to solve the Monkey Banana problem.	L3	4
5	WAP in turbo PROLOG for medical diagnosis and show the advantage and disadvantage of green and red cuts.	L3	4
6	WAP to implement factorial, Fibonacci of a given number.	L3	4
7	Write a program to solve 4-Queen problem.	L3	4
8	Write a program to solve traveling salesman problem	L3	4
9	Write a program to solve water jug problem using LISP	L3	4
10	Implement mini project using PROLOG	L3	4

Course outcomes:

CO1	Demonstrate PROLOG commands
CO2	Apply AI search Models and Generic search strategies.

CO3	Write Logic for representing Knowledge and Reasoning of AI systems.
CO4	Design different learning algorithms for improving the performance of AI systems.
CO5	Implement projects using different AI learning techniques.

CIE Assessment:

Regular Lab work :20

Record writing :5

Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)

Viva 10 marks

SEE Assessment:

Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be,

Write-up : 20 marks

Conduction : 40 marks

Analysis of results : 20 marks

Viva : 20

CO-PO Mapping

CO/P O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	3	3		2							
CO2	2	2	3		2							
CO3	3	2	3		2							
CO4	2	1	3		2							
CO5	2	1	3		2							

High-3, Medium-2, Low-1

Course Title	Internet of Things Laboratory	Semester	VI
Course Code	MVJ20ISL67	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

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

Install IoT applications and handling IoT tools.

Illustrate the methods of deploying smart objects and connect them to network.

Compare different Application protocols for IoT.

Infer the role of Data Analytics and Security in IoT.

Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

Sl No	Experiment Name	RBT Level	Hours
1	Create a program that blinks the LED on the Arduino development board. Create a program that blinks the LED on the Raspberry Pi development board using	L3	4
2	Create a program that sensor can able to communicate with the attached PC. Use a serial terminal for the communication. Create a program that displays data from the sensor in regular intervals in a compact format.	L3	4
3	Develop one-one connection from the available sensors and actuators and create code that will display the sensed data on the PC using Arduino	L3	4
4	Attach the radio unit to the board. The radio uses SPI bus. Identify and connect the appropriate pins. Take care about interference between sensor and the radio! And Check the	L3	4

	operation of the communication at the gateway. Check that the communication is working bidirectionally.		
5	Creating a virtual device: Login to devicehub.net and create a project then create a virtual device. Add the corresponding sensor and actuator to the virtual device. Take note of the IDs and data required for accessing the virtual devices. Examine how the virtual sensors and actuators can be reached using MQTT protocol.	L3	4
6	Create a connection from an MQTT capable device/software with an MQTT broker then send and receive data using it. The PCs have MQTTfx installed but other software can be used as well. Send and receive messages to/from the virtual device. The format and channel of the messages are detailed in the syllabus.	L3	4
7	Develop a program that your Raspberry Pi interact with online services through the use of public APIs and SDKs.	L3	4
8	Develop Python-based IDE (integrated development environments) for the Raspberry Pi. Trace and debug Python code on the device	L3	4
9	Develop a project using IoT devices and Cloud for automation	L3	4
10	Developing a simple automation project using Arduino Uno Or Raspberry Pi for Agriculture irrigation using various related sensors	L3	4

Course outcomes:

CO1	Learn and understand IoT applications and tools
CO2	Interfacing Sensor and Actuator with Arduino and Raspberry Pi development board.
CO3	Implementing IoT device by interfacing communication modules

CO4	Developing real time examples using Python
CO5	Elaborate the use of smart objects for designing smart systems

CIE Assessment:

Regular Lab work :20

Record writing :5

Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)

Viva 10 marks

SEE Assessment:

Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be,

Writeup : 20 marks

Conduction : 40 marks

Analysis of results : 20 marks

Viva : 20

CO-PO Mapping

CO/P O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	3	3	3	2							
CO2	3	3	3	2	2	2						
CO3	3	3	3	3	2							
CO4	2	1	3		2							
CO5	2	1	3		2							

High-3, Medium-2, Low-1