



MVJCE CURRICULUM

FOR

**COMPUTER SCIENCE &
ENGINEERING(Scheme 2020)**

VII SEMESTER

Course Title	INTERNET OF THINGS	Semester	07
Course Code	MVJ20CS71	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 2: 0)	Total	100
Credits	4	Exam. Duration	3 Hours

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

- Learn the basic issues, policy and challenges in the Internet.
- Get an idea of some of the application areas where Internet of Things can be applied.
- Understand the cloud and internet environment.
- Understand the various modes of communications with Internet.

Module-1

L1,L2, L3

Hours 10

Prerequisites : Basic Knowledge about C or C++

Introduction to IoT: Definition Foundations Challenges and Issues – Identification – Security. Components in internet of things: Control Units Sensors Communication modules Power Sources Communication Technologies RFID Bluetooth Zigbee Wifi Rlinks Mobile Internet Wired Communication-IoT Platform Overview-Raspberry pi-Arduino boards.*

Applications: Sensors in IoT.

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

- <http://www.theinternetofthings.eu/what-is-the-internet-of-things>.
- https://www.engineersgarage.com/article_page/sensors-different-types-of-sensors/

- <https://www.educba.com/applications-of-sensors/>

*** Programming Assignments are Mandatory.**

Module-2

L2, L3

Hours 10

IoT Protocols: Protocol Standardization for IoT-M2M and WSN Protocols-SCADA and RFID Protocols-Issues with IoT Standardization-Protocols-IEEE 802.15.4-BACNet Protocol-Zigbee Architecture - Network layer APS Layer Security.*

Applications:

IoT Protocol Applications

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

- <https://inductiveautomation.com/resources/article/what-is-scada>
- <https://iotbytes.wordpress.com/application-protocols-for-iot/>
- <https://data-flair.training/blogs/iot-protocols/>
- <https://www.avsystem.com/blog/iot-protocols-and-standards/>

*** Programming Assignments are Mandatory.**

Module-3

L2, L3, L4

Hours 10

Resource Management in the Internet of Things: Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects.*

Applications: RFID Applications

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

RFID Applications:

- <https://www.digiteum.com/rfid-technology-internet-of-things>
- <https://www.uio.no/studier/emner/matnat/ifi/INF5910CPS/h10/undervisningsmateriale/RFID-IoT.pdf>

*** Programming Assignments are Mandatory.**

Module-4

L3, L4, L6

Hours 10

Case Study and IoT Application Development: IoT applications in home- infrastructures security- Industries- IoT electronic equipment's. Use of Big Data and Visualization in IoT Industry 4.0 concepts - Sensors and sensor Node Interfacing using Raspberry Pi/Arduino- Web Enabled Constrained Devices.*

Laboratory Sessions/ Experimental learning:Interfacing using Raspberry Pi/Arduino

Applications: Elements in group

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

- <https://www.simform.com/home-automation-using-internet-of-things/>
- <https://iot5.net/iot-applications/smart-home-iot-applications/>
- <https://maker.pro/raspberry-pi/tutorial/how-to-connect-and-interface-raspberry-pi-with-arduino#>
- <https://create.arduino.cc/projecthub/ruchir1674/how-to-interface-arduino-with-raspberrypi->

504b06

*** Programming Assignments are Mandatory.**

Module-5

L4,L5,L6

Hours 10

Web of Things: Web of Things versus Internet of Things–Architecture Standardization for WoT–Platform Middleware for WoT– WoT Portals and Business Intelligence–Cloud of Things: Grid/SOA and Cloud Computing–Cloud Standards Cloud of Things Architecture–Open Source e–Health sensor platform.

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

- <https://www.water-io.com/iot-vs-wot>
- <https://www.talend.com/resources/iot-cloud-architecture/>

*** Programming Assignments are Mandatory.**

Course Outcomes:

CO1 Identify the components of IoT.

CO2 Analyze various protocols of IoT.

CO3 Design portable IoT using appropriate boards

CO4 Develop schemes for the applications of IOT in real time scenarios.

CO5 Design business Intelligence and Information Security for WoT

Text Books:

1 Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" –CRC Press–2012.

2 Dieter Uckelmann, Mark Harrison, "Architecting the Internet of Things", Springer2011.

3 Arshdeep Bahga, Vijay Madiseti, "Internet of Things (A Hands-On-Approach)", VPT, 2014.

4 Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things Key applications Protocols", Wiley, 2012.

5 Luigi Atzori, Antonio Lera, Giacomo Morabito, "The Internet of Things: A Survey", Journal on Network Elsevier Publications, October, 2010.

Reference Books:

1 Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" –CRC Press–2012.

2 Dieter Uckelmann, Mark Harrison, "Architecting the Internet of Things", Springer2011.

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5 Luigi Atzori, Antonio Lera, Giacomo Mo
Elsevier Publications, October, 2010.

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:

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

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	2	3
CO4	3	3	3	3	-	-	-	2	2	2	-	3	1	3
CO5	3	3	3	3	-	-	2	2	3	2	-	3	2	2

High-3, Medium-2, Low-1

Course Title	MACHINE LEARNING	Semester	07
Course Code	MVJ20CS72	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 2 : 0)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to: *This course will enable students 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

Hours 10

Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

Laboratory Sessions/ Experimental learning:

To understand purpose, give real time dataset(problem) and ask to students to solve in class room.

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

- <https://www.youtube.com/watch?v=rQ3oi9g8a1Y>
- <https://www.youtube.com/watch?v=h0e2HAPTGF4>

Module-2

L1,L2, L3

Hours 10

Decision Tree Learning

Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Laboratory Sessions/ Experimental learning:

Ask students to design a Decision Tree using freely available dataset or problem in classroom.

Video link / Additional online information (related to module if any):		
<ul style="list-style-type: none"> • https://www.youtube.com/watch?v=qDcl-FRnwSU • https://www.youtube.com/watch?v=FujVLsZYkuE 		
Module-3	L1,L2, L3	Hours 10
<p>Bayesian Learning and Evaluating Hypotheses</p> <p>Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.</p> <p>Evaluating Hypotheses: Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis</p> <p>Laboratory Sessions/ Experimental learning:</p> <p>Ask the students to build Bayes Belief Networks for real time problem in class room.</p> <p>Video link / Additional online information (related to module if any):</p> <ul style="list-style-type: none"> • https://www.youtube.com/watch?v=480a_2jRdK0 • https://www.youtube.com/watch?v=E3l26bTdtxl 		
Module-4	L1,L2, L3	Hours 10
<p>Artificial Neural Networks and Instance based Learning</p> <p>Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm. Instanced Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression.</p> <p>Laboratory Sessions/ Experimental learning:</p> <p>Give real time problem and ask students to design an ANN using perceptrons.</p> <p>Video link:</p> <ul style="list-style-type: none"> • https://www.youtube.com/watch?v=xbYgKoG4x2g&list=PL53BE265CE4A6C056. • https://www.youtube.com/watch?v=BRMS3T11Cdw&list=PL3pGy4HtqwD2a57wl7Cl7tmfxfk7JWJ9Y 		
Module-5	L1 ,L2,L3	Hours 10
<p>Reinforcement Learning and Deep Learning : Reinforcement Learning: Introduction, Learning Task, Q Learning.</p> <p>Deep Learning: Introduction to Deep Learning-Reasons to go Deep Learning, Introduction to Convolution Networks ,Restricted Boltzmann Machines, Deep Belief Nets, Recurrent Nets.</p> <p>Video link:</p> <ul style="list-style-type: none"> • https://www.youtube.com/watch?v=TIIDzLZPyhY&list=PLyqSpQzTE6M_FwzHF_Ayf4LSkz_ljMyjD9 		

- https://www.youtube.com/watch?v=iOh7QUZGyiU&list=PLqYmG7hTraZDNjre23vqCGIVpfZ_K2RZs

Course Outcomes:

CO1	Identify the issues in machine learning and Algorithms for solving it.
CO2	Explain theory of probability and statistics related to machine learning.
CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q, Learning.
CO4	Identify the difference between Machine Learning and Deep Learning and using scenario
CO5	Explain the concepts of Q learning and deep learning

Text Books:

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

CIE Assessment:

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- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

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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/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO1	3	-	-	-	1	-	-	-	-	-	-	2	-	-
CO2	3	3	3	-	-	-	-	-	1	-	1	2	1	-
CO3	2	2	2	1	3	-	-	-	-	-	1	3	-	1
CO4	3	2	3	-	-	-	-	-	-	2	3	2	-	-
CO5	3	2	3	-	-	-	-	-	-	2	3	2	2	-

High-3, Medium-2, Low-1

Course Title	GREEN COMPUTING	Semester	07
Course Code	MVJ20CS731	CIE	50

Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	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

Module-1	L1,L2, L3	Hours 8
<p>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.</p> <p>Real Time Applications: how they keep data safe while in transit</p> <p>Video link / Additional online information:</p> <ul style="list-style-type: none"> • https://nptel.ac.in/courses/106/104/106104182/ • https://www.youtube.com/watch?v=350Rb2sOc3U 		
Module-2	L1,L2, L3	Hours 8
<p>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.</p> <p>Real Time Applications: climate-smart agriculture, land restoration, groundwater management, ecosystem-based adaptation</p> <p>Video link / Additional online information:</p> <ul style="list-style-type: none"> • https://nptel.ac.in/courses/110/107/110107128/ • https://nptel.ac.in/courses/110/107/110107093/ 		
Module-3	L1,L2, L3	Hours 8
<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> <ul style="list-style-type: none"> • https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee42/ • https://onlinecourses.nptel.ac.in/noc19_ee64/preview 		
Module-4	L1,L2, L3	Hours 8

GREEN COMPLIANCE : Socio-cultural aspects of Green IT Green Enterprise Transformation Roadmap
 Green Compliance: Protocols, Standards, and Audits Emergent Carbon Issues: Technologies and Future.

Real Time Applications: Addressing Inconsistent Date Formats, Reducing False Positives in PEP Screening, Integrating Screening with Credit Card Approval Processes.

Video link / Additional online information:

- https://onlinecourses.nptel.ac.in/noc19_ee64/preview

Module-5	L1,L2, L3	Hours 8
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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.

Real Time Applications: The energy consumption in Torrent systems with malicious 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/>

Course Outcomes:

CO1	Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
CO2	Enhance the skill in energy saving practices in their use of hardware.
CO3	Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
CO4	Understand the ways to minimize equipment disposal requirements.
CO5	Carry out multiple real time case studies.

Text Books:

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

Reference Books:

1	Bhuvan Unhelkar, Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.
2	Woody Leonhard, Katherine Murray, Green Home computing for dummies, August 2012.
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:

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- Mini Project / Case Studies (8 Marks)
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CO1	3	-	-	-	1	-	-	-	-	-	-	2	1	-
CO2	3	3	3	-	-	-	-	-	1	-	1	2	2	-
CO3	2	2	2	1	3	-	-	-	-	-	1	3	2	3
CO4	3	2	3	-	-	-	-	-	-	2	3	2	2	-
CO5	3	2	3	-	-	-	-	-	-	2	3	2	1	2

High-3, Medium-2, Low-1

Course Title	ETHICAL HACKING	Semester	07
Course Code	MVJ20CS641	CIE	50
Total No. of Contact Hours	40	SEE	50

No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Understand numerous methods of real-world information intelligence
- Learn about vulnerability scanners
- Understand techniques used to sniff traffic across a network
- Familiarize with the methodologies that can be used to hack into a target.
- Appreciate the wide variety of attacks that can be performed against a wireless network

Module-1

L1,L2 ,L3

Hours 8

INTRODUCTION TO HACKING :Terminologies, Categories of Penetration Test, Writing Reports, Structure of a Penetration Testing Report, Vulnerability Assessment Summary, Risk Assessment, Methodology, Linux Basics: File Structure, Cron Job, Users, Common Applications , BackTrack, Services.

Applications: Network packet analysis, Password guessing and cracking

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_process.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_hacker_types.htm

Module-2

L2,L3

Hours 8

INFORMATION GATHERING, TARGETENUMERATION AND PORT SCANNING TECHNIQUES

Active, Passive and Sources of information gathering, Copying Websites Locally, NeoTrace, Cheops-ng, Intercepting a Response, WhatWeb, Netcraft, Basic Parameters, Xcode Exploit Scanner, Interacting with DNS Servers, Fierce, Zone Transfer with Host Command and Automation, DNS Cache Snooping- Attack Scenario, Automating Attacks, SNMP – Problem, Sniffing Passwords, Solar Winds Toolset, sweep, Brute Force and Dictionary- Tools , Attack, Enumeration, Intelligence Gathering Using Shodan, Target enumeration and Port Scanning Techniques.

Applications: Session hijacking, Session spoofing

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_enumeration.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sniffing.htm

Module-3

L2,L3,L4

Hours 8

VULNERABILITY ASSESSMENT & NETWORKSNIFFING : Introduction to Vulnerability Assessment – Pros and Cons, NMap, Updation of database, Testing SCADA Environments with Nmap, Nessus, Sniffing: Types, Hubs versus Switches, Modes, MITM Attacks, ARP Protocol Basics- working, Attacks, DoS Attacks, Dsniff tool, Using ARP Spoof to Perform MITM Attacks, Sniffing the Traffic with Dsniff, Sniffing Pictures with Drifnet, Urlsnarf and Webspay, Sniffing with Wireshark, Ettercap- ARP Poisoning, Hijacking Session with MITM Attack, ARP Poisoning with Cain and Abel, Sniffing Session Cookies with

Wireshark, Hijacking the Session, SSL Strip: Stripping HTTPS Traffic, Requirements, Automating Man in the Middle Attacks, DNS Spoofing, DHCP Spoofing

Applications: Network traffic sniffing, Denial of Service attacks

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sniffing.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_tcp_ip_hijacking.htm

Module-4

L3,L4,L6

Hours 8

Understanding Network Protocols: Attacking Network Remote Services, Common Target Protocols, tools for cracking network remote services, Attacking SMTP, Attacking SQL Servers, Client Side Exploitation Methods: E-Mails Leading to Malicious Attachments & Malicious Links, Compromising Client Side Update, Malware Loaded on USB Sticks

Post exploitation: Acquiring Situation Awareness, Privilege Escalation, Maintaining Access, Data Mining, Identifying and Exploiting Further Targets, Windows Exploit DevelopmentBasics.

Applications:Exploiting buffer overflow vulnerabilities

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_sql_injection.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_exploitation.htm

Module-5

L2

Hours 8

WIRELESS &WEBHACKING

Wireless Hacking : Requirements , Aircracking , Hidden SSIDs , Monitor Mode , Monitoring Tool- Beacon Frames on Wireshark ,Airodump-ng , Wireless Adapter in Monitor Mode , Determining the Target , Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng , Capturing Packets and Four-Way Handshake.

Web Hacking : Attacking the Authentication , Brute Force and Dictionary Attacks , Types of Authentication , Crawling Restricted Links , Testing for the Vulnerability , Authentication Bypass with Insecure Cookie Handling , SQL injection, XSS DOM based,BeEF,CSRF, Bypassing CSRF and BeEF with XSS, Vulnerability in FCKeditor, efront.

Applications: Cross Site Scripting, Firewall

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

- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_ddos_attacks.htm
- https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_wireless.htm

Course Outcomes:

CO1	Understand the core concepts related to malware, hardware and software vulnerabilities and their causes
CO2	Understand ethics behind hacking and vulnerability disclosure
CO3	Appreciate the Cyber Laws and impact of hacking Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies
CO4	Learn & understand different network protocols and attack strategies

CO5

Understanding the usefulness of wireless & web hacking

Text Books:

1	Rafay Baloch , Ethical Hacking and Penetration Testing Guide CRC Press, 2015.
2	Patrick Engebretson, The Basics of Hacking and Penetration Testing : Ethical Hacking and Penetration Testing Made Easy , Syngress Media, Second Revised Edition, 2013.

Reference Books:

1	Michael T. Simpson, Kent Backman, James E. Corley, Hands On Ethical Hacking
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CO4	3	3	3	3	-	3	2	2	2	2	-	3	2	-
CO5	3	3	3	3	-	3	2	2	3	2	-	3	2	-

High-3, Medium-2, Low-1

Course Title	DIGITAL FORENSICS	Semester	07
Course Code	MVJ20CS733	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- Examine digital evidences such as the data acquisition, identification analysis.

Module-1	L2	Hours 8
Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence		

and courts, legal concerns and private issues.

Laboratory Sessions/ Experimental learning:

Familiarization with any one digital forensics tool

Video link / Additional online information:

- <https://www.youtube.com/watch?v=2ESqwX3qb94->
- <https://nptel.ac.in/courses/106/104/106104119/>

Module-2

L2,L3

Hours 8

Understanding Computing Investigations Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Laboratory Sessions/ Experimental learning:

Case Study on cybercrime Investigation

Video link / Additional online information:

- <https://www.coursera.org/lecture/cyber-conflicts/introduction-to-cybercrime-and-fundamental-issues-xndSq>
- <https://www.youtube.com/watch?v=VoeLc5295XU>
- <https://www.youtube.com/watch?v=l77AgiphUQo>

Module-3

L2,L3

Hours 8

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Laboratory Sessions/ Experimental learning:

Studying different cases where IPR and laws are applied.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=qJ693ZlvceA>
- <https://www.youtube.com/watch?v=6vNxslcf9AE>

Module-4

L2,L3

Hours 8

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Laboratory Sessions/ Experimental learning:

Case study on protection of copyright on cyberspace

Video link / Additional online information:

- <https://nptel.ac.in/courses/109/105/109105112/>
- <https://nptel.ac.in/courses/109/105/109105112/>
- <https://nptel.ac.in/courses/106/106/106106129/>

Module-5

L2

Hours 8

Current computer forensics tools- software, hardware tools, validating and testing forensic software,

addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Laboratory Sessions/ Experimental learning:Email Forensics

Video link / Additional online information:

- <https://www.lawctopus.com/video-lectures-law-sudhir-law-review/>
- <https://www.youtube.com/watch?v=wV2OiOM3q3k>

Course Outcomes:

CO1	Analyze Computer Crime and Criminals and Liturgical Procedures
CO2	Apply the laws and regulations to the applications
CO3	Analyze the email tracking cyber applications
CO4	Understanding the protection of Intellectual Property Rights
CO5	To be well-trained as next-generation computer crime investigators.

Text Books:

1	Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2	Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

Reference Books:

1	Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
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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/PSO Mapping

CO/PO	POT1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POT0	POT1	POT2	PSO1	PSO2
CO1	2	2	-	3	-	2	-	2	-	-	-	2	2	-
CO2	3	3	-	3	2	2	-	3	-	-	-	2	2	-
CO3	2	2	2	2	-	3	3	3	-	-	-	2	3	-
CO4	3	3	2	3	-	-	-	3	-	-	-	-	3	-
CO5	3	3	-	3	-	-	-	3	-	-	-	2	-	-

High-3, Medium-2, Low-1

Course Title	SOFT COMPUTING	Semester	07
Course Code	MVJ20CS734	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100

Credits	3	Exam. Duration	3 Hours
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<p>Course objective is to: <i>This course will enable students to</i></p> <ul style="list-style-type: none"> • Understand soft computing concepts and techniques and foster their abilities in designing and implementing soft computing based solutions for real–world and engineering problems. • Understand fuzzy systems, fuzzy logic and its applications • Learn about Artificial Neural Networks and various categories of ANN. • Learn about Genetic Algorithms and optimization problems. • Learn about Computational Intelligence Paradigms and applications of CI 		
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Module–1	L1 ,L2,L3,L4	Hours 8
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<p>INTRODUCTION TO SOFT COMPUTING: Evolution of Computing, Concept of computing systems. Soft Computing Constituents, From Conventional AI to Computational Intelligence, Machine Learning Basics, Some applications of Soft computing techniques</p> <p>Real Time Applications: Framework for predicting analytics on sales forecast using back propagation network</p> <p>Video link:</p> <ul style="list-style-type: none"> • https://onlinecourses.nptel.ac.in/noc20_cs17 • https://www.youtube.com/watch?v=K9gjuXjjeEM 		
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Module–2	L1 ,L2,L3,L4	Hours 8
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<p>NEURAL NETWORKS :</p> <p>Biological neurons and it’s working, Simulation of biological neurons to problem solving. Architecture –: Single Layer and Multilayer –Feed Forward Networks–Training and Learning methods, Applications of ANNs to solve some real life problems.</p> <p>Real Time Applications: Natural Language processing using artificial neural networks</p> <p>Video link:</p> <ul style="list-style-type: none"> • https://nptel.ac.in/courses/106/106/106106184/ • https://www.youtube.com/watch?v=4TC5s_xNKs&feature=emb_logo 		
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Module–3	L1 ,L2,L3,L4	Hours 8
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<p>FUZZY LOGIC : Introduction to Fuzzy logic, Fuzzy Sets, Membership Functions, Operations on Fuzzy sets, Fuzzy Rules and Fuzzification and Defuzzification ,Fuzzy Inference Systems, Fuzzy logic controller design, Some applications of Fuzzy logic.</p> <p>Real Time Applications:</p> <ul style="list-style-type: none"> • Traffic Simulation System Based on Fuzzy Logic • Fuzzy logic rule based medical diagnosis system <p>Video link:</p> <ul style="list-style-type: none"> • https://onlinecourses.nptel.ac.in/noc20_ma48/ 		
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- <https://nptel.ac.in/courses/111/102/111102130/>

Module-4	L1,L2,L3,L4	Hours 8
<p>GENETIC ALGORITHM: Biological background, Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc., classifications and applications of GA, Solving single-objective optimization problems using GAs.</p> <p>Real Time Applications: Solving Combinatorial Optimization Problems Using Genetic Algorithms and Ant Colony Optimization</p> <p>Video link:</p> <ul style="list-style-type: none"> • https://onlinecourses.nptel.ac.in/noc20_cs81 • https://www.youtube.com/watch?v=ra13Sv7XZ3M 		

Module-5	L1,L2,L3,L4	Hours 8
<p>COMPUTATIONAL INTELLIGENCE: Computational Intelligence Paradigms, Swarm Intelligence Techniques, Basic Particle Swarm Optimization, Applications.</p> <p>Real Time Applications: Hybrid Computational Intelligence Systems for Real World Applications</p> <p>Video link:</p> <ul style="list-style-type: none"> • https://nptel.ac.in/courses/106/106/106106126/ 		

Course Outcomes:	
CO1	Learn about soft computing techniques and their applications.
CO2	Analyze various neural network architectures and Understand perceptrons and counter propagation networks.
CO3	Define the fuzzy systems and applications.
CO4	Analyze the genetic algorithms and their applications.
CO5	Analyze Computational Intelligence Paradigms and applications of CI.

Text Books:	
1	Fuzzy Logic: A Practical approach, F. Martin, Mc neill, and Ellen Thro, AP Professional, 2000.
2	Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
3	Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.

Reference Books:	
1	An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
2	Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.
3	Soft Computing, D. K. Pratihari, Narosa, 2008.

4	Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009.
5	Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.
6	Real World Applications of Computational Intelligence, Mircea Gh. Negoita, Bernd Reusch, Part of the Studies in Fuzziness and Soft Computing book series (STUDFUZZ, volume 179)

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:

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

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-	-	-	2	1	-
CO2	3	3	3	-	-	-	-	-	1	-	1	2	2	1
CO3	2	2	2	1	3	-	-	-	-	-	1	3	-	-
CO4	3	2	3	-	-	-	-	-	-	2	3	2	2	1
CO5	3	2	3	-	-	-	-	-	-	2	3	2	2	1

High-3, Medium-2, Low-1

Course Title	DEEP LEARNING	Semester	07
Course Code	MVJ20CS741	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Identify the importance of different classification patters.
- Recognition of patters using multiple techniques.
- Apply classification techniques to develop model for unsupervised learning.
- Apply biometric technology in real time applications.

Module-1	L1,L2 , L3	Hours 8
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Introduction to Deep Learning and Linear Algebra:

Scalars, vectors, multiplying matrices, inverse ,eigen decomposition, SVD(singular value decomposition), PCA, stochastic gradient descent, building a machine learning algorithm Real Time Applications: System memory allocation

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

- <https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod01lec01.mp4>
- <https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod01lec02.mp4>
- <https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod01lec03.mp4>

Module-2

L1,L2 , L3

Hours 8

Deep Feed forward Networks: Learning XOR , Gradient based learning, hidden units , Architecture design, Back propagation and other differentiation algorithms

Real Time Applications: Self Driving Cars, News Aggregation and Fraud News Detection, Natural Language Processing, Virtual Assistants, Entertainment, Visual Recognition, Fraud Detection, Healthcare.

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

- <https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod06lec26.mp4>
- <https://nptel.ac.in/content/storage2/106/105/106105215/MP4/mod06lec27.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod04lec33.mp4>

Module-3

L1,L2 , L3

Hours 8

Optimization for Training Deep Models: how learning differs from optimization, challenges, basic algorithms , parameter initialization strategies, algorithms with adaptive learning rates

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

- <https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod02lec19.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod04lec40.mp4>

Module-4

L1,L2 , L3

Hours 8

Convolutional Networks: The convolution operation, motivation, pooling, variants of basic convolution function, efficient convolution learning algorithms, random or unsupervised features.

Real Time Applications: Social media, online shopping etc.

Video link:

- <https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod10lec86.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod10lec88.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106184/MP4/mod10lec89.mp4>

Module-5

L1,L2 , L3

Hours 8

Deep Learning Research: Probabilistic PCA and factor analysis , independent component analysis, slow feature analysis

Research Ideas:

- Efficient Net: Rethinking Model Scaling for Convolutional Neural Networks
- Deep Learning for Anomaly Detection
- The Deep Learning Revolution and Its Implications for Computer Architecture and Chip Design.

Course Outcomes:

C01	Classify patterns using Bayesian Decision Theory
C02	Recognize patterns using parametric techniques
C03	Perform subspace analysis for classification problems
C04	Choose an appropriate model for unsupervised learning.
C05	Design various biometric technologies for different applications

Text Books:

1	Deep Learning (Adaptive Computation and machine learning series), Ian Goodfellow, Yoshua Bengio and Aaron Courville.
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Reference Books:

1	Deep Learning from Scratch: Building with Python from First Principles, Seith Weidman
2	Deep Learning with python, François Chollet

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/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-	-	-	2	2	-
CO2	3	3	3	2	-	-	-	-	1	-	1	2	1	-
CO3	2	2	2	1	3	-	-	-	-	-	1	3	2	1
CO4	3	2	3	2	1	-	-	-	-	2	3	2	-	-
CO5	3	2	3	1	-	-	-	-	-	2	3	2	1	2

High-3, Medium-2, Low-1

Course Title	NATURAL LANGUAGE PROCESSING	Semester	07
Course Code	MVJ20CS742	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam Duration	3 Hours

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

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

Module-1

L3

Hours 8

INTRODUCTION: Origins and challenges of NLP Language Modelling: Grammar-based LM,

Statistical LM Regular Expressions, Finite-State Automata English Morphology, Transducers forlexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum EditDistance values of real symmetric matrices: Jacobi and Givens method.

Laboratory Session: Word Analysis

Applications: Text to Speech conversion

Video link : <https://nptel.ac.in/courses/106/105/106105158/>

Module-2	L3	Hours 8
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WORD LEVEL AND SYNTACTIC ANALYSIS: Ngrams Models of Syntax – Counting Words – Unsmoothed Ngrams–Smoothing–Back off Deleted Interpolation Entropy EnglishWord Classes – Tag sets for English–Part of Speech Tagging–RuleBased Part of Speech Tagging – Stochastic Part of Speech Tagging – Transformation–Based Tagging –Issues in PoS tagging Hidden Markov and Maximum Entropy models.

Laboratory Session: Morphological Analyzer for a given word

Applications: Speech to text conversion

Video link : <https://nptel.ac.in/courses/106/105/106105158/>

Module-3	L3	Hours 8
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CONTEXT FREE GRAMMARS: Context–Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar Dependency Grammar Syntactic Parsing, Ambiguity, Dynamic Programming parsing Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs Feature structures, Unification of feature structures

Laboratory Sessions: Chunking for a given sentence

Applications: Compiler

Video link : <https://www.youtube.com/watch?v=6b40kKe2SFg>

Module-4	L3	Hours 8
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SEMANTICS AND PRAGMATICS: Representing Meaning – Meaning Structure of Language – First Order Predicate Calculus–Representing Linguistically Relevant Concepts SyntaxDriven Semantic Analysis – Semantic Attachments Syntax Driven Analyzer– Robust Analysis Lexemes and Their Senses – Internal Structure – Word Sense Disambiguation –Information Retrieval.

Laboratory Session: Pragmatic Analysis of a given sentence

Applications: Sentiment Analysis

Video link : <https://www.coursera.org/lecture/human-language/pragmatics-E8VXH>

Module-5

L1,L2, L3

Hours 8

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

Laboratory Session: Sentiment analysis on movie database

Applications: Sentiment analysis

Videolink: <https://www.coursera.org/lecture/text-mining-analytics/5-6-how-to-do-sentiment-analysis-with-sentiwordnet-5RwtX>

Course Outcomes:

CO1	To tag a given text with basic Language features.
CO2	To design an innovative application using NLP components
CO3	To implement a rule-based system to tackle morphology/syntax of a language
CO4	To design a tag set to be used for statistical processing for real-time applications
CO5	To compare the use of different statistical approaches for different types of NLP applications

Text Books:

1	Daniel Jurafsky, James H. Martin Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2	C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA:1999

Reference Books:

1	Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, Edition, OReilly Media, 2009.
2	Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S.Tiwary
3	Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.

CIE Assessment:

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- Quizzes/mini tests (4 marks)
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CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	2	-	-	-	-	-	-	-	-	-	-	-
C02	3	3	3	-	-	-	-	-	-	-	-	-	2	2
C03	3	3	3	-	-	-	-	-	-	-	-	-	1	3
C04	3	3	3	-	-	-	-	-	-	-	-	-	1	2
C05	2	2	2	-	-	-	-	-	-	-	-	-	2	-

High-3, Medium-2, Low-1

Course Title	HUMAN COMPUTER INTERACTION	Semester	07
Course Code	MVJ20CS743	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Software process and Design rules
- Implementation and user support
- Different models for cognition and collaboration
- Introduction to Ubiquitous computing

Module-1	L1,L2, L3	Hours 8
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Prerequisites – Basic Knowledge of Graphic user Interface, OOP and software tools

FOUNDATIONS –Introduction to Ubiquitous computing The Human Input–output channels Human Memory Thinking emotions Psychology & design of interactive systems; Computer Text entry devices– Positioning, Pointing & drawing Display devices for Virtual reality, 3D; Interaction models Frameworks & HCI, Ergonomics Interaction styles WIMP Interfaces context; paradigms for Interaction

Case Study – Human Computer Interaction Based on RFID and Context–Awareness in Ubiquitous Computing Environments.

Video link / Additional online information:

- <https://nptel.ac.in/courses/106/103/106103115/>
- <https://nptel.ac.in/courses/106/106/106106177/>
- https://www.tutorialspoint.com/human_computer_interface/index.htm

Module–2

L1,L2, L3

Hours 8

SOFTWARE PROCESS & DESIGN RULES– Interaction design basics user focus scenarios navigation screen design & layout; HCI in software process life cycle Usability engineering Interactive design & prototyping ; Design rules Principles for usability standards guidelines golden rules HCI patterns

Case Study– Sign to speech converter facilitated wireless communication

Video link / Additional online information:

- <https://nptel.ac.in/courses/106/103/106103115/>
- <https://nptel.ac.in/courses/106/106/106106177/>

Module–3

L2,L3, L4

Hours 8

IMPLEMENTATION & USER SUPPORT– Implementation support Windowing system elements uses tool kits user interface management; Evaluation techniques goals expert analysis choosing a method; universal design principles multimodal interaction; user support requirements Approaches adaptive help systems designing user support systems.

Case Study–HCI – Digital Fridge

Video link / Additional online information:

- <https://nptel.ac.in/courses/106/103/106103115/>
- <https://nptel.ac.in/courses/106/106/106106177/>
- https://www.tutorialspoint.com/human_computer_interface/index.htm

Module–4

L3,L4,L5

Hours 8

COGNITIVE, COMMUNICATION & COLLABORATIVE MODELS– Cognitive models Goal & task hierarchies Linguistic models Physical & device models architectures ; communication & collaboration models Face–to–face communication conversation text based group working; Task analysis difference between other techniques task decomposition Knowledge based analysis ER based techniques uses.

Case study- HCI Design in the OR: A Gesturing Case-Study

Video link / Additional online information:

- <https://nptel.ac.in/courses/106/103/106103115/>
- <https://nptel.ac.in/courses/106/106/106106177/>
- https://www.tutorialspoint.com/human_computer_interface/index.htm

Module-5

L3,L4, L6

Hours 8

UBIQUITOUS COMPUTING, HYPERTEXT, WWW- Ubiquitous computing application research virtual & augmented reality information & data visualization ; understanding hypertext finding things Web Technology & issues Static Web content Dynamic Web content; Groupware systems Computer mediated communication DSS Frameworks for groupware.

Mini Project- Develop a user interface

Video link / Additional online information:

- <https://nptel.ac.in/courses/106/103/106103115/>
- <https://nptel.ac.in/courses/106/106/106106177/>
- https://www.tutorialspoint.com/human_computer_interface/index.htm

Course Outcomes:

C01	Design effective dialog for HCI.
C02	Design effective HCI for individuals and persons with disabilities.
C03	Assess the importance of user feedback.
C04	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites
C05	Develop meaningful user interface.

Text/Reference Books:

1	Alan Dix , Janet Finlay, Gregory D.Abowd, Russell Beale, “ Human Computer Interaction”, T Edition, Pearson Education, 2004
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Reference Books:

1	John M.Carrol, “Human Computer Interaction in the New Millennium”, Pearson Education, 2002
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CIE Assessment:

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- Quizzes/mini tests (4 marks)
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- ii. 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.
- iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	-	2	1	-	-	-	-	1	1	2	2
CO2	2	1	3	-	2	1	-	-	-	-	1	1	2	2
CO3	2	1	3	-	2	1	-	-	-	-	1	1	-	-
CO4	2	1	3	-	2	1	-	-	-	-	1	1	2	-
CO5	2	1	3	-	2	1	-	-	-	-	1	1	1	3

High-3, Medium-2, Low-1

Course Title	BLOCKCHAIN TECHNOLOGY	Semester	07
Course Code	MVJ20CS744	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Familiarise the functional/operational aspects of cryptocurrency ecosystem.
- Understand emerging abstract models for Blockchain Technology.
- Understand how blockchain systems (mainly Bitcoin and Ethereum) work and how to securely interact with them.
- Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain.

<ul style="list-style-type: none"> Design, build, and deploy smart contracts and distributed applications. 		
Module-1	L1,L2, L3	Hours 8
<p>Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete.</p> <p>Cryptography: Hash function, Digital Signature – ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.</p> <p>Applications: Telecommunications, finance, universities</p> <p>Video link / Additional online information (related to module if any):</p> <ul style="list-style-type: none"> https://coincentral.com/byzantine-generals-problem/ https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.htm 		
Module-2	L2,L3	Hours 8
<p>Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.</p> <p>Applications: Government, healthcare</p> <p>Video link / Additional online information (related to module if any):</p> <ul style="list-style-type: none"> https://blockonomi.com/merkle-tree/ https://www.khanacademy.org/economics-finance-domain/core-finance/money-and-banking/bitcoin/v/bitcoin-transaction-block-chains. 		
Module-3	L2,L3,L4	Hours 8
<p>Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.</p> <p>Applications: Decentralized Applications, Encrypted messaging applications</p> <p>Video link / Additional online information (related to module if any):</p> <ul style="list-style-type: none"> https://blockonomi.com/nakamoto-consensus/ https://cointelegraph.com/explained/proof-of-work-explained 		
Module-4	L3,L4, L6	Hours 8
<p>Cryptocurrency: History, Distributed Ledger, Bitcoin protocols – Mining strategy and rewards, Ethereum – Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.</p> <p>Applications: Peer – to – peer payment application.</p> <p>Video link / Additional online information (related to module if any):</p> <ul style="list-style-type: none"> https://blockgeeks.com/guides/hyperledger/ https://blockgeeks.com/guides/smart-contracts/ 		
Module-5	L4,L5, L6	Hours 8
<p>Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects–Crypto currency Exchange,</p>		

Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

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

- <https://www.water-io.com/iot-vs-wot>
- <https://www.talend.com/resources/iot-cloud-architecture/>

Course Outcomes:

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

Text Books:

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

Reference Books:

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

CIE Assessment:

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:

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

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	3	1	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	2	-
CO4	3	3	3	3	-	-	-	2	2	2	-	3	2	3
CO5	3	3	3	3	-	-	2	2	3	2	-	3	1	-

High-3, Medium-2, Low-1

Course Title	PYTHON PROGRAMMING	Semester	07
Course Code	MVJ20CS751	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

Module-1

L1,L2, L3

Hours 8

Introduction to Python: The basic elements of python, variable, expression, Branching Programs, Control Structures, Strings and Input, Iteration.

Laboratory Sessions/ Experimental learning:

1. Write a Python program to display the current date and time.
2. Write a Python program which accepts the radius of a circle from the user and compute the area.
3. Write a python program for taking multiple inputs from user.

Video link / Additional online information:

- https://www.youtube.com/watch?v=Y3Ri2GdYfYg&list=PLqftY2uRk7oXvERQEGATSr-KzAh8WLW_D
- <https://www.youtube.com/watch?v=TqPzwenhMj0>
- <https://www.youtube.com/watch?v=gzDPuWKjmGQ>

Module-2

L1,L2, L3

Hours 8

Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files, System Functions and Parameters

Laboratory Sessions/ Experimental learning:

1. Write a Python program to find the Max of three numbers using function.
2. Write a Python program to reverse a string.
3. Python Program to Read a List of Words and Return the Length of the Longest One.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=oSPMmeaiQ68>
- https://www.youtube.com/watch?v=Lole_9cTtPE
- <https://www.youtube.com/watch?v=ixdr6V2vRC4>

Module-3

L1,L2, L3

Hours 8

Structured Types, Mutability and Higher-Order Functions: Strings, Tuples, Lists and Dictionaries, Lists and Mutability, Functions as Objects

Laboratory Sessions/ Experimental learning:

1. Python Program to Remove All Tuples in a List of Tuples with the USN Outside the Given Range.
2. Python Program to form a New String Made of the First 2 and Last 2 characters from a Given String.
3. Python Program to Sum All the Items in a Dictionary.
4. Python Program to Concatenate Two Dictionaries into One.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=ISltwlnF0eU>
- <https://www.youtube.com/watch?v=mzx74TdGYbg>
- <https://www.youtube.com/watch?v=BL5bAt8fgvU>

Module-4

L1,L2, L3

Hours 8

Classes and Object-Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding

Debugging, Exceptions and Assertions: Debugging, Handling Exceptions, Assertions

Laboratory Sessions/ Experimental learning:

1. Write a Python class to convert an integer to a roman numeral.
2. Write a Python class named Rectangle constructed by a length and width and a method which will compute the area of a rectangle.

Video link / Additional online information :

- <https://www.youtube.com/watch?v=ZDa-Z5JzLYM>
- <https://www.youtube.com/watch?v=8O5kX73OkIY>
- <https://www.youtube.com/watch?v=NMTEjQ8-AJM>

Module-5

L1,L2, L3

Hours 8

Simple Algorithms and Data structures: Search Algorithms, Sorting Algorithms, Hash Tables

Laboratory Sessions/ Experimental learning:

1. Write a Python program to create an Enum object and display a member name and value.

Sample data :

Afghanistan = 93

Albania = 355

Algeria = 213

Andorra = 376

Angola = 244

Antarctica = 672

Expected Output :

Member name: Albania

Member value: 355

2. Write a Python program to sort a list of elements using the bubble sort algorithm.

Video link / Additional online information :

- <https://www.youtube.com/watch?v=KW0UvOW0XIo>
- <https://www.youtube.com/watch?v=m9n2f9lhtrw>

Course Outcomes:

CO1	Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
CO2	Demonstrate proficiency in handling Strings and File Systems.

CO3	Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
CO4	Interpret the concepts of Object-Oriented Programming as used in Python.
CO5	Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Text Books:

1	Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.drchuck.com/pythonlearn/EN_us/pythonlearn.pdf) (Chapters 1 13, 15)
2	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 15, 16, 17)(Download pdf files from the above links)

Reference Books:

1	Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
2	Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873.
3	Wesley J Chun, "Core Python Applications Programming", 3rdEdition,Pearson Education India, 2015.ISBN-13: 978-9332555365.

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:

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

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	3	-	-	-	-	-	-	1	2	-
CO2	3	3	1	-	-	-	-	-	-	-	-	1	1	-
CO3	3	3	1	-	-	-	-	-	-	-	-	1	1	3
CO4	3	3	1	-	-	-	-	-	-	-	-	1	2	-
CO5	3	3	1	-	-	-	-	-	-	-	-	2	1	3

High-3, Medium-2, Low-1

Course Title	CYBER FORENSICS AND IPR	Semester	07
Course Code	MVJ20CS752	CIE	50

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

Course objective is to: <i>This course will enable students to</i>		
<ul style="list-style-type: none"> • Be familiar with different forensics methods • Analyse various computer forensics technologies • Disseminate knowledge on laws and acts to protects IPR. • Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in cyberspace. 		
Module-1	L2	Hours 8
<p>Prerequisites : Basic Knowledge of crypto algorithms Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis</p> <p>Laboratory Sessions/ Experimental learning: Familiarization with any one digital forensics tool</p> <p>Video link / Additional online information:</p> <ul style="list-style-type: none"> • https://www.youtube.com/watch?v=2ESqwX3qb94- • https://nptel.ac.in/courses/106/104/106104119/ 		
Module-2	L2,L3	Hours 8
<p>Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies, Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.</p> <p>Laboratory Sessions/ Experimental learning: Case Study on cybercrime Investigation</p> <p>Video link / Additional online information:</p> <ul style="list-style-type: none"> • https://www.coursera.org/lecture/cyber-conflicts/introduction-to-cybercrime-and-fundamental-issues-xndSq • https://www.youtube.com/watch?v=VoeLc5295XU • https://www.youtube.com/watch?v=l77AgiphUQo 		
Module-3	L2,L3	Hours 8
Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies		

Laboratory Sessions/ Experimental learning:

Studying different cases where IPR and laws are applied.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=qJ693ZlvceA>
- <https://www.youtube.com/watch?v=6vNxslcf9AE>

Module-4	L2,L3	Hours 8
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Protection of Intellectual Property Rights in Cyberspace in India: The Cyberspace The Relevance of Domain Names in Intellectual Property Rights, Deception by Squatting in Cyberspace, Bad Faith in Relation to Domain Name Infringement, Some Leading Cases Involving Complaints from India before WIPO, Protection of Copyright on Cyberspace, Rights of Software Copyright Owners, Infringement of Copyright on Cyberspace, Cyberspace, the Internet, Websites and the Nature of the Copyright, Linking, Hyper-Linking and Framing, Remedies for Infringement of Copyright on Cyberspace, The Liabilities of an Internet Services Provider (ISP) in Cyberspace

Laboratory Sessions/ Experimental learning:

Case study on protection of copyright on cyberspace

Video link / Additional online information:

- <https://nptel.ac.in/courses/109/105/109105112/>
- <https://nptel.ac.in/courses/109/105/109105112/>
- <https://nptel.ac.in/courses/106/106/106106129/>

Module-5	L2	Hours 8
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Penalties, Compensation and Adjudication of Violations of Provisions of IT Act and Judicial Review: Penalty and Compensation for Damage to Computer, Computer System, Compensation for Failure to Protect Data, Penalty for Failure to Furnish Information, Return or any Other Penalty, Adjudication of Disputes under the IT Act, Cyber Appellate Tribunal, Its Functions and Powers under the IT Act

Laboratory Sessions/ Experimental learning:

Listing the Scenarios of Penalties in India

Video link / Additional online information:

- <https://www.lawctopus.com/video-lectures-law-sudhir-law-review/>
- <https://www.youtube.com/watch?v=wV2OiOM3q3k>

Course Outcomes:

CO1	Analyze Computer Crime and Criminals and Liturgical Procedures
CO2	Apply the laws and regulations to the applications
CO3	Analyze the email tracking cyber applications
CO4	Understanding the protection of Intellectual Property Rights

CO5	Knowledge of law and acts
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Text Books:	
1	Nelson Phillips and EnfingerSteuart, Computer Forensics and Investigations, Cengage Learning, New Delhi, 2009.
2	Harish Chander, Cyber Laws and IT protections, PHI Edition

Reference Books:	
1	Dumortier, International Encyclopedia Of Cyber Law (3vol) , Jos
2	Bernadette H Schell, Clemens Martin, Cybercrime, ABC , CLIO Inc, California, 2004
3	Study Material for Professional Programme Intellectual Property Rights, Law and Practice, Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

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> <ul style="list-style-type: none"> - Quizzes/mini tests (4 marks) - Mini Project / Case Studies (8 Marks) - Activities/Experimentations related to courses (8 Marks)

SEE Assessment:
<p>i. 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>

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

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	3	-	2	-	2	-	-	-	2	2	-
CO2	3	3	-	3	2	2	-	3	-	-	-	2	2	-
CO3	2	2	2	2	-	3	3	3	-	-	-	2	3	-
CO4	3	3	2	3	-	-	-	3	-	-	-	-	3	-
CO5	3	3	-	3	-	-	-	3	-	-	-	2	-	-

High-3, Medium-2, Low-1

Course Title	MOBILE APPLICATION AND DEVELOPMENT	Semester	07
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Course Code	MVJ20CS753	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- Design and Develop Android application by setting up Android development environment.
- Implement adaptive, responsive user interfaces that work across a wide range of devices.
- Explain long running tasks and background work in Android applications.
- Demonstrate methods in storing, sharing and retrieving data in Android applications.
- Discuss the performance of android applications and understand the role of permissions and security.
- Describe the steps involved in publishing Android application to share with the world.

Module-1

L1,L2, L3

Hours 8

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, Android tools, Android Application components Android Manifest file, Android Application Lifecycle Activities, Activity lifecycle, activity states, monitoring state changes.

Applications: To develop the mobile computing application.

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

- <https://nptel.ac.in/courses/106/106/106106156/>
- <https://nptel.ac.in/courses/106/106/106106147/>
- <https://www.coursera.org/specializations/android-app-development>
- https://google-developer-training.github.io/android-developer-fundamentals-course-concepts/en/Unit%201/10_c_intro_to_android.html

Module-2

L2,L3

Hours 8

ANDROID UI ARCHITECTURE & UI WIDGETS: Fundamental Android UI design Layouts, Drawable resources, UI widgets, Notification, Toasts, Menu, Dialogs, Building dynamic UI with fragments.

Applications: To develop the Progressive Web Applications

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

- <https://nptel.ac.in/courses/106/106/106106156/>
- <https://nptel.ac.in/courses/106/106/106106147/>
- <https://developer.ibm.com/solutions/application-modernization/>
- <https://developer.android.com/guide/topics/ui>

Module-3

L2,L3,L4

Hours 8

INTENTS AND BROADCASTS: Intent, 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 Toasts.

Applications: To develop the Cross-Platform Native Mobile Applications

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

- <https://www.indianappdevelopers.com/blog/advantages-real-time-mobile-applications/>
- <https://nptel.ac.in/courses/106/106/10610615>
- https://www.tutorialspoint.com/android/android_broadcast_receivers.htm
- https://google-developer-training.github.io/android-developer-fundamentals-course-concepts/en/Unit%203/73_c_broadcast_receivers.html

Module-4	L3,L4, L6	Hours 8
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DATA STORAGE, SERVICES & CONTENT PROVIDERS: Saving Data, interacting with other Apps, Apps with content sharing, Shared Preferences, Preferences activity, Files access, SQLite database, Overview of services in Android, Implementing Service, Service lifecycle, Inter Process Communication.

Applications: To develop the Hybrid Mobile Applications.

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

- <https://www.endivesoftware.com/blog/real-time-solutions-in-mobile-apps/>
- <https://aws.amazon.com/mobile/mobile-application-development/>
- <https://developer.android.com/guide/topics/providers/content-providers>

Module-5	L4,L5, L6	Hours 8
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ADVANCED APPLICATIONS: Building apps with Multimedia, Building apps with Graphics & Animations, Building apps with Sensors, Bluetooth, Camera, Telephony Services, Building apps with Location Based Services and Google maps.

Applications: Native Mobile Applications

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

- <https://nptel.ac.in/courses/106/106/10610615>
 - <https://www.endivesoftware.com/blog/real-time-solutions-in-mobile-apps/>
 - <https://www.coursera.org/specializations/advanced-app-android>
- * Programming Assignments are Mandatory.

Course Outcomes:

CO1	Understand the basics of Android devices and Platform
CO2	Describe the architecture and advanced features of android technology
CO3	Interpret and use the data storage, file sharing and IPC in android platform.
CO4	Develop the skills in designing and building mobile applications using android platform.
CO5	Build mobile applications using multimedia graphics and animations, Publish Android applications in to Android Market

Text Books:

1	Google Developer Training, "Android Developer Fundamentals Course Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/ android developer fundamentals course–concepts/details.(Download pdf file from the above link).
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Reference Books:

1	RetoMeier;ProfessionalAndroid2ApplicationDevelopment;WileyIndiaPvt.ltd;1stEdition;2012; ISBN–13:9788126525898.
2	Phillips, Stewart, Hardy and Marsicano; Android Programming, 2nd edition –Big Nerd Ranch Guide;2015; ISBN-13978-0134171494.
3	Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
4	MarkMurphy; Beginning Android3; A press Springer India Pvt Ltd.; 1st Edition; 2011; ISBN– 13: 978-1-4302-3297-1
5	Eric Hellman; Android Programming Pushing the limits by Hellman; Wiley; 2013; ISBN 13:978 1118717370.

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)
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SEE Assessment:

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

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO2	3	3	1	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	1	1
CO4	3	3	3	3	-	-	-	2	2	2	-	3	2	3
CO5	3	3	3	3	-	-	2	2	3	2	-	3	-	3

High-3, Medium-2, Low-1

Course Title	MACHINE LEARNING AND ITS APPLICATION	Semester	07
Course Code	MVJ20CS754	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: *This course will enable students 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.
- Design, build, and deploy smart contracts and distributed applications.

Module-1	L1,L2, L3	Hours 8
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Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

Laboratory Sessions/ Experimental learning: Use Case study to understand purpose, ask to students to solve in class room.

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

- <https://www.youtube.com/watch?v=rQ3oi9g8aY>
- <https://www.youtube.com/watch?v=h0e2HAPTGF4>

Module-2	L1,L2, L3	Hours 8
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Decision Tree Learning :Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Laboratory Sessions/ Experimental learning: Use Case Study and ask students to design a Decision Tree.

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

- <https://www.youtube.com/watch?v=qDcl-FRnwSU>
- <https://www.youtube.com/watch?v=FujVLsZYkuE>

Module-3	L1,L2, L3	Hours 8
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Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, MDL principle, Naive Bayes classifier, Bayesian belief networks.

Evaluating Hypotheses: Estimating hypothesis accuracy, Basics of sampling theorem.

Laboratory Sessions/ Experimental learning:

Give Real Time Case study and ssk the students to build Bayes Belief Networks .

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

- https://www.youtube.com/watch?v=480a_2jRdK0
- <https://www.youtube.com/watch?v=E3l26bTdtxl>

Module-4	L1,L2, L3	Hours 8
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Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm. Instanced Based Learning: Introduction, k-nearest neighbor

learning, locally weighted regression.

Laboratory Sessions/ Experimental learning: Give real time Case Study and ask students to design an ANN.

Video link:

- <https://www.youtube.com/watch?v=xbYgKoG4x2g&list=PL53BE265CE4A6C056>.
- <https://nptel.ac.in/courses/106/106/106106184/>

Module-5

L1,L2, L3

Hours 8

Reinforcement Learning: Introduction, Learning Task, Q Learning.

Deep Learning: Introduction to Deep Learning-Reasons to go Deep Learning,

Video link:

- <https://nptel.ac.in/courses/106/106/106106143/>
- <https://nptel.ac.in/courses/106/105/106105215/>

Course outcomes:

C01	Identify the issues in machine learning and Algorithms for solving it.
C02	Explain theory of probability and statistics related to machine learning.
C03	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q, Learning.
C04	Identify the difference between Machine Learning and Deep Learning and using scenario
C05	Explain the concepts of Q learning and deep learning

Text Books:

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

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:

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

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-	-	-	2	-	-
CO2	3	3	3	-	-	-	-	-	1	-	1	2	1	-
CO3	2	2	2	1	3	-	-	-	-	-	1	3	2	3
CO4	3	2	3	-	-	-	-	-	-	2	3	2	1	-
CO5	3	2	3	-	-	-	-	-	-	2	3	2	1	-

High-3, Medium-2, Low-1

Course Title	INTERNET OF THINGS LABORATORY	Semester	07
Course Code	MVJ20CSL76	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	3 Hours
Course objective is to: <i>This course will enable students to</i>			
<ul style="list-style-type: none"> • Understand the concepts of Internet of Things. • Analyze basic protocols in wireless sensor network. • Design IoT applications in different domain and be able to analyze their performance. • Implement basic IoT applications on embedded platform. 			
S No	Experiment Name	RBT Level	Hours
1	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.	L3	3
2	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.	L3	3
3	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.	L3	3
4	To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.	L3	3
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.	L3	3
6	To interface Push button/Digital sensor (IR/LDR) with Arduino / Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.	L3	3
7	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.	L3	3
8	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	L3	3
9	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.	L3	3
Web Link and Video Lectures:(Self Learning)			
1. https://www.arduino.cc/en/Tutorial-0007/BlinkingLED			
2. https://www.arduino.cc/en/Tutorial/ADXL3xx			
3. https://www.arduino.cc/en/Tutorial/CharacterAnalysis			
4. https://www.arduino.cc/en/Tutorial/Button			
5. https://www.arduino.cc/en/Tutorial/Dimmer			
6. https://www.arduino.cc/en/Tutorial/ifStatementConditional			
Course Outcomes:			

CO1	To understand how sensors and embedded systems work
CO2	Design and implement an accessory with BLE connectivity using standard mobile application development tools
CO3	To understand how to communicate with other mobile devices using various communication platforms such as Bluetooth and Wi-Fi.
CO4	Develop and demonstrate applications e.g. smartphone-based, sensor station
CO5	To understand how to program on embedded and mobile platforms.

Reference Books:	
1	Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" -CRC Press-2012.
2	Dieter Uckelmann, Mark Harrison, "Architecting the Internet of Things", Springer2011.

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, i. Writeup : 20 marks ii. Conduction : 40 marks iii. Analysis of results : 20 marks iv. Viva : 20

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	2	-	1	2	-
CO2	2	1	1	-	-	-	-	-	-	2	-	1	1	3
CO3	2	1	1	-	-	-	-	-	-	2	-	1	2	3
CO4	2	1	1	-	-	-	-	-	-	2	-	1	1	3
CO5	2	1	1	-	-	-	-	-	-	2	-	1	2	2

High-3, Medium-2, Low-1

Course Title	MACHINE LEARNING LABORATORY	Semester	07
Course Code	MVJ20CSL77	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	3 Hours
Course objective is to: <i>This course will enable students to</i> <ul style="list-style-type: none"> • Make use of Data sets in implementing the machine learning algorithms • Implement the machine learning concepts and algorithms in any suitable language of choice. 			
S No	Experiment Name	RBT Level	Hours
1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	L3	3
2	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
3	Develop a program to demonstrate the prediction of values of a given dataset using Linear regression.	L3	3
4	Write a program to demonstrate the working of the decision tree based ID3 algorithm . Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	L3	3
5	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	L3	3
6	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	L3	3
7	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	L3	3
8	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	L3	3
9	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k-Means algorithm . Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the	L3	3

	program.		
10	Write a program to implement k -Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	L3	3
11	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	L3	3

Course Outcomes:

C01	Understand the implementation procedures for the machine learning algorithms.
C02	Design Java/Python programs for various Learning algorithms.
C03	Apply appropriate data sets to the Machine Learning algorithms.
C04	Identify and apply Machine Learning algorithms to solve real world problems.
C05	Perform statistical analysis of machine learning techniques.

Reference Books:

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

- i. Writeup : 20 marks
- ii. Conduction : 40 marks
- iii. Analysis of results : 20 marks
- iv. Viva : 20

CO-PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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C01	2	1	1	-	-	-	-	-	-	2	-	1	2	-
C02	2	1	1	-	-	-	-	-	-	2	-	1	1	3
C03	2	1	1	-	-	-	-	-	-	2	-	1	1	2
C04	2	1	1	-	-	-	-	-	-	2	-	1	1	1
C05	2	1	1	-	-	-	-	-	-	2	-	1	1	3

High-3, Medium-2, Low-1

Course Title	PROJECT PHASE 1	Semester	VII
Course Code	MVJ20CSP78	CIE	50
Total No. of Contact Hours	L : T : P :: 0 : 0 : 4	SEE	-
No. of Contact Hours/week	-	Total	50
Credits	2	Exam. Duration	-

Course Objective:

- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To expand intellectual capacity, credibility, judgment, intuition.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase – I: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course outcomes: At the end of the course the student will be able to:

CO1	Describe the project and be able to defend it.
CO2	Learn to use modern tools and techniques.
CO3	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO4	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO5	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Scheme of Evaluation :

Internal Marks: The Internal marks (50 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project.

CIE Marks Breakup for Major Project during VII Semester :

Relevance of the Topic	10 Marks
Report	20 Marks
Evaluation by Guide	25 Marks
Presentation	30 Marks

Viva- Voce	15 Marks
Total	100 Marks

CO-PO/PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3	2	1	1	2	1	1	2	2	1
CO2	2	2	2	3	3	2	1	1	2	1	2	2	1	3
CO3	2	2	2	3	3	2	1	1	2	1	2	2	1	2
CO4	2	2	2	3	3	2	1	1	2	1	2	2	1	1
CO5	2	2	2	3	3	2	1	1	2	1	2	2	1	3

High-3, Medium-2, Low-1

