

VI SEMESTER

Course Title	FOUNDATIONS OF DATA SCIENCE	Semester	06
Course Code	MVJ20AM61	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 provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science.

Module-1

L1, L2, L3,L4

Hours 10

INTRODUCTION TO DATA SCIENCE:Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Who is Data Scientist? - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation.

Video Links : <https://www.youtube.com/watch?v=KMj49syT8JM&list=PLyqSpQzTE6M-sBjDcT21Gpnj8grR2fDgc>

Module-2

L1,L2,L3

Hours 10

BIG DATA:Problems when handling large data – General techniques for handling large data – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study.

Video Links: <https://nptel.ac.in/courses/106/101/106101163/>

Module-3

L2,L3,L4

Hours 10

MACHINE LEARNING:Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms.

Video Links: <https://nptel.ac.in/courses/106/101/106101163/>

Module-4

L2,L3,L4

Hours 10

DEEP LEARNING:Introduction – Deep Feed forward Networks – Regularization – Optimization of Deep Learning – Convolutional Networks – Recurrent and Recursive Nets – Applications of Deep Learning.

Video Links: <https://nptel.ac.in/courses/106/101/106101163/>

Module-5

L2,L3,L4

Hours 10

DATA VISUALIZATION :Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools – Creating an interactive dashboard with dc.js-summary.

Video Links: <https://nptel.ac.in/courses/106/101/106101163/>

Course outcomes:

CO1	Explore the fundamental concepts of data science.
CO2	Understand data analysis techniques for applications handling large data
CO3	Understand various machine learning algorithms used in data science process
CO4	Visualize and present the inference using various tools
CO5	Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making

Text Books:

1	Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications
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	Co., 1st edition, 2016
2	An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013
3	Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016
4	Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018

Reference Books:

1	Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015
2	Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O'Reilly, 1st edition, 2013
3	Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014

CO-PO/PSO Mapping

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

CO5	3	3	2	3	2	-	-	-	-	-	-	2	3	1
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High-3, Medium-2, Low-1

Course Title	Internet of Things	Semester	06
Course Code	MVJ20AM62	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*

- Understand the basic concepts of IoT and device connectivity.
- Acquire knowledge in Real time data logging and data analytics on cloud.
- Explore the potential areas utilizing embedded controllers/processors in real time systems.

Module-1

L1, L2,

Hours 10

INTRODUCTION TO IOT: Introduction - User Experience design for IoT - Technology of Connected Devices - Networks : Technology of connectivity - Security and Privacy Issues

Video Links : <https://nptel.ac.in/courses/106/105/106105166/>

Module-2

L2,L3,L4

Hours 10

SMART HOME : Automating the Home - Smart Steps to Smart Home - Components for Smart Home - Smart Network - Controlling Smart Homes - Interfacing ESP8266 and Relay board - Blynk App - Arduino and libraries installation - IFTTT Applet - Case Study : Smarter Sensing with smart monitors - Smarter Protection with smart security systems - Smarter heating and cooling with smart thermostat.

Video Links: <https://www.youtube.com/watch?v=SuzRufz4hQo>

Module-3

L1,L2,L3,L4

Hours 10

WEARABLE TECH : Wearables: Fundamentals, Advancement and roadmap for future - Smart Watches, Fitness Trackers, Smart Eyewear - wearable bio and chemical sensors - wearable inertial sensors and applications - Architecture & pin diagram for Arduino - Interacting with Analog & Digital sensors - Dealing with personal data - Monitoring sensor data from cloud platform - Controlling actuator from IoT Cloud platform - Case Study : application of optical heart rate monitoring - wearable IoT enabled real time Health monitoring system.

Video Links: <https://nptel.ac.in/courses/106/105/106105166/>

Module-4

L1,L2,L3,L4

Hours 10

HEALTH CARE: Internet of Medical Things - Smart Medical Devices and Monitoring - Smart Hospitals - Smart Medical records - Insight to Raspberry Pi and Preparing Raspberry Pi board - GPIO Configuration - Programming Raspberry Pi, Internal & External representation of sensor data - parsing sensor data on import - displaying measured information on IoT Cloud platform - Controlling actuator from IoT Cloud platform - Triggering event notification - CoAP Communication - Other Communications - Case Study : Patient Record in Mobile App.

Video Links: <https://www.youtube.com/watch?v=UvQFH5RGOuU>

Module-5

L1,L2,L3,L4

Hours 10

SMART FARMING : Agricultural Internet of Things - Environmental and climatic change - Role of Arduino and Node MCU in agricultural field - interfacing with external devices - development of local web server for automation - labview / Matlab based data logger for agricultural field parameters monitoring system - Case study : Smart control for site specific management of fixed irrigation system - scilab based data logger for plant protection from fire in agriculture field - smart greenhouse monitoring system for flower plant growth.

Video Links: <https://www.youtube.com/watch?v=hAk3wwV27vg>

Course outcomes:

CO1	Interface I/O devices, sensors & communication modules
CO2	Examine remote data and control devices
CO3	Compare the connectivity technologies and protocols in IOT
CO4	Infer Security issues in IOT
CO5	Develop real life IoT based projects

Text Books:

1	Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes and Smart Cities are changing the world", 2015, ISBN-13 : 978-0789754004.
2	Edward Sazonov, Michael R. Neuman, "Wearable Sensors: Fundamentals, Implementation and Applications", Academic Press/Elsevier, 2014, ISBN 978-0124186620.

3	Claire Rowland, Elizabeth Goodman, Martin Chaliar, Ann Light, Alfred Lui, “Designing Connected Products: UX for the Consumer Internet of Things”, O’Reilly Media, Inc, 2015, ISBN 978-1449372569.
4	Rajesh Singh, Anita Gehlot, Bhupendra Singh & Sushabhan Choudhury, “Internet of Things (IoT) Enabled Automation in Agriculture”,2018, ISBN : 9789387973053.

Reference Books:

1	Perry Lea, ”Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security”, Packt Publishing Limited, January 2018, ISBN-13 : 978-1788470599
2	Marco Schwartz, “Internet of Things with ESP8266”, Packt Publishing Ltd, 2016, ISBN-13 : 978-1786468024.
3	Cuno Pfister , “Getting Started with the Internet of Things”, Shroff; First edition-2015, ISBN-13 : 978-9350234136.

CO-PO/PSO Mapping

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

SEE Assessment:

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

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

High-3, Medium-2, Low-1

Course Title	Quantum Computing	Semester	06
Course Code	MVJ20AM631	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (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 building blocks of a quantum computer.
- To understand the principles, quantum information and limitation of quantum operations formalizing
- To understand the quantum error and its correction.

Module-1

L1, L2,

Hours 8

FUNDAMENTAL CONCEPTS: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.

Video Links : <https://www.youtube.com/watch?v=3yoyVCAQH4M>

Module-2

L2,L3,L4

Hours 8

QUANTUM COMPUTATION : Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.

Video Links: <https://www.youtube.com/watch?v=OlatlIaqPj8>

Module-3

L1,L2,L3,L4

Hours 8

QUANTUM COMPUTERS : Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.

Video Links: <https://www.youtube.com/watch?v=Nq4YZtINNAQ>

Module-4

L1,L2,L3,L4

Hours 8

QUANTUM INFORMATIONS: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of

Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.

Video Links: <https://nptel.ac.in/courses/115/101/115101092/>

Module-5

L1,L2,L3,L4

Hours 8

QUANTUM ERROR CORRECTION :Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.

Video Links:<https://www.digimat.in/nptel/courses/video/115101092/L23.html>

Course outcomes:

CO1 Define and explain basic concepts in Quantum computing.

CO2 Demonstrate applications of Quantum computing.

CO3 Explain principles in the design of Quantum Computers

CO4 Discuss applications and limitations of Quantum operations

CO5 Explain theory and concepts in Quantum error correction.

Text Books:

1 Micheal A. Nielsen and Issac L. Chiang, “Quantum Computation and Quantum Information”, Cambridge University Press, Fint South Asian Edition, 2002

2 Bennett C.H., Bernstein E., Brassard G., Vazirani U., The strengths and weaknesses of quantum computation. SIAM Journal on Computing.

Reference Books:

1 Mika Hiravensalo, “Quantum computing” II edition, ACM computing classification, Springer- 2004

2 Nayak, Chetan; Simon, Steven; Stern, Ady; Das Sarma, Sankar, “Nonabelian Anyons and Quantum Computation”, 2008.

3 Clarke, John; Wilhelm, Frank, “Superconducting quantum bits”, 2008.

4 William M Kaminsky, “Scalable Superconducting Architecture for Adiabatic Quantum Computation”, 2004.

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

High-3, Medium-2, Low-1

Course Title	CLOUD COMPUTING	Semester	06
Course Code	MVJ20AM632	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 fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges;
- Introduce the basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations;
- Discuss the different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud; Software Defined Networks (SDN) and Software Defined Storage (SDS);
- Introduce cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage;
- Discuss the variety of programming models and develop working experience in several of them.

Module-1

L1,L2 , L3

Hours 8

Introduction to Cloud Computing:Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud. Introduction to big data analytics, using MapReduce/Hadoop for analyzing unstructured data, Hadoop ecosystem of tools.

Applications:

Microsoft Azure, Amazon Web Services

Video link / Additional online information :

- <https://www.youtube.com/watch?v=PW-V-72MJNY>

Module-2

L2 , L3

Hours 8

'Integration as a Service' Paradigm for the Cloud Era:An Introduction, The Onset of Knowledge Era, The Evolution of SaaS , The Challenges of SaaS Paradigm, Approaching the SaaS Integration Enigma, New Integration Scenarios, The Integration Methodologies, SaaS Integration Products and Platforms , SaaS Integration Services, Businesses-to-Business Integration (B2Bi) Services, A Framework of Sensor- Cloud

Integration, SaaS Integration Appliances, Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain

Laboratory Sessions/ Experimental learning:

1. Installation and Configuration of Hadoop.

Applications: PAAS(Facebook, Google App Engine)

Video link / Additional online information :

- <https://www.youtube.com/watch?v=ifZh5SJAujA>

Module-3

L2, L3, L4

Hours 8

Virtual Machines Provisioning and Migration Services: Introduction and Inspiration- Background and Related Work-Virtual Machines Provisioning and Manageability- Virtual Machine Migration Services- VM Provisioning and Migration in Action–Provisioning in the Cloud Context- The Anatomy of Cloud Infrastructures-Distributed Management of Virtual Infrastructures - Scheduling Techniques for Advance Reservation of Capacity- Capacity Management to meet SLA Commitments- RVWS Design and Cluster as a Service: The Logical Design

Laboratory Sessions/ Experimental learning:

Implementation of Para-Virtualization using VM Ware’s Workstation/ Oracle’s Virtual Box and Guest O.S

Applications:

Hardware Virtualization, Operating system Virtualization, Server Virtualization, Storage Virtualization

Video link / Additional online information :

- <https://www.youtube.com/watch?v=7m3f-P-WWbg>

Module-4

L3,L4 , L6

Hours 8

Platform and Software as a Service:Technologies and Tools for Cloud Computing- Aneka Cloud Platform- Aneka Resource Provisioning Service- Hybrid Cloud Implementation - CometCloud Architecture- Autonomic Behavior of CometCloud- Overview of CometCloud-based Applications- Implementation and Evaluation- Workflow Management Systems and Clouds- Architecture of Workflow Management Systems - Utilizing Clouds for Workflow Execution- Case Study: Evolutionary Multi objective Optimizations- Visionary thoughts for Practitioners

Laboratory Sessions/ Experimental learning:

Create an application (Ex: Word Count) using Hadoop Map/Reduce.

Applications: Schedule book

Video link / Additional online information :

- <https://www.youtube.com/watch?v=3KJjKY8k9Lk>

Module-5

L4, L5, L6

Hours 8

MapReduce Programming Model and Implementations:MapReduce Programming Model- Major MapReduce Implementations for the Cloud- The Basic Principles of Cloud Computing-A Model for Federated Cloud Computing- Traditional Approaches to SLO Management- Types of SLA- Life Cycle of

SLA- SLA Management in Cloud- Automated Policy-based Management- The Current State of Data Security in the Cloud-Data Privacy and Security Issues-Producer_Consumer Relationship-Cloud Service Life Cycle

Laboratory Sessions/ Experimental learning:

Create your resume in a neat format using google and zoho cloud Programs on PaaS

Applications: Network Storage, Google Apps and Microsoft office online

Video link / Additional online information :

- https://www.youtube.com/watch?v=uj2Sb7b_Do0

Course Outcomes:

CO1	Recall the recent history of cloud computing, illustrating its motivation and evolution.
CO2	List some of the enabling technologies in cloud computing and discuss their significance
CO3	Articulate the economic benefits as well as issues/risks of the cloud paradigm for businesses as well as cloud providers
CO4	Define SLAs and SLOs and illustrate their importance in Cloud Computing.
CO5	List some of the common cloud providers and their associated cloud stacks and recall popular cloud use case scenarios.

Text Books:

1	Cloud Computing, Principles and Paradigms, Rajkumar Buyya, James Broberg, Wiley Publication
2	Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

Reference Books:

1	Barrie Sosinsky, "Cloud Computing Bible", John Wiley & Sons, 2010.
2	Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'Reilly, 2009.

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

CO-PO/PSO Mapping

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

High-3, Medium-2, Low-1

Course Title	Introduction to Drones	Semester	06
Course Code	MVJ20AM633	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- To make the students to understand the basic concepts of UAV systems design.

Module-1	L1, L2, L3	Hours 8
INTRODUCTION TO UAV: History of UAV –classification – Introduction to Unmanned Aircraft Systems- -models and prototypes – System Composition-applications. Video Links : https://www.digimat.in/nptel/courses/video/101104073/L01.html		
Module-2	L2,L3,L4	Hours 8
THE DESIGN OF UAV SYSTEMS : Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations- Characteristics of Aircraft Types- Design Standards and Regulatory Aspects- UK,USA and Europe- Design for Stealth--control surfaces-specifications. Video Links: https://www.digimat.in/nptel/courses/video/101104083/L01.html		
Module-3	L1,L2,L3,L4	Hours 8
AVIONICS HARDWARE : Autopilot – AGL-pressure sensors-servos-accelerometer –gyros-actuators- power supply- processor, integration, installation, configuration, and testing. Video Links: https://nptel.ac.in/courses/101/104/101104083/		
Module-4	L1,L2,L3,L4	Hours 8
COMMUNICATION PAYLOADS AND CONTROLS: Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range –modems-memory system-simulation- ground test-analysis-trouble shooting. Video Links: https://nptel.ac.in/courses/101/108/101108047/		
Module-5	L1,L2,L3,L4	Hours 8
THE DEVELOPMENT OF UAV SYSTEMS : Waypoints navigation-ground control software- System Ground Testing- System In-flight Testing- Future Prospects and Challenges-Case Studies – Mini and Micro UAVs. Video Links: https://nptel.ac.in/courses/101/104/101104073/		
Course outcomes:		
CO1	Ability to design UAV system	
CO2	Prepare preliminary design requirements for an unmanned aerial vehicle.	
CO3	Perform system testing for unmanned aerial vehicles	
CO4	Integrate various systems of unmanned aerial vehicle.	
CO5	Design micro aerial vehicle systems by considering practical limitations.	

Text Books:

1	Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc, 1998
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2	Reg Austin “Unmanned Aircraft Systems UAV design, development and deployment”, Wiley, 2010.
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Reference Books:

1	Dr. Armand J. Chaput, “Design of Unmanned Air Vehicle Systems”, Lockheed Martin Aeronautics Company, 2001
2	Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy”, Springer, 2007
3	Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.

CO-PO/PSO Mapping

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

High-3, Medium-2, Low-1

Course Title	SOCIAL NETWORK ANALYSIS	Semester	06
Course Code	MVJ20AM634	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*

- Develop the skills of Social Network Concepts and Techniques
- Represent and process Network Relations
- Familiarize with Web based Social Network Applications

Module-1	L1,L2, L3	Hours 8
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INTRODUCTION: Analyzing the Social Web, A brief history of the Social Web, Websites discussed, Tools used.

NODES, EDGES AND NETWORK MEASURES: Basics of Network Structure, Representing Networks, Basic Network Structures and Properties.

NETWORK STRUCTURE AND MEASURES: Describing Nodes and Edges, Describing Networks

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

- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod01lec05.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod01lec07.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod02lec19.mp4>

Module-2

L1,L2, L3

Hours 8

NETWORK VISUALIZATION: Layouts, Visualizing Network features. **TIE STRENGTH:**

The role of Tie Strength, Measuring Tie Strength, Tie Strength and Network Structure, Tie Strength and Network Propagation

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

- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod03lec30.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod03lec31.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod04lec40.mp4>

Module-3

L1,L2 ,L3

Hours 8

ENTITY RESOLUTION AND LINK PREDICTION: Link Prediction, Entity Resolution, Link Prediction: Case Study – Friend Recommendation.

COMMUNITY DISCOVERY IN SOCIAL NETWORKS: Introduction to Community Discovery, Communities in Context, Quality Functions, The Kernighan-Lin algorithm, Agglomerative/Divisive Algorithms,

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

- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod06lec79.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod06lec80.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod06lec81.mp4>

Module-4

L1,L2 ,L3

Hours 8

COMMUNITY DISCOVERY IN SOCIAL NETWORKS (CONTD): Spectral Algorithms, Multi-level Graph Partitioning, Markov Clustering, Other Approaches.

MODELS AND ALGORITHMS FOR SOCIAL INFLUENCE ANALYSIS: Introduction to Social Influence, Influence Related Statistics, Social Similarity and Influence, Homophily, Existential Test for Social Influence, Influence and Actions, Influence and Interaction, Influence Maximization in Viral Marketing, Other Applications.

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

- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod05lec70.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod05lec71.mp4>

Module-5

L1,L2 ,L3

Hours 8

MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION: Ontology and their role in the Semantic Web: Ontology-based knowledge Representation -Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

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

- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod10lec133.mp4>
- <https://nptel.ac.in/content/storage2/106/106/106106169/MP4/mod12lec152.mp4>

Course Outcomes:

CO1	Understand and visualize the basic concepts of network structure and representation of Social Network Analysis
CO2	Analyze the Social Network structure and its visualize them in the form of layouts
CO3	Apply the Social Network Concepts in solving problems related to social, personal, business and international levels
CO4	Understand and Implement the algorithm for discovering communities in Social Networks
CO5	Understand the algorithm and models for social influence analysis

Text Books:

1	Jennifer Goldbeck, “Analyzing the Social Web”, Morgan Kaufmann Publications, 2013
2	Charu C. Aggarwal, “Social Network Data Analytics”, Springer Publications, 2011

Reference Books:

1	Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2	Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 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 subdivisions, 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	2	-
CO2	3	3	3	2	-	-	-	-	1	-	1	2	2	2
CO3	2	2	2	1	3	-	-	-	-	-	1	3	2	2
CO4	3	2	3	2	1	-	-	-	-	2	3	2	2	3
CO5	3	2	3	1	-	-	-	-	-	2	3	2	2	-

High-3, Medium-2, Low-1

Course Title	ETHICAL HACKING	Semester	06
Course Code	MVJ20AM641	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"> • Understand Ethical Hacking. • Identify how intruders escalate privileges and what steps can be taken to secure a system. • Introduce and demonstrate hacking tools for penetration testing purposes only. 		
Module-1	L1,L2 ,L3	Hours 8
<p>Ethics Of Ethical Hacking: Why you need to Understand Your Enemy's Tactics?, Recognizing The Gray Areas in Security – Vulnerability Assessment – Penetration Testing. Ethical Hacking and the Legal System: Understanding Individual Cyberlaws – 18 USC Section 1029, 1030, 2510 – Digital Millennium Copyright Act (DMCA) – Cyber Security Enhancement Act 2002. Proper and Ethical Disclosure: CERT's Current Process – Full Disclosure Policy – Organization for Internet Safety</p> <p>Applications: In-class activity to understand the penetration testing methodologies.</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=a1xQq60EtJc 		
Module-2	L2,L3	Hours 8

Social Engineering Attacks: How A Social Engineering Attack Works? – Conducting A Social Engineering Attack – Common Attacks used in Penetration Testing – Defending Against Social Engineering Attacks. Physical Penetration Attacks: Why A Physical Penetration is important – Conducting a Physical Penetration – Common Ways into A Building. Insider Attacks: Why Simulating an Insider Attack is Important – Conducting an Insider Attack – Defending against Insider Attack.

Applications: Understand the network protocols and port scanning techniques using Kali linux

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

- <https://www.digimat.in/nptel/courses/video/106106178/L34.html>

Module-3	L2,L3,L4	Hours 8
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Understanding and Detecting Content-Type Attacks: How do Content-Type Attacks work? - Which File Formats are Being Exploited Today? - Tools to Detect Malicious PDF Files – Tools to test your Protections against Content-Type Attacks – How to protect your Environment from Content-Type Attacks. Web Application Security Vulnerabilities: Overview of Top Web Application Security Vulnerabilities – SQL Injection Vulnerabilities – Cross-Site Scripting Vulnerabilities. VoIP Attacks

Applications:Familiarizing with different types of attacks such as sniffing, spoofing etc

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

- <https://nptel.ac.in/courses/106/106/106106199/>

Module-4	L3,L4,L6	Hours 8
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Passive Analysis: Ethical Reverse Engineering – Why Bother with Reverse Engineering? – Source Code Analysis. Advanced Reverse Engineering: Overview of Software Development Process – Instrumentation Tools – Fuzzing – Instrumented Fuzzing Tools and Techniques. Finding New Browser Based Vulnerabilities. Mitigation Alternatives

Applications:Exploiting buffer overflow vulnerabilities

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

- <https://www.youtube.com/watch?v=9dd3M2a4LKI>

Module-5	L2	Hours 8
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Collecting Malware and Initial Analysis: Malware – Latest Trends in Honeynet Technology – Catching Malware – Initial Analysis of Malware. Hacking Malware: Trends in Malware – DeObfuscating Malware – Reverse Engineering Malware.

Applications: Understand the protection mechanism to prevent against various server attacks.

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

- <https://nptel.ac.in/noc/courses/noc15/SEM1/noc15-cs03/>

Course Outcomes:

CO1	Understand the Ethics Of Ethical Hacking.
CO2	Identify the Social Engineering Attacks.
CO3	Recognize and Detect Types of Attacks.

CO4	Manage Instrumented Fuzzing Tools and Techniques.
CO5	Collect Malware and Initial Analysis.

Text Books:

1	Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, Terron Williams, —Gray Hat Hacking The Ethical Hackers Handbookl, 3rd Edition, 2011
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Reference Books:

1	Sharma Pankaj, —Hackingl, APH Publishing, 2005
2	Rajat Khare, —Network Security and Ethical Hackingl, Luniver Press, 2006.

CIE Assessment:

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

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

SEE Assessment:

- 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	-	-	-	-	1	-	-	-	3	2	-
CO2	3	3	1	-	-	-	-	2	-	1	-	3	2	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	-	2
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	CYBER SECURITY	Semester	06
Course Code	MVJ20AM642	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 Ethical Hacking.
- Understand Preventing, monitoring, and responding to data breaches and cyber-attacks.
- Learn the key components of cyber security network architecture.
- Analyze cyber security architecture principles.

Module-1

L2 ,L3

Hours 8

A web security forensic lesson, web languages, introduction to different web attacks, overview of n-tier web applications; Web servers: Apache, IIS, database servers, introduction and overview of cybercrime, nature and scope of cybercrime, types of cybercrime: social engineering, categories of cybercrime, property cybercrime.

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

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

Module-2

L2,L3

Hours 8

Public key cryptography, RSA, online shopping, payment gateways, unauthorized access to computers, computer intrusions, white collar crimes, viruses and malicious code, internet hacking and cracking, virus attacks, pornography, software piracy, intellectual property, mail bombs, exploitation, stalking and obscenity in internet, digital laws and legislation, law enforcement roles and responses.

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

- <https://www.youtube.com/watch?v=6qdmriq2tWA>

Module-3

L2,L3,L4

Hours 8

Web hacking basics HTTP and HTTPS URL, web under the cover overview of java security reading the

HTML source, applet security, servlets security, symmetric and asymmetric encryptions, network security basics, firewalls and IDS. Investigation: Introduction to cybercrime investigation, investigation tools, e-discovery, 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

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

- <https://nptel.ac.in/courses/106/105/106105217/>

Module-4	L3,L4	Hours 8
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Digital certificates, hashing, message digest, and digital signatures; Digital forensics: 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, windows system forensics, Linux system forensics, network forensics.

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

- <https://www.digimat.in/nptel/courses/video/106106178/L05.html>

Module-5	L2	Hours 8
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Basics, secure JDBC, securing large applications, cyber graffiti; Laws and acts: Laws and ethics, digital evidence controls, evidence handling procedures, basics of Indian Evidence Act IPC and CrPC, electronic communication privacy act, legal policies.

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

- <https://www.youtube.com/watch?v=F7mH5vz1qEI>

Course Outcomes:

CO1	Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.
CO2	Design, develop, test and evaluate secure software.
CO3	Develop policies and procedures to manage enterprise security risks.
CO4	Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.
CO5	Assess cyber-security risk management policies in order to adequately protect an organization

Text Books:

1	Mc Clure, Stuart, Saumil Shah, Shreeraj Shah, —Web Hacking: Attacks and Defense, AddisonWesley Professional, Illustrated Edition, 2003.
2	Garms, Jess, Daniel Somerfield, —Professional Java Security, WroxPress, Illustrated Edition, 2001.

Reference Books:

1	Nelson Phillips, EnfingerSteuart, —Computer Forensics and Investigations, Cengage Learning, New Delhi,2009.
2	Kevin Mandia, Chris Prosis, Matt Pepe, —Incident Response and Computer Forensics —, Tata McGraw Hill,2009
3	Robert M Slade, —Software Forensics, Tata McGraw Hill, New Delhi, 1st Edition,2005.

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 subdivisions, 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	-	-	-	-	1	-	-	-	3	2	-
CO2	3	3	1	-	-	-	-	2	-	1	-	3	2	-
CO3	3	3	1	2	-	-	-	-	-	1	-	3	-	2
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	GREEN COMPUTING	Semester	06
Course Code	MVJ20AM643	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

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

Hours 8

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 management, ecosystem-based adaptation

Video link / Additional online information:

- <https://nptel.ac.in/courses/110/107/110107128/>
- <https://nptel.ac.in/courses/110/107/110107093/>

Module-3

L1,L2, L3

Hours 8

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.

Real Time Applications: ChessBrain

Video link / Additional online information:

- <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

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.
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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:

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	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	COMPUTER VISION	Semester	06
Course Code	MVJ20AM644	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*

- Focuses on development of algorithms and techniques to analyze and interpret the visible world around us.
- Understand the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc.
- Explore the applications ranging from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Module-1

L1,L2, L3

Hours 8

DIGITAL IMAGE FORMATION AND LOW-LEVEL PROCESSING

Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing

Video link / Additional online information:

- <https://www.youtube.com/watch?v=CVV0TvNK6pk>

Module-2

L1,L2, L3

Hours 8

DEPTH ESTIMATION AND MULTI-CAMERA VIEWS

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

Video link / Additional online information:

- http://www.cse.iitm.ac.in/~vplab/computer_vision.html

Module-3

L1,L2, L3

Hours 8

FEATURE EXTRACTION

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Video link / Additional online information:

- <https://nptel.ac.in/courses/106/106/106106046/>

Module-4

L1,L2, L3

Hours 8

IMAGE SEGMENTATION

Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

Video link / Additional online information:

- <https://nptel.ac.in/courses/117/105/117105079/>

Module-5

L1,L2, L3

Hours 8

PATTERN ANALYSIS

Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA,

LDA, ICA; Non-parametric methods.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=mfePdDh9t6Q>

Course Outcomes:

CO1	Understand the concepts of Digital Image Processing.
CO2	Analyse Homography and stereopsis.
CO3	Analyse Edges and Hough Transforms.
CO4	Demonstrate the ideas of image Segmentation.
CO5	Implement the concepts of Pattern Analysis.

Text Books:

1	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

Reference Books:

1	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2	K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
3	R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.
4	Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

CIE Assessment:

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

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

SEE Assessment:

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

High-3, Medium-2, Low-1

Course Title	ARTIFICIAL INTELLIGENCE	Semester	06
Course Code	MVJ20AM651	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 distinction between optimal reasoning Vs. human like reasoning.
- Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- Learn different knowledge representation techniques.

Module-1

L1,L2, L3

Hours 8

Problem Solving by Search-I: Introduction to AI, Intelligent Agents

Problem Solving by Search –II: Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environment .

Video link / Additional online information:

- <https://www.youtube.com/watch?v=fV2k2ivttL0>

Module-2

L1,L2, L3

Hours 8

Problem Solving by Search-II and Propositional Logic

Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions.

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

Propositional Logic: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=FQWta3XjyWg>

Module-3

L1,L2, L3

Hours 8

Logic and Knowledge Representation

First-Order Logic: Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.

Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Knowledge Representation: Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information

Video link / Additional online information:

- <https://www.youtube.com/watch?v=qVyX7Xwi45I>

Module-4

L1,L2, L3

Hours 8

Planning

Classical Planning: Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. **Planning and Acting in the Real World:** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

Video link / Additional online information:

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

Module-5

L1,L2, L3

Hours 8

Uncertain knowledge and Learning

Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use,

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

Learning: Forms of Learning, Supervised Learning, Learning Decision Trees. Knowledge in Learning: Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming

Video link / Additional online information:

- <https://www.youtube.com/watch?v=yE8oCPmKXOI>

Course Outcomes:

CO1	Ability to formulate an efficient problem space for a problem expressed in natural language.
CO2	Select a search algorithm for a problem and estimate its time and space complexities.
CO3	Possess the skill for representing knowledge using the appropriate technique for a given problem
CO4	Possess the ability to apply AI techniques to solve problems of game playing, and machine learning
CO5	Understand the applications of AI, namely game playing, theorem proving, and machine learning

Text Books:

1	Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.
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Reference Books:

1	Artificial Intelligence, 3rd Edn, E.Rich and K.Knight (TMH)
2	Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3	Artificial Intelligence, Shivani Goel, Pearson Education
4	Artificial Intelligence and Expert systems – Patterson, Pearson Education

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

High-3, Medium-2, Low-1

Course Title	WEB TECHNOLOGIES	Semester	06
Course Code	MVJ20AM652	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 different kind of Internet Technologies.
- Learn java-specific web services architecture

Module-1	L2, L3, L4	Hours 8
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Fundamentals: A Brief Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol, Security, The Web Programmer's Toolbox.

Introduction to HTML/XHTML: Origins and Evolution of HTML and XHTML, Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, Syntactic difference between HTML and XHTML

Video link / Additional online information:

- <https://www.youtube.com/watch?v=QEtWL4lWIL4>

Module-2

L2, L3, L4

Hours 8

Cascading Style Sheets: Introduction, Levels of Style Sheets, Selector Forms, PropertyValue Forms, Font Properties, List Properties, Alignment of Text, Color, The Box Model, Background Images, The and Tags, Conflict Resolution.

The Basics of JavaScript: Object Orientation and JavaScript, General Syntactic Characteristics, Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, An Example, Constructors, Pattern Matching Using Regular Expressions, Another Example, Errors in Scripts.

Video link / Additional online information:

- <http://www.digimat.in/nptel/courses/video/106106156/L10.html>

Module-3

L2, L3, L4

Hours 8

JavaScript and HTML Documents: The JavaScript Execution Environment, The Document Object Model, Elements Access in JavaScript, Events and Event Handling, Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from Text Box and Password Elements.

Dynamic Documents with JavaScript: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=3uxp7mqUIfk>

Module-4

L2, L3, L4

Hours 8

Introduction to XML: Introduction, The Syntax of XML, XML Document Structure, Document Type Definitions, Namespaces, XML Schemas, Displaying RAW XML Documents, Displaying XML Document with CSS, XSLT Style Sheets, XML Processors, Web Services.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=itRkLa2kq6w>

Module-5

L2, L3, L4

Hours 8

Introduction to PHP: Origins and Uses of PHP, Overview of PHP, General Syntactic Characteristics, Primitives, Operations, and Expressions, Output, Control Statements, Arrays, Functions, Pattern Matching, Form Handling, Cookies, Session Tracking.

Video link / Additional online information:

- https://www.nptelvideos.com/php/php_video_tutorials.php

Course Outcomes:

CO1	Understand the World Wide Web and XHTML related tags
CO2	Describe visual design using CSS and logic design using JavaScript.
CO3	Describe dynamic documents using DOM with elements.
CO4	Recognize extended tags by XML.
CO5	Understand a server-side scripting language using PHP.

Text Books:

1	Robert W. Sebesta : Programming the World Wide Web, Seventh Edition, Pearson Education, 2014
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Reference Books:

1	Deitel and Deitel and Nieto, —Internet and World Wide Web - How to Programl, Prentice Hall, 5th Edition, 2011.
2	UttamK.Roy, —Web Technologiesl, Oxford University Press, 2011

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	3	2	-	1	-	-	-	-	-	-	2	1	-
CO2	3	3	3	-	1	-	-	-	1	-	1	2	3	-

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

High-3, Medium-2, Low-1

Course Title	FOUNDATIONS OF DATA SCIENCE	Semester	06
Course Code	MVJ20AM653	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

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

- To provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science.

Module-1

L1, L2, L3

Hours 8

Introduction: Big Data and Data Science hype and getting past the hype Datafication. Current landscape of perspectives. Skill sets needed. Statistical Inference. Populations and samples. Statistical modeling, probability distributions, Introduction to R programming.

Video Links : <https://www.youtube.com/watch?v=KMj49syT8JM&list=PLyqSpQzTE6M-sBjDcT21Gpnj8grR2fDgc>

Module-2	L1,L2,L3	Hours 8
<p>Exploratory Data Analysis and the Data Science Process. Basic tools (plots, graphs and summary statistics) of EDA. Philosophy of EDA. The Data Science Process. Case Study: Real Direct (online real estate) Three Basic Machine Learning Algorithms. Linear Regression, k-Nearest Neighbors (k-NN), k-means</p> <p>Video Links: https://nptel.ac.in/courses/106/101/106101163/</p>		
Module-3	L2,L3,L4	Hours 8
<p>Feature Generation and Feature Selection (Extracting Meaning From Data). Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination). Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests.</p> <p>Video Links: https://nptel.ac.in/courses/106/101/106101163/</p>		
Module-4	L2,L3,L4	Hours 8
<p>Recommendation Systems: Building a User-Facing Data Product. Algorithmic ingredients of a Recommendation Engine. Dimensionality Reduction. Singular Value Decomposition. - Principal Component Analysis.</p> <p>Video Links: https://nptel.ac.in/courses/106/101/106101163/</p>		
Module-5	L2,L3,L4	Hours 8
<p>Data Visualization. Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues. Discussions on privacy, security, ethics</p> <p>Video Links: https://nptel.ac.in/courses/106/101/106101163/</p>		
Course outcomes:		
CO1	Understand the statistical foundations of data science	
CO2	Learn techniques to pre-process raw data so as to enable further analysis.	
CO3	Conduct exploratory data analysis and create insightful visualizations to identify patterns	
CO4	Introduce machine learning algorithms for prediction/classification and to derive insights.	
CO5	Analyze the degree of certainty of predictions using statistical test and models.	

Text Books:	
1	Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2	Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
3	Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Reference Books:

1	Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015
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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:

- 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 subdivisions, 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	3	1	2	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	3	1	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	1	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	3	2	-	-	-	-	-	-	2	3	1

High-3, Medium-2, Low-1

Course Title	PYTHON PROGRAMMING	Semester	06
Course Code	MVJ20AM654	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.

Module-1

L1,L2, L3

Hours 8

Conceptual introduction: topics in computer science, algorithms; modern computer systems: hardware architecture, data representation in computers, software and operating system; installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages.

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

Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated). String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=oSPMmeaiQ68>
- https://www.youtube.com/watch?v=LoIe_9cTtPE
- <https://www.youtube.com/watch?v=ixdr6V2vRC4>

Module-3	L1,L2, L3	Hours 8
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Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions.

Video link / Additional online information:

- <https://www.youtube.com/watch?v=ISItwlnF0eU>
- <https://www.youtube.com/watch?v=mzx74TdGYbg>
- <https://www.youtube.com/watch?v=BL5bAt8fgvU>

Module-4	L1,L2, L3	Hours 8
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Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects, inheritance, polymorphism, operator overloading (`_eq_`, `_str_`, etc); abstract classes; exception handling, try block.

Video link / Additional online information :

- <https://www.youtube.com/watch?v=wp9elxZzypg>

Module-5	L1,L2, L3	Hours 8
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Graphical user interfaces; event-driven programming paradigm; tkinter module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.

Video link / Additional online information :

- <https://nptel.ac.in/courses/106/106/106106182/>

Course Outcomes:

CO1	Understand core programming basics - including data types, control structures, algorithm development, and program design with functions - via the Python programming language.
CO2	Demonstrate the fundamental principles of Object-Oriented Programming, as well as in depth data and information processing techniques.
CO3	Implement Python Programs using core data structures like Lists, Dictionaries
CO4	Explore real-world software development challenges
CO5	Create practical and contemporary applications.

Text Books:

1	Fundamentals of Python: First Programs- Kenneth Lambert, Course Technology, Cengage Learning, 2012, ISBN-13: 978-1-111-82270-5
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Reference Books:

1	Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O’Reilly Publication
2	How to Think Like a Scientist –Learning with Python “, Allen Downey, Jeffrey Elkner, Chris Meyers, Green Tea Press, 2002, First Edition.
3	Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python “, Green Tea Press, 2002, First Edition.
4	Beginning Python –From Novice to Professional, - Magnus Lie Hetland, Second Edition, A Press Publication

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 subdivisions, 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	DATA SCIENCE LABORATORY	Semester	06
Course Code	MVJ20AML66	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: *This course will enable students to*

- Develop the ability to build and assess data-based models.
- Develop relevant programming abilities.
- Apply Data science concepts to solve problems in real world context.

S No	Experiment Name	RBT Level	Hours
1	Introduction to R tool for data analytics science	L3	3
2	Basic Statistics and Visualization in R	L3	3
3	K-means Clustering using R Studio	L3	3
4	Use R Functions for Association Rule Models	L3	3
5	Use R Functions for Linear Regression(Ordinary Least Squares - OLS)	L3	3
6	Use R Graphics functions to visualize the results generated with Logistic Regression	L3	3
7	Use the ODBC Connection to the “Census” database to create a training data set for Naive Bayesian Classifier from the big data.	L3	3
8	Build a Decision Tree Model based on data whose schema is composed of attributes. Predict the outcome of one attribute based on the model.	L3	3
9	Simulate Principal component analysis	L3	3
10	Simulate Singular Value Decomposition	L3	3

Course Outcomes:

CO1	Understand basics of Data Visualization
CO2	Implement visualization of distributions
CO3	Write programs on visualization of time series, proportions & associations
CO4	Apply visualization on Trends and uncertainty

Reference Books:

1	Big Data Analytics with R and Hadoop by vignesh prajapati - 2013 Packet Publishing.
2	R and data mining: examples and case studies -yanchang zhao -2012 Elsevier.

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,

v. Writeup : 20 marks

vi. Conduction : 40 marks

vii. Analysis of results : 20 marks

viii. Viva : 20

CO-PO/PSO Mapping

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

High-3, Medium-2, Low-1

Course Title	INTERNET OF THINGS LABORATORY	Semester	06
Course Code	MVJ20AML67	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: *This course will enable students to*

- Learn tools relevant to Embedded System and IoT development.
- Develop simple applications using Arduino/Raspberry Pi/open platform.
- Design and develop IOT application for real world scenario.

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 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
4	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.	L3	3
5	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.	L3	3
6	To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.	L3	3
7	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.	L3	3
8	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
9	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.	L3	3
10	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.	L3	3
11	To install MySQL database on Raspberry Pi and perform basic SQL queries.	L3	3
12	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	L3	3

Course Outcomes:	
CO1	Test and experiment different sensors for application development.
CO2	Develop IoT applications using Arduino/Raspberry Pi/open platform.
CO3	Explore deployment platforms for IoT applications.

Reference Books:	
1	Perry Lea, "Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security", Packt Publishing Limited, January 2018, ISBN-13 : 978-1788470599.
2	Arshdeep Bahga and Vijay Madiseti, "Internet of Things: A Hands on Approach" 2014.

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

High-3, Medium-2, Low-1