| | | | |
|---|---|---|---|
| **Course Title** | **ARTIFICIAL INTELLIGENCE FOR ROBOTICS** | **Semester** | 07 |
| **Course Code** | MVJ20AM71 | **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***

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and Machine learning.

| **Module-1** | L1,L2 , L3 | **Hours 10** |
|---|---|---|

**Introduction**: Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents.

**Problem Solving :** Solving problems by searching –Informed search and exploration–Constraint satisfaction problems– Adversarial search, knowledge and reasoning–knowledge representation – first order logic

**Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=6hmIKIWBVSI

| **Module-2** | L2 , L3 | **Hours 10** |
|---|---|---|

**Planning:** Planning with forward and backward State space search – Partial order planning – Planning graphs– Planning with propositional logic – Planning and acting in real world.

**Video link / Additional online information (related to module if any):** https://www.youtube.com/watch?v=Mjr_V9KVo74

| **Module-3** | L2,L3, L4 | **Hours 10** |
|---|---|---|

**Reasoning:** Uncertainty – Probabilistic reasoning–Filtering and prediction–Hidden Markov models–Kalman filters– Dynamic Bayesian Networks, Speech recognition, making decisions.

**Video link / Additional online information (related to module if any):**https://www.youtube.com/watch?v=5K1to94YQtU

| **Module-4** | L3,L4 , L6 | **Hours 10** |
|---|---|---|

**Learning :** Forms of learning – Knowledge in learning – Statistical learning methods –reinforcement learning, communication, perceiving and acting, Probabilistic language processing, and perception.

**Video link / Additional online information (related to module if any):**https://www.youtube.com/watch?v=pKeVMlkFpRc

| **Module-5** | L4,L5 , L6 | **Hours 10** |
|---|---|---|

**AI In Robotics :** Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.

**Video link / Additional online information (related to module if any):**https://www.youtube.com/watch?v=3C6ZLS-gfXU

**Course Outcomes:**

| | |
|---|---|
| CO1 | Identify appropriate AI methods to solve a given problem |
| CO2 | Formalize a given problem in the language/framework of different AI methods. |
| CO3 | Summarize the learning methods adopted in AI. |
| CO4 | Design and perform an empirical evaluation of different algorithms on a problem formalization |
| CO5 | Illustrate the applications of AI in Robotic Applications. |

| Text Books: | |
|---|---|
| 1 | Stuart Russell, Peter Norvig, “Artificial Intelligence: A modern approach”, Pearson Education, India, 2016. |
| 2 | Negnevitsky, M, “Artificial Intelligence: A guide to Intelligent Systems”,. Harlow: Addison Wesley, 2002 |

| Reference Books: | |
|---|---|
| 1 | David Jefferis, “Artificial Intelligence: Robotics and Machine Evolution”, Crabtree Publishing Company, 1992. |
| 2 | Robin Murphy, Robin R. Murphy, Ronald C. Arkin, “Introduction to AI Robotics”, MIT Press, 2000. |
| 3 | Francis.X.Govers, “Artificial Intelligence for Robotics”, Packt Publishing, 2018. |
| 4 | Huimin Lu, Xing Lu, “Artificial Intelligence and Robotics”, Springer, 2017. |
| 5 | Michael Brady, Gerhardt, Davidson, “Robotics and Artificial Intelligence”, Springer, 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 | 3 | 3 | 3 | 3 | | 2 | - | - | - | - | - | 2 | - |
| CO2 | 3 | 3 | 3 | 3 | 3 | | - | - | - | - | - | - | - | - |
| CO3 | 3 | 3 | 3 | 3 | 3 | | 2 | 3 | 3 | 3 | 3 | - | 2 | - |

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

High-3, Medium-2, Low-1

| **Course Title** | **NATURAL LANGUAGE PROCESSING** | **Semester** | 07 |
|---|---|---|---|
| **Course Code** | MVJ20AM72 | **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***

- Acquaintance with natural language processing and learn how to apply basic algorithms in this field.
- Recognize the significance of pragmatics for natural language understanding.
- Capable of describing the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

| **Module-1** | L1,L2,L3 | **Hours 10** |
|---|---|---|

**Regular Expressions, Text Normalization, Edit Distance:** Regular Expressions, Words, Corpora,

| | | |
|---|---|---|
| Text Normalization, Minimum Edit Distance.<br>**N-Gram Language Models:** N-grams, Evaluating Language Models, Generalization and Zeros, Smoothing, Kneser-Ney Smoothing, The web and stupid Backoff, Advanced Perplexity's Relation to Entropy.<br>**Video link** : https://nptel.ac.in/courses/106/105/106105158/ | | |
| **Module-2** | L2,L3 | **Hours 10** |
| **Parts of Speech Tagging:** English Word Classes, The Penn Tree bank part of speech Tagset, Part of Speech tagging, HMM part of speech tagging, Maximum Entropy Markov Models, Bidirectionality, Part of Speech tagging for other languages<br>**Video link** : https://nptel.ac.in/courses/106/105/106105158/ | | |
| **Module-3** | L2,L3 | **Hours 10** |
| Formal Grammars of English: Constituency, Context Free Grammars, Some Grammar Rules for English, Treebanks, Grammar Equivalence and Normal Form, Lexicalized Grammars. Syntactic Parsing: Ambiguity, CYK Parsing, Partial parsing.<br>**Video link** : https://www.youtube.com/watch?v=6b40kKe2SFg | | |
| **Module-4** | L2,L4 | **Hours 10** |
| **Dependency Parsing:** Dependency Relations, Formalisms, Treebank, Transition Based Dependency Parsing, Graph based dependency parsing, Evaluation.<br>**Representation of Sentence Meaning:** Computational Desiderata for Representations, Model – Theoretic Semantics, First Order Logic, Event and State Representations, Description Logics<br>**Video link** : https://www.coursera.org/lecture/human-language/pragmatics-E8VXH | | |
| **Module-5** | L3, L4 | **Hours 10** |
| **Semantic Parsing :** Information Extraction: Named Entity Recognition, Relation Extraction, Extracting Times, Events and their times, Template Filling. Lexicons for Sentiment, Affect and Connotation: Defining Emotion, Available Sentiment and Affect Lexicons, Creating affect lexicons by human labeling, semi supervised induction of affect lexicons, supervised learning of word sentiment, Using lexicons for Sentiment Recognition<br>**Video link**: https://www.coursera.org/lecture/text-mining-analytics/5-6-how-to-do-sentiment-analysis-with-sentiwordnet-5RwtX | | |
| **Course Outcomes:** | | |
| CO1 | Understand the concepts of morphology, syntax, semantics and pragmatics of the language. | |
| CO2 | Understand the elements and applications of Part-of-speech tagging | |
| CO3 | Understand approaches to syntax and semantics in NLP | |
| CO4 | Provide the student with knowledge of various levels of analysis involved in NLP | |

| | |
|---|---|
| CO5 | Building robust systems to perform linguistic tasks with technological 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 | Natural Language Processing using Python by Steven Bird, Ewan Klien, Edward Loper, 1 st edi Oreilly Publications, 2009. |
| 2 | Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S.Tiwary |

**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 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 1 | 3 |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO5 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **HIGH PERFORMANCE COMPUTING** | **Semester** | 07 |
| **Course Code** | MVJ20AM731 | **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***

- Improve the system performance
- Learn various distributed and parallel computing architecture
- Learn different computing technologies

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|
| Grid Computing: Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (Ibm). **Video link** : https://www.youtube.com/watch?v=GlobK-eWDSo | | |
| **Module-2** | L2,L3 | **Hours 8** |
| Cluster Setup & Its Advantages, Performance Models & Simulations; Networking Protocols & I/O, Messaging Systems. Process Scheduling, Load Sharing And Balancing; Distributed Shared Memory, | | |

| | | |
|---|---|---|
| Parallel I/O.<br>**Video link** : https://www.youtube.com/watch?v=9J4uXnSDias | | |
| **Module-3** | L2,L3,L4 | **Hours 8** |
| Example Cluster System – Beowlf; Cluster Operating Systems: Compas And Nanos Pervasive Computing Concepts & Scenarios; Hardware & Software; Human – Machine Interface.<br>**Video link** : https://www.youtube.com/watch?v=GlobK-eWDSo | | |
| **Module-4** | L3,L4 | **Hours 8** |
| Device Connectivity; Java for Pervasive Devices; Application Examples<br>**Video link** : https://www.youtube.com/watch?v=bS6XqjBO99Q | | |
| **Module-5** | L2,L3 | **Hours 8** |
| Classical Vs Quantum Logic Gates; One, Two & Three Qubit Quantum Gates; Fredkin & Toffoli Gates; Quantum Circuits; Quantum Algorithms.<br>**Video link**: https://nptel.ac.in/courses/115/101/115101092/ | | |

| **Course Outcomes:** | |
|---|---|
| CO1 | Understanding the concepts in grid computing |
| CO2 | Ability to set up cluster and run parallel applications |
| CO3 | Ability to understand the cluster projects and cluster OS |
| CO4 | Understanding the concepts of pervasive computing |
| CO5 | Understanding the concepts of quantum computing |

| **Text Books:** | |
|---|---|
| 1 | "Selected Topics In Advanced Computing" Edited By Dr. P. Padmanabham And Dr. M.B. Srinivas, Pearson Education. |
| **Reference Books:** | |
| 1 | J. Burkhardt et.al: 'pervasive computing' Pearson Education |
| 2 | Marivesar:' Approaching quantum computing', Pearson Education |
| 3 | Raj kumar Buyya:'High performance cluster computing', Pearson Education |
| 4 | Neilsen & Chung L:' Quantum computing and Quantum Information', Cambridge University Press. |
| 5 | A networking approach to Grid Computing, Minoli, Wiley |

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

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **BIG DATA ANALYTICS** | **Semester** | 07 |
| **Course Code** | MVJ20AM732 | **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***

- The scope and essentiality of Big Data and Business Analytics.
- The technologies used to store, manage, and analyze big data in a Hadoop ecosystem.
- The techniques and principles in big data analytics with scalability and streaming capability.
- The hypothesis on the optimized business decisions in solving complex real-world problems

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**INTRODUCTION TO BIG DATA:** Characteristics of Data,Evolution of Big Data,Definition of Big Data,Challenges with Big Data,Traditional Business Intelligence (BI) versus Big Data. Big data analytics: Classification of Analytics, Importance and challenges facing big data, Terminologies Used in Big Data Environments, The Big Data Technology Landscape.

**Video link** : https://www.digimat.in/nptel/courses/video/106104189/L01.html

| **Module-2** | L2,L3 | **Hours 8** |
|---|---|---|

**INTRODUCTION TO HADOOP:**Introducing Hadoop,RDBMS versus Hadoop,Distributed Computing Challenges, History and overview of Hadoop, Use Case of Hadoop,Hadoop Distributors,Processing Data with Hadoop, Interacting with Hadoop Ecosystem

**Video link** : https://www.digimat.in/nptel/courses/video/106104189/L04.html

| **Module-3** | L2,L3 | **Hours 8** |
|---|---|---|

**THE HADOOP DISTRIBUTED FILESYSTEM:** Hadoop Distributed File System(HDFS):The Design of HDFS, HDFS Concepts, Basic Filesystem Operations, Hadoop Filesystems. The Java Interface- Reading Data from a Hadoop URL, Reading Data Using the Filesystem API, Writing Data. Data Flow- Anatomy of a File Read, Anatomy of a File Write, Limitations.

**Video link** : https://www.digimat.in/nptel/courses/video/106104189/L04.html

| **Module-4** | L2,L3 | **Hours 8** |
|---|---|---|

**UNDERSTANDING MAP REDUCE FUNDAMENTALS** :Map Reduce Framework: Exploring the features of Map Reduce, Working of Map Reduce, Exploring Map and Reduce Functions,

| | | |
|---|---|---|
| Techniques to optimize Map Reduce jobs, Uses of Map Reduce. Controlling MapReduce Execution with InputFormat, Reading Data with custom RecordReader,-Reader, Writer, Combiner, Partitioners, Map Reduce Phases,Developing simple MapReduce Application.<br>**Video link** : https://www.digimat.in/nptel/courses/video/106104189/L06.html | | |
| **Module-5** | L2,L3 | **Hours 8** |
| **INTRODUCTION TO PIG :** Introducing Pig: Pig architecture, Benefits, Installing Pig, Properties of Pig, Running Pig, Getting started with Pig Latin, Working with operators in Pig, Working with functions in Pig.<br>**Video link**: https://www.youtube.com/watch?v=qr_awo5vz0g | | |

| **Course Outcomes:** | |
|---|---|
| CO1 | Explain the evolution of big data with its characteristics and challenges with traditional business intelligence. |
| CO2 | Explain the big data technologies used to process and querying the bigdata in Hadoop, MapReduce and Pig. |
| CO3 | Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes in distributed Hadoop Ecosystem |
| CO4 | Develop a Map Reduce application for optimizing the jobs. |
| CO5 | Develop applications for handling huge volume of data using Pig Latin |

| **Text Books:** | |
|---|---|
| 1 | Seema Acharya, Subhashini Chellappan,—BigData and Analytics,Wiley Publications,2nd Edition, 2014 DT Editorial Services,—BigData, Dream Tech Press,2nd Edition,2015. |
| 2 | Tom White,—Hadoop:The Definitive Guide,O'Reilly,3 rd Edition,2012. |
| 3 | Big Data Black Book, dream tech publications , 1st Edition, 2017. |
| **Reference Books:** | |
| 1 | Michael Minelli, Michele Chambers,Ambiga Dhiraj, —Big Data,Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Wiley CIO Series, 1stEdition,2013. |
| 2 | Rajiv Sabherwal, Irma Becerra- Fernandez, —Business Intelligence –Practice, Technologies and Management, John Wiley, 1st Edition,2011 |
| 3 | Arvind Sathi, —Big Data Analytics: Disruptive Technologies for Changing the Game, IBM |

| | |
|---|---|
| | Corporation, 1st Edition,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)

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

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **PERVASIVE COMPUTING** | **Semester** | 07 |
| **Course Code** | MVJ20AM733 | **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 an insight into future developments in the field of pervasive computing.
- Provide an in-depth knowledge on pervasive computing and wireless networking.
- Describe the variety of pervasive services and applications.

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**Pervasive Computing :** Evolution of Pervasive Computing - Decentralization continues - Applied Pervasive computing - Pervasive computing principles - Pervasive Information Technology - Smart Cards - Smart Labels.

**Video link** : https://www.youtube.com/watch?v=bS6XqjBO99Q

| **Module-2** | L2,L3 | **Hours 8** |
|---|---|---|

**Embedded Controls:** Smart sensors and Actuators - Smart Appliances - Appliances and Home Networking -Automotive Computing. Operating Systems: Windows CE -Palm OS - Symbian EPOC - Java Card - Windows for Smart Cards.

**Video link** : http://digimat.in/nptel/courses/video/108108147/L01.html

| **Module-3** | L2,L3 | **Hours 8** |
|---|---|---|

**Middleware Components:** Programming Consumer Devices - Smart Card Programming - Messaging Components - Database Components. Security: The importance of security - Cryptographic patterns and methods Cryptographic Tools-Secure socket layer

**Video link** : https://www.digimat.in/nptel/courses/video/117108048/L01.html

| **Module-4** | L2,L3 | **Hours 8** |
|---|---|---|

**Gateways, Device Management and Synchronization :** Connectivity Gateway - Wireless Gateway - Transcoding - Residential Gateway - Architecture and components of Web Application Servers - Web Sphere Application Server Web Sphere Everyplace Suite - Oracle Portal-to-Go - Tasks of Device Management Systems - Tivoli Device Support Infrastructure - User Profiles and Directory Services - Synchronization - The Challenge of Synchronizing Data - Industry Data Synchronization Standards -Today's Synchronization Solution

**Video link** : https://www.digimat.in/nptel/courses/video/106105183/L40.html

| **Module-5** | L2,L3 | **Hours 8** |
|---|---|---|

**Portals and Access Services:** Internet Portals-Wireless Portal - Broadcasting Portal - Home Services - Communication Services - Home Automation - Energy Services - Security Services - Remote Home Healthcare Services - Travel and Business Services - Consumer Services

**Video link**: https://www.youtube.com/watch?v=oxMdDsud5vg

**Course Outcomes:**

| | |
|---|---|
| CO1 | Describe the principles of pervasive technology. |
| CO2 | Identify the functionalities of operating systems and middleware |
| CO3 | Analyze the device management and synchronization techniques. |
| CO4 | Explain the various gateways |
| CO5 | Choose the appropriate techniques to develop various pervasive applications. |

| **Text Books:** | |
|---|---|
| 1 | Asoke K Talukder, Roopa R Yavagal, "Mobile computing: Technology, Applications and Service Creation", Second Edition, Tata McGraw-Hill Publishing Company Limited, 2017, ISBN 978-0070144576 |
| 2 | UweHansmann, LotharMerk, Martin S. Nicklous, Thomas Stober, "Pervasive Computing.Handbook",Second edition, Springer, 2003, ISBN 978-3-642-05525-6. |
| **Reference Books:** | |
| 1 | Asoke K Taukder, Roopa R Yavagal, "Mobile Computing", Second Edition, Tata McGraw Hill Pub Co., New Delhi, 2010, ISBN 9780070144576 |
| 2 | MinyiGuo, Jingyu Zhou, Feilong Tang, Yao Shen, "Pervasive Computing: Concepts, Technologies and Applications", CRC Press,2016, ISBN 9781466596276. |

**CIE Assessment:**

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

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **OPERATIONS AND SUPPLY CHAIN MANAGEMENT** | **Semester** | 07 |
| **Course Code** | MVJ20AM734 | **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***

- To provide an insight on the operations, quality management and sampling tools and fundamentals of supply chain networks, tools and techniques.

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|
| **INTRODUCTION TO OPERATIONS AND SUPPLY CHAIN MANAGEMENT :** Scope and | | |

| | | |
|---|---|---|
| Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles - The Operations Function - The Evolution of Operations and Supply Chain Management – Globalization - Productivity and Competitiveness - Strategy and Operations-Operational Decision-Making Tools: Decision Analysis-Decision Analysis with and without Probabilities<br>**Video link** :https://www.digimat.in/nptel/courses/video/110106045/L01.html | | |
| **Module-2** | L2,L3 | **Hours 8** |
| **QUALITY MANAGEMENT:** Quality and Value in Athletic Shoes -What Is Quality-Quality Management System-Quality Tools Quality in Services-Six Sigma-Quality Costs and Productivity-Quality Awards-ISO 9000-Statistical Process Control-Operational Decision-Making Tools: Acceptance Samp<br>**Video link** : https://www.youtube.com/watch?v=SMOQV2CyVQo | | |
| **Module-3** | L2,L3 | **Hours 8** |
| **NETWORK DESIGN AND TRANSPORTATION:** Factors influencing Distribution network design – Design options for Distribution Network-– factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation<br>**Video link** : http://www.digimat.in/nptel/courses/video/106105183/L11.html | | |
| **Module-4** | L2,L3 | **Hours 8** |
| **SOURCING AND COORDINATION :** Role of sourcing supply chain - supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of coordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain<br>**Video link** : https://www.youtube.com/watch?v=Nrl0CtS1m8Y | | |
| **Module-5** | L2,L3 | **Hours 8** |
| **SUPPLY CHAIN AND INFORMATION TECHNOLOGY:** The role IT in supply chain- The supply chain IT frame work - Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.<br>**Video link**: https://www.youtube.com/watch?v=AozkKon-krk | | |

| **Course Outcomes:** | |
|---|---|
| CO1 | To know about the operations and fundamentals of supply chain |
| CO2 | To understand the quality management tools and sampling process |

| | |
|---|---|
| CO3 | To understand the design factors and various design options of distribution networks in industries and the role of transportation and warehousing |
| CO4 | To understand the various sourcing decisions in supply chain |
| CO5 | To understand the supply chain management in IT industries |

| **Text Books:** | |
|---|---|
| 1 | Roberta S. Russell, Bernard W. Taylor, "Operations and Supply Chain Management, 10th Edition, Wiley Publications,2019 |
| 2 | Sunil Chopra, Peter Meindl and Kalra, Supply Chain Management, Strategy, Planning, and Operation, Pearson Education, 2010. |
| **Reference Books:** | |
| 1 | Jeremy F.Shapiro, Modeling the Supply Chain, Thomson Duxbury, 2002. |
| 2 | Srinivasan G.S, Quantitative models in Operations and Supply Chain Management, PHI, 2010 |
| 3 | David J.Bloomberg , Stephen Lemay and Joe B.Hanna, Logistics, PHI 2002 |
| 4 | James B.Ayers, Handbook of Supply Chain Management, St.Lucle press, 2000 |
| 5 | F. Robert Jacobs (Author), Richard B. Chase, Operations and Supply Chain Management McGraw Hill 2017 |

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

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **HEALTHCARE ANALYTICS** | **Semester** | 07 |
| **Course Code** | MVJ20AM741 | **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 health data formats, health care policy and standards
- Learn the significance and need of data analysis and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analytics for critical care applications

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**INTRODUCTION TO HEALTHCARE ANALYSIS :** Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

**Video link** :https://www.digimat.in/nptel/courses/video/110104095/L01.html

| **Module-2** | L2,L3 | **Hours 8** |
|---|---|---|

**ANALYTICS ON MACHINE LEARNING** : Machine Learning Pipeline – Pre-processing – Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables – Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection.

**Video link** :https://www.digimat.in/nptel/courses/video/106105152/L01.html

| **Module-3** | L2,L3 | **Hours 8** |
|---|---|---|

**HEALTH CARE MANAGEMENT:** IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

**Video link** : https://www.digimat.in/nptel/courses/video/110104095/L41.html

| **Module-4** | L2,L3 | **Hours 8** |
|---|---|---|

**HEALTHCARE AND DEEP LEARNING :** Introduction on Deep Learning – DFF network CNN-RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

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

| **Module-5** | L2,L3 | **Hours 8** |
|---|---|---|

**CASE STUDIES:**Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG

| | |
|---|---|
| Data Analysis.<br>**Video link:** https://www.youtube.com/watch?v=UvQFH5RGOnU | |
| **Course Outcomes:** | |
| CO1 | Use machine learning and deep learning algorithms for health data analysis |
| CO2 | Apply the data management techniques for healthcare data |
| CO3 | Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications |
| CO4 | Design health data analytics for real time applications |
| CO5 | Design emergency care system using health data analysis |

| | |
|---|---|
| **Text Books:** | |
| 1 | Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015. |
| **Reference Books:** | |
| 1 | Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018. |
| 2 | Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018. |
| 3 | Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016. |
| 4 | Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020. |

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

High-3, Medium-2, Low-1

| **Course Title** | **HEALTHCARE ANALYTICS** | **Semester** | 07 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| **Course Code** | MVJ20AM741 | **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 health data formats, health care policy and standards
- Learn the significance and need of data analysis and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analytics for critical care applications

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**INTRODUCTION TO HEALTHCARE ANALYSIS :** Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

**Video link** :https://www.digimat.in/nptel/courses/video/110104095/L01.html

| **Module-2** | L2,L3 | **Hours 8** |
|---|---|---|

**ANALYTICS ON MACHINE LEARNING** : Machine Learning Pipeline – Pre-processing – Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables – Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection.

**Video link** :https://www.digimat.in/nptel/courses/video/106105152/L01.html

| **Module-3** | L2,L3 | **Hours 8** |
|---|---|---|

**HEALTH CARE MANAGEMENT:** IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

**Video link** : https://www.digimat.in/nptel/courses/video/110104095/L41.html

| **Module-4** | L2,L3 | **Hours 8** |
|---|---|---|

**HEALTHCARE AND DEEP LEARNING :** Introduction on Deep Learning – DFF network CNN-RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and

| | | |
|---|---|---|
| Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.<br>**Video link** : https://www.youtube.com/watch?v=W3_yaf3HvHU | | |
| **Module-5** | L2,L3 | **Hours 8** |
| **CASE STUDIES:**Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.<br>**Video link:** https://www.youtube.com/watch?v=UvQFH5RGOnU | | |

| **Course Outcomes:** | |
|---|---|
| CO1 | Use machine learning and deep learning algorithms for health data analysis |
| CO2 | Apply the data management techniques for healthcare data |
| CO3 | Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications |
| CO4 | Design health data analytics for real time applications |
| CO5 | Design emergency care system using health data analysis |

| **Text Books:** | |
|---|---|
| 1 | Chandan K.Reddy, Charu C. Aggarwal, “Health Care data Analysis”, First edition, CRC, 2015. |
| **Reference Books:** | |
| 1 | Vikas Kumar, “Health Care Analysis Made Simple”, Packt Publishing, 2018. |
| 2 | Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, “Health Care Data Analysis and Management, First Edition, Academic Press, 2018. |
| 3 | Hui Jang, Eva K.Lee, “HealthCare Analysis : From Data to Knowledge to Healthcare Improvement”, First Edition, Wiley, 2016. |
| 4 | Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, “Big Data Analytics in HealthCare”, Springer, 2020. |

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

High-3, Medium-2, Low-1

| **Course Title** | **NEURAL COMPUTING IN AI** | **Semester** | 07 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| **Course Code** | MVJ20AM742 | **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 the most comprehensive concept of neural networks in the engineering perspective.
- Understand the important design concepts of neural architectures in different applications.
- Understand the applications associated with many different areas like recommender systems, machine translation, and reinforcement-learning.
- Gain knowledge on methodologies underlying Neuro-Fuzzy and Soft Computing.

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**INTRODUCTION TO NEURAL NETWORK & LEARNING :** Models of a Neuron – Neural Networks Viewed as Directed Graphs – Feedback – Network Architectures – Knowledge Representation – Artificial Intelligence and Neural Networks – Error-Correction Learning – Memory-Based Learning – Hebbian Learning – Competitive Learning – Boltzmann Learning.

**Video link** :

| **Module-2** | L2,L3 | **Hours 8** |
|---|---|---|

**PERCEPTRONS** : Least-Mean-Square Algorithm – Perceptron – Perceptron Convergence Theorem – Back-Propagation Algorithm – XOR Problem – Output Representation and Decision Rule – Feature Detection – Regularization Networks – Generalized Radial-Basis Function Networks

**Video link** :

| **Module-3** | L2,L3 | **Hours 8** |
|---|---|---|

**SUPPORT VECTOR MACHINES & SELF-ORGANIZING MAP:** Optimal Hyperplane for Linearly Separable Patterns - Optimal Hyperplane for non separable Patterns – How to build a support vector machine for Pattern Recognition – XOR Problem Revisited – Support Vector Machines for Nonlinear Regression – Self-Organizing Map – Properties of the Feature Map – Learning Vector Quantization – Hierarchical Vector Quantization – Contextual Maps.

**Video link** :

| **Module-4** | L2,L3 | **Hours 8** |
|---|---|---|

**FUZZY SYSTEMS :** Utility of Fuzzy Systems – Limitations of Fuzzy Systems – Uncertainty and Information – Fuzzy Sets and Membership – Classical Sets – Fuzzy Sets – Crisp Relations – Fuzzy Relations – Tolerance and Equivalence Relations – Fuzzy Tolerance and Equivalence Relations –

| | | |
|---|---|---|
| Value Assignments.<br>**Video link :** | | |
| **Module-5** | L2,L3 | **Hours 8** |
| **FUZZIFICATION & DEFUZZIFICATION:**Features of the Membership Function – Fuzzification – Defuzzification to Crisp Sets – λ-Cuts for Fuzzy Relations – Defuzzification to Scalars – Logic and Fuzzy Systems.<br>**Video link:** | | |

| **Course Outcomes:** | |
|---|---|
| CO1 | Understand the concept of neural networks. |
| CO2 | Acquire knowledge on the aspects of learning process. |
| CO3 | Apply the design concepts of neural architectures. |
| CO4 | Implement the learning process associated with many different application areas |
| CO5 | Design the methodologies for Neuro-Fuzzy and Soft Computing applications. |

| **Text Books:** | |
|---|---|
| 1 | Raul Rojas, Neural Networks: A Systematic Introduction, Springer Science & Business Media, 2013 |
| 2 | Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3 rd Edition, John Wiley & Sons Ltd, 2010. |
| **Reference Books:** | |
| 1 | Alianna J. Maren, Craig T. Harston, Robert M. Pap, Handbook of Neural Computing Applications, Academic Press, 2014. |
| 2 | Robert Fuller, Introduction to Neuro-Fuzzy Systems, Springer Science & Business Media, 2013. |
| 3 | James J. Buckley, Esfandiar Eslami, An Introduction to Fuzzy Logic and Fuzzy Sets, Springer Science & Business Media, 2013. |
| 4 | Simon Haykin, Neural Networks – A Comprehensive Foundation, 2nd edition, Pearson Prentice Hall, 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.

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**CO-PO/PSO Mapping**

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

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **VISION SYSTEMS AND ROBOTICS** | **Semester** | 07 |
| **Course Code** | MVJ20AM743 | **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***

- Learn the basics of robotics.
- Understand the robot end effectors.

- Learn the techniques used in robot mechanics.
- Learn the fundamentals of machine vision systems and robot programming.

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**BASICS OF ROBOTICS :** Introduction- Basic components of robot-Laws of robotics- classification of robot-work space - accuracy resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives.

**Video link** :

| **Module-2** | L2,L3 | **Hours 8** |
|---|---|---|

**ROBOT END EFFECTORS :** Robot End effectors: Introduction- types of End effectors- Tools as end effectors - Drive system for grippers - Mechanical gripper- types of gripper mechanism- gripper force analysis and gripper design - other types of gripper- special purpose grippers.

**Video link** :

| **Module-3** | L2,L3 | **Hours 8** |
|---|---|---|

**ROBOT MECHANICS :** Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation.

**Video link** :

| **Module-4** | L2,L3 | **Hours 8** |
|---|---|---|

**MACHINE VISION FUNDAMENTALS :** Machine vision: image acquisition, digital images- sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology - Camera calibration – Stereo Reconstruction.

**Video link :**

| **Module-5** | L2,L3 | **Hours 8** |
|---|---|---|

**V ROBOT PROGRAMMING:**Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- VAL language commands- motion control, hand control, program control, pick and place applications - palletizing applications using VAL, Robot welding application using VAL program- Rapid Language - basic commands Virtual robotics - VAL-II and AML – applications of robots

**Video link:**

**Course Outcomes:**

| | |
|---|---|
| CO1 | Able to know the basics of robotics. |

| | |
|---|---|
| CO2 | Able to understand the concepts of robot end effectors. |
| CO3 | Obtain forward, reverse kinematics and dynamics model of the industrial robot arm |
| CO4 | Develop the vision algorithms. |
| CO5 | Understand the robot programming and applications of robots. |

| **Text Books:** | |
|---|---|
| 1 | Carsten Steger, Markus Ulrich, Christian Wiedemann, Machine Vision Algorithms and Applications, Second edition, Weinheim, WILEY-VCH, 2018 |
| 2 | John J. Craig, Introduction to Robotics - Mechanics and Control, 3 rd Edition, Pearson Education Inc, 2013. |
| **Reference Books:** | |
| 1 | Mikell P Groover, Mitchel Weiss, Roger N Nagel, Nicholas G Odrey, Ashish Dutta, Industrial Robotics Technology, Programming and Applications, Second edition, 2012. |
| 2 | S.R. DEB, S.DEB, Robotics Technology and Flexible Automation, 2 nd Edition, Tata McGraw Hill Education, 2011. |
| 3 | S.K. Saha, Introduction to Robotics, 4 th Edition, Tata McGraw Hill Education, 2011. |
| 4 | Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis, Oxford University Press, Sixth impression, 2010. |

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**CO-PO/PSO Mapping**

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

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **DEEP LEARNING TECHNIQUES** | **Semester** | 07 |
| **Course Code** | MVJ20AM744 | **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***

- Learn feed forward deep networks
- Understand convolutional networks and sequence modelling
- Study probabilistic models and auto encoders
- Expose the students to various deep generative models
- Study the various applications of deep learning

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**DEEP NETWORKS :** Machine Learning Basics: Learning Algorithms – Supervised and Unsupervised learning – Feed forward Deep networks – regularization – Optimization for training Deep models.

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

| **Module-2** | L2,L3 | **Hours 8** |
|---|---|---|

**CONVOLUTIONAL NETWORKS AND SEQUENCE MODELLING :**Convolutional Networks – Convolution operation – Motivation Pooling – Basic Convolution function – Algorithms – Recurrent and recursive nets : Recurrent neural networks – Bidirectional RNN – Recursive Neural networks – Auto regressive networks – Long term dependencies – Temporal dependencies – Approximate search

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

| **Module-3** | L2,L3 | **Hours 8** |
|---|---|---|

**PROBABILISTIC MODELS AND AUTO ENCODERS** : Structured Probabilistic models : Challenges of unstructured modelling – using graphs to describe model structure – Learning about dependencies – inference – Deep learning approach – Monte carlo models – Linear Factor models and Auto encoders

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

| **Module-4** | L2,L3 | **Hours 8** |
|---|---|---|

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

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

| **Module-5** | L2,L3 | **Hours 8** |
|---|---|---|
| **APPLICATIONS:**Speech, Audio and Music processing – Language modelling and Natural language processing – information retrieval – object recognition and computer vision – Multi modal and multi task learning<br>**Video link:** http://www.deeplearning.net | | |

| **Course Outcomes:** | |
|---|---|
| CO1 | Use feed forward deep networks |
| CO2 | Apply convolutional networks and sequence modelling for problem solving |
| CO3 | Use probabilistic models and auto encoders |
| CO4 | Use deep generative models for problem solving |
| CO5 | Apply the deep learning techniques |

| **Text Books:** | |
|---|---|
| 1 | Yoshua Bengio and Ian J.Goodfellow and Aaron Courville, "Deep Learning", MIT Press, 2015 |
| 2 | Li Deng, Dong Yu, "Deep Learning: Methods and Applications", now publishers, 2014 |
| **Reference Books:** | |
| 1 | Special Issue on deep learning for speech and language processing, IEEE Transaction on Audio, Speech and Language Processing, vol. 18, iss. 5, 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 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 1 | 3 |
| CO4 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| CO5 | 3 | 1 | 2 | 2 | - | - | - | - | - | - | - | 1 | 2 | - |

High-3, Medium-2, Low-1

| **Course Title** | **INTERNET OF THINGS** | **Semester** | 07 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| **Course Code** | MVJ20AM751 | **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 fundamentals of IOT
- Learn about the basics of IOT Protocol
- Illustrate Mechanism and Key Technologies in IOT
- Explain the Standard of the IOT
- Learn about the IOT Platforms design Methodology and logical design of IOT system using Python
- Develop IOT applications using Raspberry Pi and apply Cloud services for IOT systems.

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**INTRODUCTION TO INTERNET OF THINGS:** Definition and Characteristics of IoT, Physical Design of IoT, IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies, Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Internet of things application examples: Overview, Smart metering /Advanced metering infrastructure, ehealth/ Body area networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking.

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

| **Module-2** | L2,L3 | **Hours 8** |
|---|---|---|

**FUNDAMENTAL IOT MECHANISM AND KEY TECHNOLOGIES:** Identification of IOT objects and services, structural aspects of the IOT, Key IOT Technologies, Evolving IOT standards overview and approaches, IETF IPv6 routing protocol for RPL Roll, Constrained application protocol, Representational state transfer, ETSI M2M, Third generation partnership Project service requirement for machine type communication, CENE\EC, IETF IPv6 over lower power WPAN, Zigbee IP(ZIP), IPSO(IP in smart object).

**Video link** :https://www.digimat.in/nptel/courses/video/106105166/L02.html

| **Module-3** | L2,L3 | **Hours 8** |
|---|---|---|

| | | |
|---|---|---|
| **LAYER ½ CONNECTIVITY**: Wireless technologies for the IOT, WPAN technologies for IOT/M2M, Cellular and mobile network technologies for IOT/M2M. Layer3 Connectivity, IPv6 technologies for the IOT: Overview and Motivations, Address Capabilities, IPv6 protocol Overview, IPv6 Tunelling, Ipsec in IPV6 Header Compression Schemes, Quality of service in IPv6, Migration Strategies to IPv6.<br><br>**Video link** : https://www.youtube.com/watch?v=dxslf8jHlAo | | |
| **Module-4** | L2,L3 | **Hours 8** |
| **IOT Platforms Design Methodology:** Introduction, IOT design methodology, Case Study on IOT System for Weather Monitoring, Motivation for using Python, IOT Systems- Logical design using Python: Introduction, Python data types and data structures, Control flow, Functions, Modules, Packages, File handling, Date/Time Operations, Classes.<br>**Video link :**https://www.digimat.in/nptel/courses/video/108108098/L01.html | | |
| **Module-5** | L2,L3 | **Hours 8** |
| **IOT physical devices and Endpoints:** What is an IOT device, Raspberry Pi, About the board, Linux on Raspberry Pi, Raspberry Pi interfaces.<br>Case Studies illustrating IOT design: Home Automation.<br>**Video link:** https://www.youtube.com/watch?v=h0gWfVCSGQQ | | |

| **Course Outcomes:** | |
|---|---|
| CO1 | Understands the essentials of IOT |
| CO2 | Analyze the Concept of Web services to access/control IOT devices |
| CO3 | Examine the design methodology of IOT and logical design using Python |
| CO4 | Develop a Portable IOT using Raspberry |
| CO5 | Identify Physical devices required to deploy on IOT application and connect to the cloud for real time scenarios |

| **Text Books:** | |
|---|---|
| 1 | A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Internet of Things, Universities Press, 2015. , ISBN:978-81-7371-954-7. |
| 2 | Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications, Wiley, 2013 ISBN:9781118473474. |
| **Reference Books:** | |
| 1 | Michael Miller, The Internet of Things, First Edition, Pearson, 2015 |

| | |
|---|---|
| 2 | Claire Rowland, Elizabeth Goodman et.al., Designing Connected Products, First Edition, O'Reilly, 2015 |
| 3 | Michael McRoberts "Beginning Arduino" , Technology in action 2nd edition. |

**CIE Assessment:**

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

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/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 | 2 | 1 | 3 | - | - | - | - | - | - | - | - | 2 | 3 |
| CO2 | 2 | 2 | 1 | 3 | - | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 1 | 3 |
| CO4 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| CO5 | 3 | 1 | 2 | 2 | - | - | - | - | - | - | - | 1 | 2 | - |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **CYBER FORENSICS** | **Semester** | 07 |
| **Course Code** | MVJ20AM752 | **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***

- Learn computer forensics.
- Become familiar with forensics tools.
- Learn to analyze and validate forensics data

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**INTRODUCTION TO COMPUTER FORENSICS:** Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**Video link** : https://nptel.ac.in/courses/106/106/106106129/

| **Module-2** | L2,L3 | **Hours 8** |
|---|---|---|

**EVIDENCE COLLECTION AND FORENSICS TOOLS:** Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

**Video link** :https://www.youtube.com/watch?v=2ESqwX3qb94

| **Module-3** | L2,L3 | **Hours 8** |
|---|---|---|

**ANALYSIS AND VALIDATION** : Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

**Video link** : https://www.youtube.com/watch?v=s01A-yqOby8

| **Module-4** | L2,L3 | **Hours 8** |
|---|---|---|

**ETHICAL HACKING :** Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats - Sniffing.

**Video link :**https://nptel.ac.in/courses/106/105/106105217/

| **Module-5** | L2,L3 | **Hours 8** |
|---|---|---|

**ETHICAL HACKING IN WEB :** Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

**Video link:** https://www.digimat.in/nptel/courses/video/106105217/L33.html

**Course Outcomes:**

| | |
|---|---|
| CO1 | Understand the basics of computer forensics |
| CO2 | Apply a number of different computer forensic tools to a given scenario |
| CO3 | Analyze and validate forensics data |
| CO4 | Identify the vulnerabilities in a given network infrastructure |
| CO5 | Implement real-world hacking techniques to test system security |

| **Text Books:** | |
|---|---|
| 1 | Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, ―Computer Forensics and Investigations‖, Cengage Learning, India Edition, 2016 |
| 2 | CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015. |
| **Reference Books:** | |
| 1 | John R.Vacca, ―Computer Forensics‖, Cengage Learning, 2005 |
| 2 | MarjieT.Britz, ―Computer Forensics and Cyber Crime‖: An Introduction‖, 3rd Edition, Prentice Hall, 2013. |
| 3 | AnkitFadia ― Ethical Hacking‖ Second Edition, Macmillan India Ltd, 2006 |
| 4 | Kenneth C.Brancik ―Insider Computer Fraud‖ Auerbach Publications Taylor & Francis Group– 2008. |

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

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **INTRODUCTION TO DRONES** | **Semester** | 07 |
| **Course Code** | MVJ20AM753 | **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.<br>**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.<br>**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.<br>**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.<br>**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.<br>**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 |
| 2 | Reg Austin “Unmanned Aircraft Systems UAV design, development and deployment”, Wiley, 2010. |

| **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**

**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 | 2 | 3 | 3 | - | - | - | - | - | - | 3 | 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 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 3 |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **BIG DATA ANALYTICS** | **Semester** | 07 |
| **Course Code** | MVJ20AM754 | **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 Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Provide hands on Hadoop Eco System
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R.

| **Module-1** | L1,L2 | **Hours 8** |
|---|---|---|

**INTRODUCTION TO BIG DATA AND HADOOP** Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools,

| | | |
|---|---|---|
| Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy.<br>**Video link** : https://www.digimat.in/nptel/courses/video/106104189/L01.html | | |
| **Module-2** | L2,L3 | **Hours 8** |
| **HDFS(Hadoop Distributed File System)** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.<br>**Video link** : https://www.digimat.in/nptel/courses/video/106104189/L04.html | | |
| **Module-3** | L2,L3 | **Hours 8** |
| **MAP REDUCE** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.<br>**Video link** : https://www.digimat.in/nptel/courses/video/106104189/L04.html | | |
| **Module-4** | L2,L3 | **Hours 8** |
| **PIG :** Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.<br>**HIVE :** Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.<br>**HBASE :** HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.<br>**Video link** : https://www.youtube.com/watch?v=qr_awo5vz0g | | |
| **Module-5** | L2,L3 | **Hours 8** |
| **DATA ANALYTICS WITH R MACHINE LEARNING :** Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with Big R.<br>**Video link**: https://nptel.ac.in/courses/110/107/110107092/ | | |

| **Course Outcomes:** | |
|---|---|
| CO1 | Identify Big Data and its Business Implications. |
| CO2 | List the components of Hadoop and Hadoop Eco-System |
| CO3 | Manage Job Execution in Hadoop Environment |
| CO4 | Develop Big Data Solutions using Hadoop Eco System |
| CO5 | Apply Machine Learning Techniques using R. |

| **Text Books:** | |
|---|---|
| 1 | Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012. |

| | |
|---|---|
| 2 | Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015. |
| **Reference Books:** | |
| 1 | Michael Minelli, Michele Chambers,Ambiga Dhiraj, ―Big Data,Big Analytics: Emerging Business Intelligence and Analytic Trends for Today‘s Business, Wiley CIO Series, 1stEdition,2013. |
| 2 | Rajiv Sabherwal, Irma Becerra- Fernandez, ―Business Intelligence –Practice, Technologies and Management, John Wiley, 1st Edition,2011 |
| 3 | Arvind Sathi, ―Big Data Analytics: Disruptive Technologies for Changing the Game, IBM Corporation, 1st Edition,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 | 2 | 2 | | - | - | - | - | - | - | - | - | - | 2 | - |
| CO2 | 2 | 2 | | - | - | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 1 | 3 |
| CO4 | 1 | 2 | 3 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| CO5 | 1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | - |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| **Course Title** | **ARTIFICIAL INTELLIGENCE FOR ROBOTICS LABORATORY** | **Semester** | 07 |
| **Course Code** | MVJ20AML76 | **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***

- Introduce students to the basic concepts and techniques of AI and Robotics.
- Develop skills of using for solving real world problems.
- Gain experience of doing independent study and research.

| S No | Experiment Name | RBT Level | Hours |
|---|---|---|---|
| **1** | Programming in C or Matlab to implement fuzzy logic application for autonomous robot system. | **L3** | **3** |
| **2** | Programming in C/Matlab to implement simulated annealing/genetic algorithm for solving inverse kinematic problems | **L3** | **3** |
| **3** | Programming in C/Matlab to solve traveling salesman problem using ant colony optimization algorithm | **L3** | **3** |
| **4** | Write program using Visual Prolog to create an expert system. | **L3** | **3** |
| **5** | Write program for obstacle avoidance in mobile robots using any one algorithm | **L3** | **3** |
| **6** | Implement A* algorithm to Solve 8-puzzle problem (Assume any initial configuration and define goal configuration clearly) | **L3** | **3** |
| **7** | Define the operators for controlling domestic robot; use these operators to | **L3** | **3** |

| | | | |
|---|---|---|---|
| | plan an activity to be executed by the robot. For example, transferring two/three objects one over the other from one place to another. Use Means-Ends analysis with all the steps revealed | | |
| **8** | Solving real time planning and scheduling problems using software like Witness/Pro-model | **L3** | **3** |

| **Course Outcomes:** | |
|---|---|
| CO1 | Test and experiment different problems using MATLAB. |
| CO2 | Develop AI applications using PROLOG/C/MATLAB. |
| CO3 | Explore deployment platforms for Robotics applications. |

| **Reference Books:** | |
|---|---|
| 1 | Saeed B. Niku, Introduction to Robotics Analysis, Application, Pearson Education Asia, 2001 |

| **CIE Assessment:** |
|---|
| Regular Lab work :20<br>Record writing :5<br>Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)<br>Viva 10 marks |
| **SEE Assessment:** |
| Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be,<br>i. Writeup : 20 marks<br>ii. Conduction : 40 marks<br>iii. Analysis of results : 20 marks<br>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

| | | | |
|---|---|---|---|
| **Course Title** | **NATURAL LANGUAGE PROCESSING LABORATORY** | **Semester** | 07 |
| **Course Code** | MVJ20AML77 | **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***

- Introduce the fundamental concepts and techniques of natural language processing.

| S No | Experiment Name | RBT Level | Hours |
|---|---|---|---|
| **1** | Implementing word similarity | **L3** | **3** |
| **2** | Implementing simple problems related to word disambiguation | **L3** | **3** |
| **3** | Simple demonstration of part of speech tagging | **L3** | **3** |
| **4** | Lexical analyzer. | **L3** | **3** |
| **5** | Semantic Analyzer. | **L3** | **3** |
| **6** | Sentiment Analysis. | **L3** | **3** |
| **7** | Probabilistic Parsing | **L3** | **3** |
| **8** | Probabilistic Context free Grammar | **L3** | **3** |
| **9** | Conditional Frequency Distribution | **L3** | **3** |
| **10** | Named Entity Recognition | **L3** | **3** |

**Course Outcomes:**

| | |
|---|---|
| CO1 | Understand the fundamental concepts and techniques of natural language processing (NLP) |
| CO2 | Understanding of the models and algorithms in the field of NLP. |
| CO3 | Demonstrate the computational properties of natural languages and the commonly used algorithms for processing linguistic information. |
| CO4 | Understanding semantics and pragmatics of languages for processing |

**Reference Books:**

| | |
|---|---|
| 1 | Daniel J and James H. Martin,‖speech and language processing‖ an introduction to natural language processing, computational linguistcs& speech recognition‖prentice hall,2009 |
| 2 | Lan H Written and Elbef,MarkA.Hall,‖data mining: practical machine learning tools and techiniques‖,Morgan Kaufmann,2013 |

| **CIE Assessment:** |
|---|
| Regular Lab work :20<br>Record writing :5<br>Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)<br>Viva 10 marks |
| **SEE Assessment:** |
| Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be,<br>i. Writeup : 20 marks<br>ii. Conduction : 40 marks<br>iii. Analysis of results : 20 marks<br>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