Semester: VI		
IIOT and Wireless Sensor Network (Theory)		
Course Code: MVJ21IO61		**CIE Marks:100**
Credits: L:T:P:S: 3:1:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Learn the basic issues, policy and challenges on the Internet.	
2	Bring the IoT perspective in thinking and building solutions	
3	Acquire an idea of some of the application areas where Internet of Things can be applied.	
4	Understand the cloud and internet environment.	
5	Analyse the various modes of communications with Internet.	

UNIT-I	
Prerequisites : *Basic Knowledge about C or C++* **Introduction to IoT**: IoT Vs. IIoT, History of IIoT, Components of IIoT: Sensors, Interface, Networks, People &Process, Hype cycle, IoT Market, Trends& future Real life examples, Key terms: IoT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIoT in Manufacturing Processes Use of IIoT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIoT **Video link / Additional online information (related to module if any):** 1. http://www.theinternetofthings.eu/what-is-the-internet-of-things. 2. https://www.engineersgarage.com/article_page/sensors-different-types-of-sensors/ **3.** https://www.educba.com/applications-of-sensors/	**8 Hrs**
UNIT-II	
Architectures: Overview of IoT components ,Various Architectures of IoT and IIoT, Advantages & disadvantages, Industrial Internet, Reference Architecture; IIoT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IoT. **Applications:** IoT Protocol Applications **Video link / Additional online information (related to module if any):** 1. https://inductiveautomation.com/resources/article/what-is-scada 2. https://iotbytes.wordpress.com/application-protocols-for-iot/ **3.** https://data-flair.training/blogs/iot-protocols/ **4.** https://www.avsystem.com/blog/iot-protocols-and-standards/	**8 Hrs**
UNIT-III	

Sensor and Interfacing: Introduction to sensors, Transducers, Classification, Roles of sensors in IIoT , Various types of sensors , Design of sensors, sensor architecture, special requirements for IIoT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet , Current, M2M etc **Video link / Additional online information (related to module if any):** **1.** https://www.digiteum.com/rfid-technology-internet-of-things **2.** https://www.uio.no/studier/emner/matnat/ifi/INF5910CPS/h10/undervisningsmateriale/RFID-IoT.pdf	**8 Hrs**
UNIT-IV	
Overview of Wireless Sensor Networks: Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks. Architectures: Single-Node Architecture, Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture, Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design principles for WSNs, Service interfaces of WSNs Gateway Concepts. Applications: Health care monitoring, Area monitoring, Industrial monitoring, Threat detection. **Video link / Additional online information:** 1. https://nptel.ac.in/courses/106/105/106105166/ **2.** https://nptel.ac.in/courses/106/105/106105160/	**8 Hrs**
UNIT-V	
Communication Protocols: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols (CSMA, PAMAS), Schedule based protocols (LEACH) Address and Name Management in WSNs, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering. Applications: Environmental/Earth sensing, Air pollution monitoring, Forest fire detection, Landslide detection, Water quality monitoring **Video link / Additional online information:** 1. https://nptel.ac.in/courses/106/105/106105160/	**8 Hrs**

2. https://nptel.ac.in/courses/106/105/106105195/ **3. Video link / Additional online information (related to module if any):** 1. https://www.water-io.com/iot-vs-wot https://www.talend.com/resources/iot-cloud-architecture/	

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe IoT and IIoT
CO2	Analyse various IoT Layers and their relative importance
CO3	Design and develop the real life IoT applications using off the shelf hardware and software
CO4	Develop an energy efficient system for WSN.
CO5	Create a real-life application involving Wireless Sensor Networks using IoT concepts

Text Books	
1.	Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications 2.Bernd Scholz-Reiter, Florian.
2.	Cisco, IOT Fundamentals – Networking Technologies, Protocols, Use Cases for IOT, Pearson Education; First edition (16 August 2017). ISBN-10: 9386873745, ISBN-13: 978-9386873743
3.	Raj Kamal,"Internet of Things-Architecture and design principles", McGraw Hill Education.
4.	Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor NetworksTechnology, Protocols, And Applications", John Wiley, 2007.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of

three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3, Medium-2, Low-1

Semester: VI		
Artificial Intelligence (Theory and Practice)		
Course Code: MVJ21IO63		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**

Course Learning Objectives: The students will be able to	
1	Describe the basic principles, techniques, and applications of Artificial Intelligence
2	Analyze and explain different AI learning methods.
3	Compare and contrast different AI techniques available.
4	Understanding the minimax algorithm.
5	Apply the concept of NLP algorithms

UNIT-I	
INTRODUCTION: What Is AI? The Foundations of Artificial Intelligence ,The History of Artificial Intelligence, The State of the Art . Intelligent Agents : Agents and Environments ,Good Behaviour: The Concept of Rationality ,The Nature of Environments, The Structure of Agents. Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules. **Experimental Learning:** Implementation of Relational and Inheritable Knowledge **Video Links** • https://www.youtube.com/watch?v=3MW3ICnkQ9k	**8 Hrs**
UNIT-II	
The natural Language of Artificial Intelligence: Introduction, Converting English to Prolog Facts and Rules, Goals, Prolog Terminology, Variables, Control Structures, Arithmetic operators, Matching in Prolog, Backtracking, Cuts, Recursion, Lists, Dynamic databases, Input/Output and Streams **Using Predicate Logic:** Representing simple facts in logic, representing instance and ISA relationships, Computable Functions and Predicates, Resolution, Natural Deduction. **Experimental Learning:** Implementing programs in PROLOG to solve problems of Predicate Logic **Video Links:** • https://www.youtube.com/watch?v=pzUBrJLIESU • https://www.youtube.com/watch?v=2juspgYR7as • https://www.youtube.com/watch?v=h9jLWM2lFr0 • https://www.youtube.com/watch?v=-v1K9AnkAeM	**8 Hrs**
UNIT-III	

Heuristic search techniques: Generate and test, Hill Climbing, Best First Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis. **Weak Slot- and- Filler Structures:** Semantic Nets,Frames. **Strong slot-and Filler Structures-** Conceptual Dependency, Scripts. **Experimental Learning**: Program to implement Best first Search, A*, AO* algorithm **Video Links:** • https://www.youtube.com/watch?v=ieZr_TpRwnQ • https://www.youtube.com/watch?v=lCrHYT_EhDs	**8 Hrs**
UNIT-IV	
Game Playing : Overview, Minimax Search Procedure, Adding alpha beta cut off, Additional Refinements, Iterative Deepening, References on Specific games. **Learning:** What is learning?, Forms of learning, Rote learning, learning by taking advice, Learning in problem solving, Induction leaning, Explanation based learning, Discovery, Analogy, Formal learning Theory, Neural Network Learning. **Experimental Learning** : Real time problem solving using Game Playing **Video Links**: • https://www.youtube.com/watch?v=_i-lZcbWkps • https://www.youtube.com/watch?v=l-hh51ncgDI	**8 Hrs**
UNIT-V	
Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and Pragmatic processing, Statistical Natural language processing and Spell checking. **Genetic Algorithms**: A peek into the biological world, Genetic Algorithms (GAs), Significance of genetic operators, termination parameters, niching and speciation, evolving neural network, theoretical grounding. **Experimental Learning**: Program to implement spell checking problem **Video Links**: • https://www.youtube.com/watch?v=zG8AJhVy5NY • https://www.youtube.com/watch?v=Z_8MpZeMdD4	**8 Hrs**
LABORATORY EXPERIMENTS	
13. Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem 14. Implement and Demonstrate Best First Search Algorithm on any AI problem 15. Implement AO* Search algorithm. 16. Solve 8-Queens Problem with suitable assumptions	

17. Implementation of TSP using heuristic approach
18. Implementation of the problem-solving strategies: either using Forward Chaining or Backward Chaining
19. Implement resolution principle on FOPL related problems
20. Implement any Game and demonstrate the Game playing strategies
21. Aim: Illustrate and Demonstrate the working model and principle of Find-S algorithm. Program: For a given set of training data examples stored in a .CSV file, implement and demonstrate the Find-S algorithm to output a description of the set of all hypotheses consistent with the training examples.
22. Aim: Demonstrate the working model and principle of candidate elimination algorithm. Program: For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
23. Aim: To construct the Decision tree using the training data sets under supervised learning concept. Program: Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
24. Aim: To understand the working principle of Artificial Neural network with feed forward and feed backward principle. Program: Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
25. Aim: Demonstrate the text classifier using Naïve bayes classifier algorithm. Program: Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

Any 12 experiments to be conducted

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify AI based problems and understand Intelligent agents
CO2	Apply predicate logic and heuristic techniques to solve AI problems.
CO3	Understand the different representation of knowledge.
CO4	Understand the concepts of learning and Natural Language Processing.
CO5	Understand Genetic Algorithms and solve AI problems using PROLOG.

Text Books	
5.	Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.
6.	E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.
3.	Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.
Reference Books	
1	G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem Solving”, Fourth Edition, Pearson Education, 2002.
2	N.P. Padhy “Artificial Intelligence and Intelligent Systems” , Oxford University Press-2015

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Semester: VI		
Cloud Computing (Theory and Practice)		
Course Code: MVJ21IO64		**CIE Marks:50+50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	To understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability, benefits, as well as current and future challenges.	
2	To introduce the basic ideas and principles in data center design, cloud management techniques and cloud software deployment considerations.	
3	To 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)	
4	To introduce cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage.	
5	To discuss the variety of programming models and develop working experience in several of them.	

UNIT-I	
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	**10 Hrs**
UNIT-II	
'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	**10 Hrs**

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	
UNIT-III	
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	**10 Hrs**
UNIT-IV	
Platform and Software as a Service**:**Technologies and Tools for Cloud Computing- Aneka Cloud Platform- Aneka Resource Provisioning Service- Hybrid Cloud Implementation - Comet Cloud Architecture- Autonomic Behavior of Comet Cloud- Overview of Comet Cloud-based Applications- Implementation and Evaluation- Workflow Management	**10 Hrs**

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	
UNIT-V	
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**	**10 Hrs**
LABORATORY EXPERIMENTS	
1. Installation of various hypervisors and instantiation of VMs with image file using open-source hypervisors such as Virtual Box, VMWare Player, Xen and KVM. 2. Create and Launch Virtual Machines in Amazon Web Services and Google App Engine. Access Windows Server using RDP and Linux Instances using Putty/ssh. 3. Develop the Storage Services Using Buckets and EBS in Amazon Web Services 4. Write a Google app engine program to generate n even numbers and deploy it to Google cloud. 5. Develop a Virtual Private Cloud using AWS/GCP Platform. 6. Demonstrate Cloud Database Services in AWS/GCP 7. Working in Codenvy to demonstrate Provisioning and Scaling of a website	

8. Install Hadoop single node cluster and run simple applications like wordcount **Any 6 experiments to be conducted**

Course Outcomes: After completing the course, the students will be able to	
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/Reference 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.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three

sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

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

Semester: VI		
INDUSTRIAL IOT AND APPLICATIONS (OEC 1)		
Course Code: MVJ21IO621		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 3 Hrs.

Course Learning Objectives: The students will be able to	
1	Understand the basic concepts of IIoT and Cyber physical systems.
2	Describe CPS and CMS models.
3	Illustrate the architectural design of IIoT
4	Design of AI and data analytics for manufacturing.

UNIT-I	
Introduction to IIoT: Industrial Internet of Things and Cyber Manufacturing Systems, Application map for Industrial Cyber Physical Systems, Cyber Physical Electronics production. **Laboratory Sessions/ Experimental learning:** Familiarization with Arduino/RaspberryPi and perform necessary software installation **Applications:** Data acquisition **Video link / Additional online information:** http://youtu.be/oBZnySDgst8	8 Hrs
UNIT-II	
Modelling of CPS and CMS: Modelling of Cyber Physical Engineering and manufacturing, Model based engineering of supervisory controllers for cyber physical systems, formal verification of system, components, Evaluation model for assessments of cyber physical production systems. **Laboratory Sessions/ Experimental learning:** To interface LED/BUZZER with Arduino and write a program to turn on LED for 1 second after every 2 seconds.	8 Hrs

Applications: Automated and remote equipment management and monitoring **Video link / Additional online information:** http://youtu.be/oBZnySDgst8	
UNIT-III	
Architectural Design Patterns for CMS and IIoT: CPS-based manufacturing and Industries 4.0., Integration of Knowledge base data base and machine vision, Interoperability in Smart Automation, Enhancing Resiliency in Production Facilities through CPS. Communication and Networking of IIoT. **Laboratory Sessions/ Experimental learning:** 1. To interface push button with Arduino and write a program to turn ON LED when push button is pressed. **Applications:** Predictive maintenance **Video link / Additional online information:** http://youtu.be/oBZnySDgst8	8 Hrs
UNIT-IV	
Artificial Intelligence and Data Analytics for manufacturing: Application of CPS in Machine tools, Digital production, Cyber Physical system Intelligence, Introduction to big data and machine learning and condition Monitoring. **Laboratory Sessions/ Experimental learning:** 1. To interface DHT11 sensor with Arduino and write a program to print temperature reading and humidity reading. **Applications:** Supply chain optimization **Video link / Additional online information:** http://youtu.be/oBZnySDgst8	8 Hrs
UNIT-V	
Application of IIoT: Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IIOT in Manufacturing Sector.	8 Hrs

Laboratory Sessions/ Experimental learning: 1. To interface Bluetooth with Arduino and write a program to send sensor data to smart phone using Bluetooth. **Applications:** Plant safety improvement **Video link / Additional online information:** http://youtu.be/oBZnySDgst8	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyse the operation IOT devices and use of them in applications.
CO2	Evaluate the performance of smart machines.
CO3	Demonstrate the electronic systems and analyse their applicability
CO4	Apply CPS in machine tools.
CO5	Design a simple prototype AI for a certain application.

Text Books:	
1.	Mikell .P. Groover, "Automation, Production systems, and computer integrated manufacturing"- 3rd edition, Pearson 2009
2.	Groover, Weiss, Nagel, "Industrial Robotics"- McGraw Hill International, 2nd edition, 2012
Reference Books:	
1.	YoramKoren, Robotics for Engineers –McGraw Hill International, 1st edition, 1985.
2.	Klafter, Chmielewski and Negin, Robotic Engineering - An Integrated approach, PHI, 1st edition, 2009.
3.	Tiess Chiu Chang & Richard A. Wysk, An Introduction to Automated Process Planning Systems

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three).

The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):
Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Semester: VI		
PRIVACY AND SECURITY IN IOT (MOOC Course)		
Course Code: MVJ21IO65		CIE Marks: 50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 3 Hrs.

Course Learning Objectives: The students will be able to	
1	To make the student understand the concept of mobile computing terminology and basics
2	To understand the wireless protocols.
3	To understand various routing mechanisms.

UNIT-I	
Introduction to IoT: Physical Design of IoT, Logical design of IoT, IoT Enabling Technology and Applications. IoT Physical Device and Endpoints, Tools of IoT **Video link / Additional online information** • http://youtu.be/E4h4Z3g-eLM (NPTEL VIDEO)	8 Hrs
UNIT-II	
M2M to IoT Introduction, Difference between IoT and M2M, Some Definitions, M2M Value Chains, IoT Value Chains, networking in IoT **Video link / Additional online information (related to module if any):** http://youtu.be/E4h4Z3g-eLM (NPTEL VIDEO)	8 Hrs
UNIT-III	
Internet of Things (IoT) Architecture: Introduction, State of the art, Architecture Reference Model-Developing Internet of Thing: IoT Platform design methodology, Case Study Illustrating IoT Design. IoT Physical Servers and Cloud Offering, Data Analytics for IoT. **Video link / Additional online information** http://youtu.be/E4h4Z3g-eLM	8 Hrs
UNIT-IV	
Need of Internet of Things (IoT) Security: Requirement and Basic Properties, Main Challenges, Confidentiality, Integrity, Availability,	8 Hrs

NonRepudiation Security Classification & Access Control: Data classification (Public and Private), Privacy issues in IoT, IoT Authentication and Authorization, IoT Data Integrity **Video link / Additional online information** http://youtu.be/E4h4Z3g-eLM	
UNIT-V	
Internet of Things Privacy, Security and Governance: Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Case Study 1: Smart Home, Case Study 2: Smart Grid Network, Case Study 4: Wearable Computing & BYOD, Case Study 5: Mobile HealthCare **Video link:** http://youtu.be/E4h4Z3g-eLM	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Able to interpret GSM architecture and its services.
CO2	Analyse the various wireless application protocols and its different concepts for various mobile applications.
CO3	Learn the representation of mobile network layer protocols and its functionalities.
CO4	Understand, analyse & develop any existing or new models of mobile environments for 3G networks.
CO5	Understand, evaluate, and create the platforms, protocols, and related concepts along with along with mobile in mobile environment.

Text/Reference Books:	
1	Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
3	Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 201 ISBN: 978-1-4493- 9357-1
4	"Practical Internet of Things Security" ,Drew Van Duren,2016.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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