SONA COLLEGE OF TECHNOLOGY,(Autonomous) Salem-636 005.

Department of Mechanical Engineering

ADVANCED DIPLOMA IN SMART MANUFACTURING

CURRICULUM & SYLLABI

Academic Year: 2021-22

I - SEMESTER (FULL TIME)

S.No	Course Code	Course Title	L	T	P	C	Group Code
THEORY							
1		Advanced Manufacturing Technologies	3	-	-	3	C
2		Mechanics of Materials	3	1	-	4	C
3		Embedded Systems and Microprocessors	3	-	-	3	C
Total			9	1	-	10	-

II - SEMESTER (FULL TIME)

S.No	Course Code	Course Title	L	T	P	C	Group Code
THEORY							
1		Additive Manufacturing Technology	4	-	-	4	C
2		Electric Drives & control	3	-	-	3	C
3		Smart Manufacturing Tools	3	-	-	3	C
Total			10	-	-	10	-

III - SEMESTER (FULL TIME)

S.No	Course Code	Course Title	L	T	P	C	Group Code
THEORY							
1		Computer Aided Design & Manufacturing	4	-	-	4	C
2		Product Design & Development	3	-	-	3	C
3		Industrial Internet of things	3	-	-	3	C
Total			10	-	-	10	-

IV- SEMESTER (FULL TIME)

S.No	Course Code	Course Title	L	T	P	C	Group Code
PRACTICAL							
1		Project Work	-	-	20	10	C

CBCS-Credit Split-up

Semester	I	II	III	IV	Total
Credit	10	10	10	10	40

Course Code		L	T	P	C
Course Name	**ADVANCED MANUFACTURING TECHNOLOGIES**	3	-	-	3

Course Outcomes

Upon completion of this course the students will be able to

CO1 Understand the fundamentals and classify nontraditional machining processes and also discuss recent development in manufacturing.

CO2 Explain the various mechanical type nontraditional machining process like AJM, WJM and USM and also analyze their process characteristics and parameters.

CO3 Discuss the fundamentals of electro-chemical process like ECM, electro chemical grinding and honing processes and also calculate the material removal rate of ECM and ECG.

CO4 Explain the fundamentals of thermal machining process like EDM, and WEDM and also discuss their process parameters.

CO5 Describe the fundamentals of plasma machining, discuss their process parameters and know the importance of etchant.

Unit I INTRODUCTION L 9 T 0

Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications. Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

Unit II MECHANICAL PROCESSES L 9 T 0

Abrasive jet machining, Water jet machining and abrasive water jet machining Basic principles, equipment's, process variables, mechanics of metal removal, MRR, application and limitations. Ultrasonic Machining. (AJM, WJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

Unit III ELECTRO – CHEMICAL PROCESSES L 9 T 0

Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal

removal rate. Fundamentals of chemical, machining, advantages and applications.

Unit IV THERMAL METAL REMOVAL PROCESSES-I L 9 T 0

General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

Unit V THERMAL METAL REMOVAL PROCESSES -II L 9 T 0

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut. Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining-principle maskants –etchants-applications. Magnetic abrasive finishing, Abrasive flow finishing.

Total Number of hours: 45

Learning Resources

Text Books

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., 2004.

Reference Books

1. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc.
2. Adithan. M. "Unconventional Machining Processes" Atlantic publishers and distributors, 2009.
3. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, 2003.
4. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London, 1998.

Course Code		L	T	P	C
Course Name	**MECHANICS OF MATERIALS**	3	1	-	4

Course Outcomes

Upon completion of this course the students will be able to

CO1 Analyze the concepts of stress and strain in simple and compound bars.

CO2 Analyze principal planes, stresses and Mohr circle concept to an inclined plane.

CO3 Determine shear force and Bending moment for different beam and supports.

CO4 Apply basic equation of simple torsion and design of shafts and helical springs.

CO5 Compute the slope and deflection calculation in beams and columns using different methods.

Unit I Stress, Strain and Deformation of Solids L 9 T 3

Simple stress and strain – Stresses and strains due to axial force - Mechanical properties of materials – Stress-strain curve –- Hooke's law - Factor of safety – Stepped shafts – Uniformly varying sections – Stresses in composite sections - Temperature stresses – Poisson's ratio - shear modulus, bulk modulus, relationship between elastic constants.

Unit II Analysis of Stresses in Two Dimensions L 9 T 3

State of stresses at a point – Normal and tangential stresses on inclined planes - Principal planes and stresses – Plane of maximum shear stress - Mohr's circle for biaxial stresses –Hoop and longitudinal stresses in thin cylinders and shells – under internal pressure – deformation of thin cylinders and shells.

Unit III Beams - Loads and Stresses L 9 T 3

Beams – types of supports – simple and fixed, types of load – concentrated, uniformly distributed, varying distributed load, combination of above loading – relationship between bending moment and shear force – bending moment, shear force diagram for simply supported, cantilever and over hanging beams – Point of contra flexure. Introduction to Theory of simple bending.

Unit IV Torsion in Shafts and springs L 9 T 3

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts Springs: Classification – Leaf springs, closed coil helical springs - Application of various springs – Maximum shear stress in spring – Deflection of helical coil springs under axial loads.

Unit V Deflection of Beams L 9 T 3

Deflection of beams – double integration method – Macaulay's method – slope and deflection using moment area method. Columns: Buckling of long columns due to axial load - Equivalent length of a column – Euler's and Rankine's formulae for columns of different end conditions – Slenderness ratio

Total Number of hours: 60

Learning Resources

Text Books

1. R K Bansal, "A text book of Strength of Materials", Lakshmi Publications (P) Limited, New Delhi, 2007.
2. R K Rajput, "Strength of Materials", S Chand & Co., New Delhi, 2006.

Reference Books

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995.
2. Singh D.K "Mechanics of Solids" Pearson Education 2002.
3. Ryder G.H, "Strength of Materials", Macmillan India Ltd., Third Edition, 2002.
4. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997.

Course Code		L	T	P	C
Course Name	**EMBEDDED SYSTEMS AND MICROPROCESSORS**	3	-	-	3

Course Outcomes

Upon completion of this course the students will be able to

CO1 Analyze hardware and software architecture of any embedded systems.

CO2 Develop an embedded system using development boards.

CO3 Describe the architecture of 8 bit and 16-bit microprocessors.

CO4 Analyze the functionality of each block in 8051 microcontrollers.

CO5 Design an electronic system using PIC microcontroller.

Unit I Concepts of Embedded Systems L 9 T 3

Introduction to embedded system-Application areas-categories of embedded systems-Overview of embedded system architecture- Specialties of embedded systems-Recent trends in embedded systems-Hardware architecture of embedded systems.

Unit II Design of Embedded systems L 9 T 3

Hardware design-Selection of processor-Software design--Implementation-Integration and testing-Types of testing-Types of Hardware Platforms-Hardware description of AVR microcontroller development and its features-Introduction to RTOS –Architecture of the kernel-Scheduling Algorithms-FIFO-Round Robin-Shortest job firs-Semaphores.

Unit III 8 bit and 16 bit Microprocessors L 9 T 3

8085 architecture-Signal diagram-instruction set-addressing modes-interrupts -8086-architecture –Signal diagram –Arithmetic and logical instructions-addressing modes -memory segmentation.

Unit IV 8 bit Embedded Controller L 9 T 3

Architecture of 8051 Microcontroller – signals – I/O ports – memory – counters and timers – serial data I/O – interrupts.

Unit V PIC Embedded Controller L 9 T 3

PIC 16C61 / 71 microcontroller architecture – FSR – Reset action – Oscillatory connections – Memory organizations- Instructions-Addressing modes-I/O ports-Interrupts-Timers-ADC in PIC 16C61 / 71 microcontroller.

Total Number of hours: 45

Learning Resources

Text Books

1.Microprocessors and Microcontrollers 2nd Edison – Oxford university press,2018 by A. Nagoor Kani.

2 Microprocessors and Microcontrollers 2nd Edison – McGrawHill Companies,2015 by A. Nagoor Kani.
3 K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dreamtech press, 2016.
4 Ajay V Deshmukh, "Microcontrollers [Theory and Applications]", McGrawHill, 2017.

Reference Books

1. Soumitra Kumar Mandal , "Microprocessors and Microcontrollers, Architecture, Programming and Interfacing using 8085, 8086 and 8051", McGrawHill Companies,2017
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming and application with 8085", 4th Edition, Penram International Publishing, New Delhi, 2000.
3. Dougles V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 2017.
4. Shibu K V, "Introduction to Embedded Systems", McGraw Hill, 2009.
5. Raj Kamal "Embedded Systems Architecture Programming and Design" 2nd Edition TMH, 2010.

Course Code		L	T	P	C
Course Name	**ADDITIVE MANUFACTURING TECHNOLOGY**	4	-	-	4

Course Outcomes

Upon completion of this course the students will be able to

- **CO1** Discuss the need for time compression in product development in making prototypes.
- **CO2** Categorize the various RP systems and implement in product development.
- **CO3** Compare fused deposition modeling and laminated object manufacturing based on process parameters and field of application.
- **CO4** Analyze the parameters of solid ground curing and 3D printers and justify their application in various systems.
- **CO5** Apply laser engineered net shaping and rapid tooling in medical and other fields for reducing manufacturing time.

Unit I INTRODUCTION L 12 T 0

Need for time compression in product development, Product development – conceptual design – development – detail design – prototype – tooling.

Unit II CLASSIFICATION L 12 T 0

Classification of RP systems, Stereo lithography systems – Principle – process parameters – process details – machine details, Applications – Direct Metal Laser Sintering (DMLS) system – Principle – process parameters – process details – machine details, Applications.

Unit III FDM & LOM L 12 T 0

Fusion Deposition Modeling – Principle – process parameters – process details – machine details, Applications – Laminated Object Manufacturing – Principle – process parameters – process details – machine details, Applications.

L 12 T 0

Unit IV SGC & 3DP

Solid Ground Curing – Principle – process parameters – process details – machine details, Applications. 3 – Dimensional printers – Principle – process parameters – process details – machine details, Applications, and other concept modelers like thermo jet printers, Sander's model maker, JP system 5, Object Quadra system.

Unit V LENS & Rapid Tooling L 12 T 0

Laser Engineering Net Shaping (LENS), Ballistic Particle Manufacturing (BPM) – Principle – Introduction to rapid tooling – direct and indirect method, software for RP – STL files, Magics, Mimics – Application of Rapid prototyping in Medical field.

Total Number of hours: 60

Learning Resources

Text Books

1. Pham D.T. & Dimov.S.S., "Rapid manufacturing", Springer-Verlag, London, 2001.
2. Amitabha Ghosh, "Rapid Prototyping – A Brief Introduction", Affiliated East –West Press Private Limited, New Delhi, 2002

Reference Books:

1. N.Hopkinson, R.J.M, Hauge, p m, dickens, "Rapid Manufacturing – An Industrial revolution for the digital age", Wiley, 2006
2. Ian Gibson, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying", Wiley, 2006
3. Paul F. Jacobs, Rapid Prototyping and Manufacturing, "Fundamentals of Stereolithography", McGraw Hill 1993.
4. Chua C.K, Leong K.F and Lim C.S, Rapid Prototyping: Principles and Applications, second edition, World Scientific, 2003.

Course Code		L	T	P	C
Course Name	**ELECTRIC DRIVES AND CONTROL**	3	-	-	3

Course Outcomes

Upon completion of this course the students will be able to

- **CO1** Describe about Types of electric drives, Heating and cooling curves.
- **CO2** Discuss about the Speed control of DC motors and three phase induction motor.
- **CO3** Analyze the operation of Slip power recovery schemes and field oriented fed induction motor control.
- **CO4** Ability to analyze, comprehend, design and simulate synchronous motors based Marginal angle drives.
- **CO5** Apply microcontroller and DSP based design in real time applications concepts.

Unit I ELECTRIC DRIVES-INTRODUCTION L 9 T 0

Basic Elements – Types of Electric Drives – factors are influencing the choice of electrical drives – Heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

Unit II SOLID STATE SPEED CONTROL OF DC DRIVES L 9 T 0

Introduction- Half wave and Full Wave Rectifiers -Single phase half controlled and fully controlled bridge rectifier fed DC drives – skin and proximity effects- Speed control of DC motors – Ward Leonard scheme – Drawbacks – Thyristor converter fed DC Drives: single and four quadrant operations. Chopper fed DC Drives: Time ratio control and current limit control – single, two and four quadrant operation.

Unit III THREE PHASE AC INDUCTION MOTOR DRIVES L 9 T 0

Speed control of three phase induction motors: Stator control – Stator voltage and frequency control – AC Chopper and Cycloconverter fed induction motor drives. Rotor control – Rotor resistance control and slip power recovery schemes – Static control of rotor resistance using DC Chopper – Static and Scherbius drives – Introduction to vector control-based drives, Direct and Indirect Vector Control.

Unit IV THREE PHASE AC SYNCHRONOUS MOTOR DRIVES L 9 T 0

Speed control of three phase synchronous motors – Voltage source and current source converter fed synhchronous motors – Commutator less DC motor- Cycloconverter fed synchronous motors – Effects of harmonics on the performance of AC motors – Closed loop control of drive motors, Marginal angle control and power factor control.

Unit V DIGITAL CONTROL AND DRIVE APPLICATIONS L 9 T 0

Digital techniques in speed control – Advantages and limitations – DSP based control of drives – Selection of drives and control schemes for steel rolling mills. Paper mills, lifts and cranes-Real Time case studies.

Total Number of hours: 45

Learning Resources

Text Books

1. Gobal K. Dubey, "Fundamentals of Electrical Drives", Narosal Publishing House, New Delhi
2. B.K.Bose, "Power Electronic & AC drives", Prentice Hall, 2006.

Reference Books:

1. Hamid A.Toliyat, Steven Campbell, 'DSP based electromechanical motion control', CRC Press, 2019.
2. Vedam Subramanyan, Electrical Drives concepts and applications, Tata Mc Graw Hill Publications, 2014.
3. R. Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 2003.

Course Code		L	T	P	C
Course Name	**SMART MANUFACTURING TOOLS**	3	-	-	3

Course Outcomes

Upon completion of this course the students will be able to

- **CO1** Describe the principles, functions and types of Jigs and Fixtures.
- **CO2** Demonstrate the components and development of jigs.
- **CO3** Demonstrate the components and development of fixtures.
- **CO4** Explain the application of automated material transfer system and AGV.
- **CO5** Identify the part family and develop the FMS layout based on industry.

Unit I INTRODUCTION TO JIGS AND FIXTURES L 9 T 0

Tool design objectives - Production devices - Inspection devices - Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Tolerance and error analysis.

Unit II JIGS L 9 T 0

Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

Unit III FIXTURES L 9 T 0

General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component.

Unit IV AUTOMATED MATERIAL TRANSFER SYSTEM AND AGV L 9 T 0

Automated production line – system configurations, work part transfer mechanisms – fundamentals of automated assembly system – part delivery at workstations – design for automated assembly – consideration in material handling system design – conveyor systems – types of conveyors –. automated guided vehicle system – types of vehicles and AGV applications - automated transport system- conventional storage methods and equipments – automated storage/retrieval system and carousel storage system deadlocks in automated manufacturing systems – applications in dead lock avoidance.

Unit V FMS L 9 T 0

FMS - overview – levels- manufacturing module -assembly cell -manufacturing group - production systems-manufacturing line - part families – visual – parts classification and coding – production flow analysis – grouping of parts and machines by rank order clustering method – benefits of GT – case studies. FMS – components – workstations – FMS layout configurations – computer control systems – FMS planning and implementation issues – architecture of FMS – flow chart showing various operations in FMS.

Total Number of hours: 45

Learning Resources

Text Books

1. Edward G Hoffman, "Jigs & Fixture Design", Thomson – Delmar Learning, Singapore 2004.
2. Mikell P. Groover, "Automation, Production Systems, and Computer-integrated Manufacturing", Pearson Education 2016.

Reference Books:

1. Kempster, "Jigs & Fixtures Design, The English Language Book Society", 1978
2. Joshi, P.H., "Jigs & Fixtures, Second Edition", Tata McGraw-Hill Publishing Company Limited, New Delhi 2004
3. Serope Kalpakjian,Manufacturing Engineering and Technology (SI Edition) Pearson Education 2016.

Course Code		L	T	P	C
Course Name	**COMPUTER AIDED DESIGN AND MANUFACTURING**	4	-	-	4

Course Outcomes

Upon completion of this course the students will be able to

- **CO1** Analyze the fundamental concepts of Computer Aided Design and 2D transformation Techniques.
- **CO2** Elaborate the concepts of CNC Technology and the constructional features of CNC Machines.
- **CO3** Write a CNC part program to manufacture engineering components.
- **CO4** Describe the scope of CIM and the Process plan sheet preparation methods.
- **CO5** Discuss the various types of Computer Aided Quality Control Methods used in manufacturing industries.

Unit I COMPUTER AIDED DESIGN L 12 T 0

Introduction to CAD, Interactive display devices, Operator input/output devices, Graphic standards, 2D Transformation- Scaling, Translation and Rotation. Geometric Modeling-Wire Frame Modeling, Surface Modeling, Solid Modeling-Constructive solid geometry (CSG), Boundary Representation (B-Rep).

Unit II COMPUTER AIDED MANUFACTURING L 12 T 0

CNC Technology-Classification of CNC systems-Contouring System-Interpolators, open loop and closed loop CNC systems, Hardware features-Direct Numerical Control. Construction features -Structural members-Slide ways-Sides linear bearings-Ball screws-Spindle drives and feed drives-work holding devices and tool holding devices-Automatic Tool changers.

Unit III CNC – PROGRAMMING L 12 T 0

Computer Numerical Control codes- Punched tapes, G,M Code, Standards, Types of dimensioning, Manual Part programming for point to point- Linear, Circular interpolation. - Canned cycles and subroutines. CNC programming practices for Turning and Milling Operations.

L 12 T 0

Unit IV GROUP TECHNOLOGY AND CAPP

Introduction to CIM, Role of Elements, CIM Networking, Group Technology, Part Families, parts Classification & Coding, GT Machine cells, Shop floor phases, Benefits of GT. Computer Aided Process Planning (CAPP), Retrieval type, Generative type Process Planning Systems, Benefits of CAPP.

Unit V COMPUTER AIDED QUALITY CONTROL AND FMS L 12 T 0

Computer Aided Quality Control (CAQC)- Introduction, Contact Inspection methods, Non-Contact Inspection methods, Co-ordinate Measuring Machine. Flexible manufacturing Systems- Introduction, Scope, Types, Elements and Benefits of FMS.

Total Number of hours: 60

Learning Resources

Text Books

1. 1. Ibrahim Zeid." CAD-CAM Theory and Practice", Tata McGraw-Hill Publishing Co.Ltd., 2005.
2. P.Radhakrishan, S.Subramanyan, V. Raju, "CAD/CAM/CIM". New Age International Publishers, 3rd Edition 2007.
3. Mikell P. Groover and Emory W. Zimmers, Jr, "CAD/CAM Computer Aided and Manufacturing". Eastern Economy Edition,PHI publishers 2007.

Reference Books:

1. Mikell.P.Groover "Automation, Production Systems and computer integrated and manufacturing", Pearson Education 2002.
2. P.N. Rao, "CAD/CAM Principles and Applications". Tata McGraw Hill Publications, 2002.
3. William.M. Neumann and Robert.F. Sproul, "Principle of Computer Graphics" McGraw Hill Book Co. Singapore, 2002.
4. Paul G. Ranky, "Computer Integrated Manufacturing- An Introduction with Case Studies" Prentice Hall International, 2004.

Course Code		L	T	P	C
Course Name	**PRODUCT DESIGN AND DEVELOPMENT**	3	-	-	3

Course Outcomes

Upon completion of this course the students will be able to

CO1 Apply different ideas enabling people to work with innovation and development in organization.

CO2 Examine the product specification, selection concept, product performance and manufacturing.

CO3 Develop product geometry, layout, fundamental and incidental interaction.

CO4 Design the integrated process robust design, conceptualization and management of industrial design.

CO5 Estimate and analyze the manufacturing components cost, assembly cost and planning for prototypes.

Unit I INTRODUCTION L 9 T 0

Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement.

Unit II CONCEPT GENERATION, SELECTION AND TESTING L 9 T 0

Plan and establish product specifications. Task - Structured approaches - clarification – search externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety – component standardization - product performance – manufacturability.

Unit III PRODUCT ARCHITECTURE L 9 T 0

Product development management - establishing the architecture - creation - clustering -geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

Unit IV INDUSTRIAL DESIGN L 9 T 0

Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs – conceptualization- refinement - management of the industrial design process.

Unit V **DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT** L 9 T 0

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping – Planning for prototypes - Economic Analysis.

Total Number of hours: 45

Learning Resources

Text Books

1. Ulrich K.T. and Eppinger S.D., "Product Design and Development" McGraw –Hill International Editions, 1999

Reference Books:

1. Belz A., 36-Hour Course: "Product Development" McGraw-Hill, 2010.
2. Rosenthal S., "Effective Product Design and Development", Business One Orwin,Homewood, 1992, ISBN 1-55623-603-4.
3. Pugh S., "Total Design – Integrated Methods for successful Product Engineering",Addison Wesley Publishing, 1991, ISBN 0-202-41639-5.

		L	T	P	C
Course Code					
Course Name	**INDUSTRIAL INTERNET OF THINGS**	3	-	-	3

Course Outcomes

Upon completion of this course the students will be able to

- **CO1** Assess the characteristics of IoT and Analyze the difference between M2M and IoT.
- **CO2** Incorporate the digital devices in mechanical engineering projects using Arduino board.
- **CO3** Construct the logical design for IoT using Python and Raspberry Pi.
- **CO4** Identify the architecture and infrastructure of cloud computing.
- **CO5** Design and develop the automation system with inventory management & quality control.

Unit I INTRODUCTION TO IOT L 9 T 0

Introduction to IoT: characteristics of IoT, levels & deployment templates, Sensing, Actuation, Communication Protocols, Machine-to-Machine Communications, Difference between IoT and M2M, Communication modules - RFID, Bluetooth, WiFi, Zigbee.

Unit II CLASSIFICATION L 9 T 0

Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Uno architecture, setup the IDE, writing Arduino software, basics of embedded c programming for Arduino, Introduction of python programming for Arduino.

Unit III IOT WITH PYTHON PROGRAMMING & RASPBERRY PI L 9 T 0

Logical design using Python, installing python, python data types and data structures, control f functions, modules, Introduction to Raspberry, Implementation of IoT with Raspberry Introduction to SDN, SDN for IoT, Data Handling and Analytics.

Unit IV CLOUD PLATFORMS FOR IOT L 9 T 0

Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, S Benefits and challenges of cloud computing, public vs private clouds, role of virtualizatio enabling the cloud-Cloud architecture, Fog Computing.

Unit V INDUSTRIAL IOT L 9 T 0

IoT vs IIoT, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Case Study: Agriculture, Healthcare, Activity Monitoring, power plants, inventory management

& quality control, plant safety and security (including AR and VR safety applications).

Total Number of hours: 45

Learning Resources

Text Books

1. A. Bahga and V. Madisetti, Internet of Things, A hands-on approach, VPT, 1st edition, 2014.
2. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0, CRC Press, 2020.
3. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.

Reference Books

1. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key applications and Protocols, Wiley, 2012.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, and David Boyle, From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence, Elsevier, 2014.
3. Marco Schwatrz, Internet of Things with Arduino Cookbook, Packt Publication Ltd, 2016.
4. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.

Course Code		L	T	P	C
Course Name	**PROJECT WORK PHASE**	-	-	20	10

Course Outcomes

Upon completion of this course the students will be able to

- Apply knowledge and demonstrate to manage project in multi-disciplinary.
- Design and conduct experiments to interpret data pertaining to engineering problems.
- Apply contextual knowledge to assess social, health and cultural issues and endue to professional engineering practice.
- Prepare documentation and presentation for engineering activities for society.
- Perform effectively on leader in multi-disciplinary terms.

1. The students formed into a team of convenient groups of not more than 4 members on a project are not allowed to change their team members.

2. Every project team should report to their faculty guide for discussion from the day of beginning of 2nd semester.

3. The group has to analyse the selected problem addressed in their project work to draw solution.

4. A project report has to be submitted by each student group at the end of the 2nd semester.

5. Three reviews have to be conducted by a team of faculty (minimum of 3 and maximum of 5) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

Total No of Hours:300