ANNA UNIVERSITY: : CHENNAI 600 025
AFFILIATED INSTITUTIONS
REGULATIONS - 2017
M.E. MECHATRONICS
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)
1. The graduates acquire ability to create mathematical model, design, analysis and synthesis the system integration based on the knowledge of mechanical, electrical, electronic, control, computer, communication, fluid and other engineering domains.
2. The graduates use their talent, self-confidence, knowledge and engineering practice which facilitate them to pursue position of scientific and/or managerial leadership in their career paths.
3. The graduates apply their consciousness of moral, professional responsibilities and motivation to practice life-long learning in a team work environment.

PROGRAMME OUTCOMES (PO)
1. Graduate will demonstrate strong basics in mechanics and its design, electronics engineering serves the foundation for the Programme.
2. Graduate will be familiar about the importance of the sensors, signal conditioning, and control system design for the appropriate use of mechatronic system developments.
3. Graduate able to demonstrate the effective use of actuators and its elements for the generation, control and conversion of energy for the typical automation.
4. Graduate able to develop the mechatronic systems by the integration of mechanical, electrical, electronics, fluid, and other multidisciplinary systems.
5. Graduate able to build the real time automation system within realistic constraints such as industrial, economic, environmental, ethical, social, health and safety.
6. Graduate will become familiar with modern automation tools and such as incorporating robots and vision based intelligence automation.
7. Graduate will acquire the capability to identify, formulate and solve engineering problems related to mechatronic systems.
8. Graduate will has an understanding of social, professional and ethical responsibility when developing automated system.
9. Graduate will be able to communicate effectively both in verbal and nonverbal forms.
10. Graduate will be trained towards developing and understanding the impact of development of mechatronics system on global, economic, environmental and societal context.
11. Graduate will be capable of understanding the value for life-long learning and motivating them to involve the research works.
12. Graduate will be able to design and develop innovative/ manufacturable / marketable / environmental friendly systems useful to the nation and the society.
13. Graduate will be able to emerge as a successful entrepreneur.
### Mapping of PEOs with POs

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TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = (22 + 26 + 15 + 12) = 75
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### SEMESTER III (Elective IV & V)

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<td>Industrial Safety</td>
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## EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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MR5101 CONCEPTS IN ELECTRONICS ENGINEERING

OBJECTIVES:
- To understand the basics and working principles of electronic components and their applications.

UNIT I ELECTRONIC COMPONENTS AND DEVICES
Resistors, capacitors, inductors, transformers – types and properties - junction diodes, zener diodes, transistors and thyristors - types-operating mechanism-characteristics and applications. LED – characteristics and applications

UNIT II OPERATIONAL AMPLIFIERS AND APPLICATIONS
Operational amplifiers – principles, specifications, characteristics and applications- arithmetic operations, integrator, differentiator, comparator, schmitt trigger, instrumentation amplifiers, active filters, linear rectifiers, waveform generators, A/D converters, feedback and power amplifiers, sine wave oscillators

UNIT III DIGITAL ELECTRONICS

UNIT IV MEASURING INSTRUMENTS

UNIT V POWER MANAGEMENT
Pulse width modulation and pulse position modulation – batteries--SMPS - sensors, actuators and controllers energy consumption -power optimization of integrated system.

TOTAL : 30 PERIODS

OUTCOMES:
This course is intended for learning the fundamentals and applications of Electronic Components, Devices, analog circuits, digital circuits, test and measuring instruments. Further, students will learn to develop customized electronics components for mechatronic applications.

REFERENCES
OBJECTIVES:
- To give hands on experience on basic electronics unit developments for the mechanical stream students.

LIST OF EXPERIMENTS
2. Experimentation with CRO.
3. Design of DC power supplies
4. Design of inverting amplifier and non-inverting amplifiers
5. Design of Instrumentation amplifier.
7. Design of combinational circuits and sequential circuits.
9. RC Servo motor driver circuit.
10. Design of stepper motor driver circuit.

TOTAL: 30 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- The laboratory experiments provides a hands on experience onboard electronics developments particularly the students come from mechanical stream.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. CRO-1
2. DSO-1
3. DC Power supply
   5V – 5 No’s
   12V, 10A - 1 No
   24V, 10A or higher - 1 No
4. Function generator-1
5. OP-Amp trainer kit (inverting and non-inverting amplifier module)
6. Analog filters trainer kit
7. Sequential circuit trainer kit
8. Combination circuit trainer kit
9. A/D Converter trainer kit -1 No
10. D/A Converter Trainer kit-1 No
11. Driver Circuit Module for servomotor-1 No
12. Driver Circuit module for stepper motor-1 No
13. Multi-Meter, bread board, and solder machine.
14. Electronic components for power supply (transformer, regulator, diode, capacitors) -5 No’s
MR5102   CONCEPTS OF MACHINES AND MECHANISMS    L T P C
                                                   2 2 0 3

OBJECTIVES:
- To impart knowledge of basic mechanical engineering to the students.

UNIT I    MECHANISMS
12
Definition – Machine and Structure – Kinematic link, pair and chain – classification of
Kinematic pairs – Constraint& motion - Degrees of freedom – Slider crank – Single and double
– Crank rocker mechanisms – Inversions – applications. Kinematic analysis and synthesis of
simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II    FRICTION
12
Types of friction – friction in screw and nuts – pivot and collar – thrust bearings – collar bearing
– plate and disc clutches – belt (flat & vee) and rope drives – creep in belts – Jockey pulley –
open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tension –
condition for maximum power transmission.

UNIT III    GEARING AND CAMS
12
Gear profile and geometry-nomenclature of spur and helical gears – law of gearing –
interference requirement of minimum number of teeth in gears-gear trains-simple and
compound gear trains determination of speed and torque in epicyclic gear trains-Cam profile-
different types of followers.

UNIT IV    VIBRATION
12
Free, forced and damped vibrations of single degree of freedom systems – force transmitted to
supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and
multirotor systems – geared shafts – critical speed of shafts.

UNIT V    MACHINE TOOLS
12
Machine tool construction-features – operations of lathe, milling machine, drilling machine –
Drive system for machine tools – mechanical, hydraulic and electric stepped and variable
speeds – spindle speeds and feed drives-linear and reciprocation motion generation.

TOTAL : 60 PERIODS

OUTCOMES:
- The students will understand the concepts, design, construction and properties of
  mechanical elements and machines.

REFERENCES
   2012.
MA5156  APPLIED MATHEMATICS FOR ENGINEERS  

OBJECTIVES:
This course is designed to enrich the knowledge in various advanced mathematical techniques such as matrix theory, calculus of variations, probability and random variables, Laplace transforms and Fourier transforms. The fundamental concepts in these areas will be more useful for the students to model the engineering problems and solving them by applying these methods.

UNIT I  MATRIX THEORY  
The Cholesky decomposition - Generalized Eigenvectors - Canonical basis - QR factorization - Least squares method - Singular value decomposition.

UNIT II  CALCULUS OF VARIATIONS  
Concept of variation and its properties – Euler’s equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems - Direct methods : Ritz and Kantorovich methods.

UNIT III  PROBABILITY AND RANDOM VARIABLES  

UNIT IV  LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS  

UNIT V  FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS  

TOTAL : 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:
- Apply various methods in matrix theory to solve system of linear equations.
- Maximizing and minimizing the functional that occur in various branches of engineering disciplines.
- Computation of probability and moments, standard distributions of discrete and continuous random variables and functions of a random variable.
- Application of Laplace and Fourier transforms to initial value, initial–boundary value and boundary value problems in Partial Differential Equations.
REFERENCES:

MR5103 SENSORS AND SIGNAL CONDITIONING

OBJECTIVES:
- To learn the various types of sensors, transducers and signal conditioning circuits for Mechatronics system development

UNIT I INTRODUCTION

UNIT II MOTION, PROXIMITY AND RANGING SENSORS

UNIT III FORCE, MAGNETIC AND HEADING SENSORS

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS
Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric, Temperature – IC, Thermistor, RTD, Thermocouple.

UNIT V SIGNAL CONDITIONING

TOTAL: L=45+P(30)=75 PERIODS

OUTCOMES:
- The students will learn the principles of various sensors and transducers and also able to study the characteristics of sensors.
REFERENCES

LAB COMPONENT

OBJECTIVES:
- To learn and gather the practical experience on sensors and its measurements for mechatronics system development.

LIST OF EXPERIMENTS
1. Study on various kinds of sensors and its characteristics.
2. Study on signal conditioning units.
3. Experimentation on voltage, current, power, and frequency measurement.
4. Strain gage, load cell and torque transducer characterization & applications – data acquisition & instrument control.
5. Experimentation with tactile sensor for force and touch detection.
6. LVDT, acoustics ranging, Hall Effect sensor and ultrasonic distance measurement applications.
8. Study on eddy current sensor for thickness measurement.
9. Study on ultrasonic sensors for material fault diagnosis.
10. Experimentation on laser sensor for non-contact dimension measurement.
11. Study on Experimentation with Gyroscope, Accelerometer and magnetometer.
12. Experimentation with speed and position measurement using encoders.

TOTAL: 30 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- Students able to come with suitable sensor selection for the mechatronics system development based on the laboratory experience.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Temperature Sensors (RTD, Thermocouple, Thermistor, & IC Temperature sensor)- 1 in Each
2. Optical sensors (Photovoltaic, Photo Conductive, Photo Transistor, & Photo Diode) - 1 in Each
3. Strain Gauge Trainer – 1 No’s
4. Load cell Trainer – 1 No’s
5. Torque Transducer Trainer – 1 No’s
6. LVDT, Acoustics Ranging and Hall Effect Trainer – 1 No’s on Each
7. Pressure sensor, ultrasonic sensor Trainer – 1 No’s on Each
8. Proximity sensor (Eddy current, optical, inductive, capacitive principle) – 1 No’s on Each
9. Gyroscope, Accelerometer and Magnetometer Trainer – 1 No’s on Each
10. Encoders (Absolute, incremental) – 1 No’s on Each
11. Tactile sensor (force and touch) Trainer – 1 No
12. DAQ card – 5 No
13. PC - 5

MR5104 CONTROL SYSTEM DESIGN

L T P C
3 0 2 4

OBJECTIVES:
• To understand dynamics, design and analysis of control systems to meet the desired specifications.

UNIT I SYSTEM REPRESENTATION AND MODELLING

UNIT II DESIGN OF FEEDBACK CONTROL SYSTEM

UNIT III TIME AND FREQUENCY DOMAIN ANALYSIS

UNIT IV CONTROL SYSTEM DESIGN
Root locus approach to control system design – lead, lag, lag-lead compensation using time domain analysis. control system design using frequency domain analysis - lead, lag, lag-lead compensation using frequency domain analysis– P, PI, and PID controllers – tuning methods and rule.

UNIT V CONTROL AND ANALYSIS OF SERVO MOTOR

L=45+P(30)=75 PERIODS
OUTCOMES:

- The students will know the various types of control systems and their modelling, with reference to mode controls, and determination of stability in time and frequency domain.

REFERENCES


LABORATORY

L T P C
0 0 2 0

OBJECTIVES:

- To study the classical concepts behind the control system design for various systems in both time and frequency domain.

LIST OF EXPERIMENTS

1. Series, cascaded, feedback system modelling.
2. State space modeling
3. Study on time domain representation and specifications
4. Study on Routh-Hurwitz criterion and Root locus techniques
5. Study on frequency domain representation and specifications
6. Bode plot and polar plot technique
7. Study on tuning and finding of controller gain using combination of PID controllers.
8. Study on velocity vs. torque control.
9. Study on position vs. torque control.
10. Study on various motion control systems

TOTAL: 30 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- The outcome of this laboratory is to create familiarization with control system design for various systems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. MATLAB/ SCILAB – Control System Tool Box with - 15 No’s
2. Motion control PLC with motor, load setup and feedback setup-1
OBJECTIVES:
This course is intended for learning the Introduction and Architecture of Microcontroller, Fundamentals of Assembly language Programming, Programming of Microcontroller and Interfacing of Microcontroller. This course is also gives the ideas of Fundamentals. Architecture and Operations of programmable logic controller, Problem solving using logic ladder diagrams and communication in PLCs.

UNIT I  INTRODUCTION TO MICRO CONTROLLER
Microprocessors and Microcontrollers – CISC and RISC - Fundamentals of Assembly language Programming – Instruction to Assembler – C Programming for Microcontrollers – Compiler and IDE – Introduction to Embedded systems - Architecture 8051 family - PIC 18FXXX – family – Memory organization

UNIT II  PROGRAMMING OF 8051 MICROCONTROLLER
Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication of 8051.

UNIT III  PROGRAMMING OF PIC18FXXX MICROCONTROLLER
Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication, CCP, ECCP PWM programming of PIC18FXXX.

UNIT IV  PERIPHERAL INTERFACING
Interfacing of Relays, Memory, key board, Displays – Alphanumeric and Graphic, RTC, ADC and DAC, Stepper motors and DC Motors, I^2C, SPI with 8051 and PIC family

UNIT V  PLC PROGRAMMING

TOTAL : 45 PERIODS

REFERENCES
OBJECTIVES:
- To learn the drawing, modeling, simulation and assembly of machines and its components.

LIST OF EXPERIMENTS

1. 2D modeling and 3D modeling of components such as
   - Bearing.
   - Couplings.
   - Ball screw.
   - Gears.
   - Sheet metal components
   - Jigs, fixtures and die.
   - Structures and frames

2. Modeling and simulation of mechanism
   - 4 Bar chain
   - Slider crank,
   - Ball and screw,
   - Rack and pinion.
   - Belt and chain drives.
   - Quick return and elliptical trammel.

3. Assembly and simulation of system
   - Serial manipulators
   - Automotive systems
   - Manufacturing machineries

4. Analysis of mechanical components
   - Introduction to FEA packages.
   - Machine elements (link, gear, joints) under static loads and dynamic loads.

TOTAL: 30 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- The computer aided modeling and simulation laboratory will give the hands on experience on modeling the mechanical structure and its elements and also it delivers the Assembly and simulation of Machine and mechanisms.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
PC with Solidworks & FEA packages -15 No's
OBJECTIVES:
- To impart the knowledge in the design of machine elements and product design used in mechatronics systems.

UNIT I INTRODUCTION  12
Introduction to national and international symbols- Engineering materials and their physical properties and applied to design- Selection of materials- selection for new design and material considerations-Factors of safety in design- Dimensioning and detailing- Fitness and tolerance-Surface finish and machining symbols –Product development- Elementary concept of functional, aesthetic and form design- Principles of design optimization- Future trends- CAD.

UNIT II STATIC AND VARIABLE STRESSES  12
Static and variable loading in machine elements- Stress concentration- Goodmen and soderberg method of design- Design of power transmission shafts- Subjected to torsion, bending and axial loads- Design of close coiled helical spring -Design of couplings- Muff, Flange, Bushed and pin types.

UNIT III DESIGN OF TRANSMISSION ELEMENTS  12

UNIT IV PRODUCT DESIGN AND DEVELOPMENT  12
Quality function development (QFD) - product design and specification, design for manufacturability (DFM), design for assembly and disassembly, human factors in design ergonomics, creativity in design, TRIZ- axiomatic design.

UNIT V FINITE ELEMENT ANALYSIS  12
Basic Concept of FEA - finite element analysis of one dimensional and two dimensional problems-variational formulation of B.V.P. – Ritz Method-Examples related to one-dimensional and two-dimensional problems.

TOTAL : 60 PERIODS

OUTCOMES:
- The students will learn the design of machine elements, product design concepts and introduction to finite element analysis.

REFERENCES
OBJECTIVES:
- To impart through knowledge in system modelling, system identification and simulation of mechatronic system.

UNIT I  INTRODUCTION
Mechatronics system overview – recent advancements – application – key elements – mechatronics system design process.

UNIT II  MODELING OF SYSTEM

UNIT III  SIMULATION

UNIT IV  DESIGN OPTIMIZATION
Optimization – problem formulation - constraints – over view of linear and nonlinear programming techniques – other optimization techniques- optimal design of mechatronics system with case studies.

UNIT V  CASE STUDIES ON BUILDING A MECHATRONICS SYSTEM
Modeling and simulation of automotive system - power window, engine timing, building clutch look up - antilock braking system ABS and automatic transmission controller - modeling of stewart platform with actuators.

OUTCOMES:
The students will gain the basic system modeling, simulation and design optimization for mechatronics systems developments.

REFERENCES
OBJECTIVES:
- To learn the system design and its integration for modeling the mechatronics systems.

LIST OF EXPERIMENTS
1. Modeling of various types of electrical motors and with gear train.
   - Power window.
   - Engine timing.
   - Building clutch look up.
   - Antilock braking system ABS.
   - Automatic transmission controller.
5. Modeling and Simulation of mobile robot.
7. Modeling of conveyor and object sorting system using various sensors.
8. Modeling of quadcopter.

OUTCOMES:
Upon Completion of the course, the students will be able to:
- The students will acquire the hands on experience in design, modeling and simulation of mechatronic system.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
Adam’s Software and MATLAB software packages are to be used to carryout the listed experiments.

TOTAL: 30 PERIODS
MR5201  MACHINE VISION  L  T  P  C
3  0  0  3
OBJECTIVES:
- To impart knowledge on imaging machine vision and its applications.

UNIT I  INTRODUCTION  8
Human vision – Machine vision and Computer vision – Benefits of machine vision – Block
 diagram and function of machine vision system implementation of industrial machine vision
system – Physics of Light – Interactions of light – Refraction at a spherical surface – Thin Lens
Equation

UNIT II  IMAGE ACQUISITION  12
Scene constraints – Lighting parameters – Lighting sources, Selection – Lighting Techniques –
Types and Selection – Machine Vision Lenses and Optical Filters, Specifications and Selection
– Imaging Sensors – CCD and CMOS, Specifications – Interface Architectures – Analog and
Digital Cameras – Digital Camera Interfaces – Camera Computer Interfaces, Specifications and
Selection – Geometrical Image formation models – Camera Calibration

UNIT III  IMAGE PROCESSING  10
Processing in Spatial and Frequency Domain – Point Operation, Thresholding, Grayscale
Stretching – Neighborhood Operations, Image Smoothing and Sharpening – Edge Detection –
Binary Morphology – Colour image processing.

UNIT IV  IMAGE ANALYSIS  6
Feature extraction – Region Features, Shape and Size features – Texture Analysis – Template

UNIT V  MACHINE VISION APPLICATIONS  9
Machine vision applications in manufacturing, electronics, printing, pharmaceutical, textile,
applications in non-visible spectrum, metrology and gauging, OCR and OCV, vision guided
robotics – Field and Service Applications – Agricultural, and Bio medical field, augmented
reality, surveillance, bio-metrics.

TOTAL : 45 PERIODS
OUTCOMES:
- The outcome of this course is to apply the vision concepts in various mechatronics
applications.

REFERENCES
2. Emanuele Trucco, Alessandro Verri, “Introductory Techniques For 3D Computer Vision”,
   First Edition
   Edition

22
OBJECTIVES:
- To impart knowledge in the area of hydraulic, pneumatic electric actuators and their control.

UNIT I  FLUID POWER SYSTEM GENERATION AND ACTUATORS  

UNIT II  CONTROL AND REGULATION ELEMENTS  
Control and regulation Elements—Direction, flow and pressure control valves--Methods of actuation, types, sizing of ports. Spool valves-operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance

UNIT III  CIRCUIT DESIGN FOR HYDRAULIC AND PNEUMATICS  
Typical Design methods – sequencing circuits design - combinational logic circuit design-cascade method - Karnaugh map method- Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits.

UNIT IV  ELECTRICAL ACTUATORS  
D.C Motor-Working principle, classification, characteristics, Merits and Demerits, Applications- AC Motor- Working principle, Types, Speed torque characteristics, Merits and demerits, Applications Stepper motor- principle ,classification, construction. Piezo electric actuators – Linear actuators Hybrid actuators – Applications

UNIT V  ELECTRICAL DRIVE CIRCUITS  

L=45+P(30)=75 PERIODS

OUTCOMES:
The students able to familiar with basic concepts of hydraulic, pneumatics and electric drives and their controlling elements and also gather the knowledge on designing the hydraulic and pneumatic circuits using ladder diagram.

REFERENCES
OBJECTIVES:
- To study the functional aspects of different pneumatic and hydraulic Components and its use in circuits and also to train the student in designing different pneumatic and hydraulic circuits for different applications.

LIST OF EXPERIMENTS

Hydraulic and Pneumatic Drives
1. Simulation of speed control circuits in a hydraulic trainer.
2. Simulation of hydraulic circuits in a hydraulic trainer.
3. Simulation of single and double acting cylinder circuits using different directional control values.
4. One shot and regenerative pneumatic circuits.
5. Simulation of ladder logic program.
7. Simulation of logic and electro-pneumatic circuits.
8. Simulation of electro pneumatic sequencing circuits.
9. Simulation of PLC based electro pneumatic sequencing circuits.
10. To design and connect the circuits for the given problem (case study).

Electrical Drives
1. Speed and torque characterization and control of DC motors.
2. Speed and Torque characterization and control of AC motors.
3. Speed and torque characterization and sequence control of stepper motor
4. Electrical energy planning and management of autonomous system.
5. Closed loop position and velocity control of a DC servo motor.
6. Tuning of P, PI and PID controller using simulation software.

TOTAL: 30 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- The outcome of this laboratory is to create familiarization with fluid power drives and its electronic control for automation application.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Hydraulic Trainer with Pump and Valves
2. Pneumatic Trainer with Compressor and Valves
3. Electro Pneumatic Trainer
4. Electro Hydraulic Trainer
5. Hydraulics and Pneumatics Simulation Software
6. System Controlled DCMotor with Feedback Setup
7. System Controlled ACMotor with Feedback Setup
8. System Controlled Stepper Motor Setup
9. MATLAB/SCILAB/ any other Software for Controller Tuning.
10. PC-7
OBJECTIVES:
- To introduce and train the students to use microcontroller for actuation and control of speed

LIST OF EXPERIMENTS

1. Assembly language programming and simulation of 8051 in Keil IDE.
3. Sensor interfacing with ADC to X8051 & PIC.
4. DAC & RTC interfacing to X8051 & PIC.
5. Timer, Counter and Interrupt program application for X8051 and PIC.
6. Step motor (unipolar & bipolar motor) and PWM servo motor control to interfacing with X8051.
7. UART serial programming in X8051 and PIC.
8. PC Interfacing of stepper motor - Unipolar & Bipolar.
12. Serial communication of ARM processor with computation platform.
13. Programming on single board computers for sensor and actuator interface.
14. Programming on communication and control between single board computers for machine to machine communication.

TOTAL: 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- To use microcontroller and other processor to control different motors like DC motor, stepper motor, servo motor etc.,

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. 8051 Microcontroller Trainer Kit with Software- 3 No’s
2. PIC Trainer Kit with Software - 3 No’s
3. ARM 7 Trainer Kit with Software - 3 No’s
4. Single Board Computer Evaluation Board with Software - 3 No’s
5. Computers- 12 No’s
6. ADC interface- 3
7. Servomotor – 3 no’s
8. Stepper motor - 3 no’s
OBJECTIVES:
- To gather the practical exposure on machine vision elements, lighting technique, processing softwares and algorithms.

LIST OF EXPERIMENTS
1. Study on different kinds of vision sensors.
2. Study on lighting techniques for machine vision.
4. Experimentation on image acquisition towards the computation platform.
5. Pre-processing techniques in image processing.
6. Edge detection and region of interest extraction.
7. Experimentation with image processing algorithm for feature extraction.
8. Experimentation with pattern recognition.
10. Vision based Gear parameter measurement.

TOTAL: 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- The students will acquire the hands on experience in machine vision techniques.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. CMOS Camera (USB/Ethernet) - 1 No
2. CCD Camera (USB/Ethernet) - 1 No
3. Standard Boom Stand (Bench top setup) - 2 No's
4. Extension Tube (5mm to 50mm) - 2 No's
5. Lenses (between 3mm to 50mm focal length) - 2 No's
6. Tele-centric lense - 1 No
7. Lighting (Coaxial, ring lighting, Diffused, backlighting) - 1 No Each.
8. Machine vision software - 2 No's
9. PC - 2 No's

MR5391  INDUSTRIAL ROBOTICS  L T P C
3 0 0 3

OBJECTIVE:
- To teach students the basics of robotics, construction features, sensor applications, robot cell design, robot programming and application of artificial intelligence and expert systems in robotics.

UNIT I  INTRODUCTION AND ROBOT KINEMATICS
UNIT II ROBOT DRIVES AND CONTROL

UNIT III ROBOT SENSORS

UNIT IV ROBOT CELL DESIGN AND APPLICATION

UNIT V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

TOTAL: 45 PERIODS

OUTCOME:
The student will be able to design robots and robotic work cells and write program for controlling the robots. The student will be able to apply artificial intelligence and expert systems in robotics.

REFERENCES
OBJECTIVES:

- To impart through knowledge in basic and advance multi body mechanical system dynamics and its mathematical preliminaries.

UNIT I  INTRODUCTION TO DYNAMICS  9

UNIT II  COMPUTATIONAL METHODS FOR DYNAMIC ANALYSIS  10

UNIT III  NONLINEAR SYSTEMS AND CONCEPTS  10

UNIT IV  SYSTEM CHARACTERIZATION  9
Stability, controllability, observability - Phase Plane Analysis- Phase Portrait- Limit Cycle- Describing Function- Assumption – Limit Cycles

UNIT V  CONTROL OF NONLINEAR MECHANICAL SYSTEMS  7
Double inverted pendulum – nonlinear machineries – robot- suspension system- aircraft.

TOTAL : 45 PERIODS

OUTCOMES:

- On successful completion of this course, all students will have ability to understand and analysis the multi-body system dynamics for mechanical systems.
- Students able to develop an equation and able to understand the behaviour of the nonlinear systems.

REFERENCES
MR5002 COMPUTER AIDED INSPECTION  L  T  P  C
3  0  0  3

OBJECTIVES:
- To make the learner to design and fabricate inspection methods and systems incorporating electronic systems for inspection and quality control in engineering.

UNIT I FUNDAMENTALS AND CONCEPTS IN METROLOGY  9
Standards of measurement – Analog and digital measuring instruments-comparators – Limits, Fits and Tolerances – Gauge design – Angular measurements – Surface Roughness – Form errors and measurements.

UNIT II INSPECTION AND GENERAL MEASUREMENTS  12

UNIT III OPTO ELECTRONICS IN ENGINEERING INSPECTION  6
Use of opto electronics in Tool wear measurement – Micro hole measurement and surface Roughness – Applications in In-Process measurement and on line Inspection.

UNIT IV MACHINE VISION  9

UNIT V COORDINATE METROLOGY AND QUALITY CONTROL  9
Co-ordinate measuring machines – Applications and case-studies of CMM in Inspection – Use of Computers in quality control – Control charts – Reliability.

TOTAL : 45 PERIODS

OUTCOMES:
- The students will acquire the knowledge on computer aided inspection of various geometries

REFERENCES

MR5003 DIGITAL MANUFACTURING  L  T  P  C
3  0  0  3

OBJECTIVES:
- To explain in detail about the various Mechatronics elements in CNC machines and also programming of CNC machines.
UNIT I  INTRODUCTION OF NC, CNC, DNC AND ADAPTIVE CONTROL  6
Classification of machine tools – types, functions and processes - fundamentals of NC and CNC technologies Adaptive control - types, application and benefits - general configuration of adaptive control and function – reasons for process change - practical problems with adaptive control - example for feedback and adaptive control.

UNIT II  MECHATRONIC ELEMENTS IN CNC MACHINE TOOLS 9
CNC systems - configuration of the CNC system – interfacing – monitoring – diagnostics - machine data - compensations for machine accuracies - PLC in CNC – PLC programming for CNC, steps in programming and case studies - machine structure -types of loads on CNC machine - guide ways and types - mechanical transmission elements - elements for rotary motion to linear motion - ball screw and types - roller screw and types - rack and pinion - various torque transmission elements - requirements of feed drives and spindle drive.

UNIT III  MECHATRONICS ELEMENT IN CNC MEASURING SYSTEM AND TOOLING 9

UNIT IV  CNC PROGRAMMING 14

UNIT V  TESTING AND MAINTENANCE OF CNC MACHINES 5

OUTCOMES:
The students will learn mechatronics elements, control and programming in CNC machine.

REFERENCES
OBJECTIVES:
To equip students with fundamentals of finite element principles so as to enable them to understand the behavior of various finite elements and to be able to select appropriate elements to solve physical and engineering problems with emphasis on structural and thermal engineering applications.

UNIT I  INTRODUCTION  6

UNIT II  ONE DIMENSIONAL ANALYSIS  10
Steps in FEA – Discretization, function – derivation of element characteristics matrix, shape function, assembly and imposition of boundary conditions – solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III  SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS  10

UNIT IV  ANALYSIS OF PRODUCTION PROCESSES  10

UNIT V  COMPUTER IMPLEMENTATION  9
Pre Processing, Mesh generation, elements connectivity, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages such as ANSYS and DEFORM – Development of code for one dimensional analysis and validation.

TOTAL : 45 PERIODS

OUTCOMES:
To equip students with fundamentals of finite element principles so as to enable them to understand the behavior of various finite elements and to be able to select appropriate elements to solve physical and engineering problems with emphasis on structural and thermal engineering applications.
REFERENCES

MR5005 COMPUTER AIDED PRODUCTION AND AUTOMATION OF PLANTS L T P C

OBJECTIVES:

• To impart the system development knowledge on automation production and manufacturing system integration in different applications.

UNIT I COMPUTER AIDED PRODUCTION PLANNING 8

UNIT II AUTOMATED MATERIAL TRANSFER AND STORAGE SYSTEM 10

UNIT III GROUP TECHNOLOGY AND FLEXIBLE MANUFACTURING SYSTEMS 10
UNIT IV AUTOMATION SYSTEMS AND ADVANCED MANUFACTURING

Intelligent Manufacturing – Virtual Manufacturing- Internet Controlled Manufacturing-
Intelligent Agents – Advanced Manufacturing Systems - Robots Role in Various Levels of
manufacturing- Sensors in Manufacturing Process-Automated Measurement and
Inspections- Vision based inspection Manufacturing Process - Network and Computer
Interface - Industrial Networks for Production Line Control

UNIT V CASE STUDIES

Case studies of Automated Factory – Manufacturing Task - Car Manufacturing &
Assembly – Electronics Manufacturing – Food Processing – Textile Processing

TOTAL : 45 PERIODS

OUTCOMES:
• Students will familiar the automated plant design, material handling, storage, 
  flexible manufacturing technique and advanced manufacturing concepts.

REFERENCES
7. SabrieSoloman, Sensors and control systems in Manufacturing, Second Edition, 

MR5006 MICRO AND NANO SYSTEMS

OBJECTIVES:
• To inspire the students about the trends in development and synthesizing of micro 
  and nano systems.
• To introduce students the characterization tools required in micro and Nano 
  material synthesis and fabrication.

UNIT I INTRODUCTION TO MICRO AND NANO TECHNOLOGY

Over view of nanotechnology and MEMS - Nano structuring- Nano defects, Nano 
particles and Nano layers-science and synthesis of Nano materials-lithography-based 
micromachining-Photolithography, vacuum systems, etching methods, deposition 
methods, and process integration -LIGA and laser-assisted processing
UNIT II  CHARACTERIZATION OF NANO MATERIALS

UNIT III  MICRO AND NANO SENSORS

UNIT IV  MICRO AND NANO ACTUATORS

UNIT V  MICRO AND NANO SYSTEM

TOTAL : 45 PERIODS

OUTCOMES:
- The students exposed to the evolution of micro- Nano systems elements and fabrication technique.
- The Students aware a characterization tools for synthesizing materials for micro and nano sensors, devices and actuators and its fabrication technique.

REFERENCES
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**MR5007 EMBEDDED SYSTEMS WITH ADVANCED MICROCONTROLLERS**

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**OBJECTIVES:**
- To impart knowledge in the area of real time embedded system.
- To understand the ARM & FPGA Processor, high level language descriptions of software for embedded system.

**UNIT I INTRODUCTION TO EMBEDDED SYSTEMS AND ARM 9 CORE**


**UNIT II PROGRAMMING OF ARM PROCESSOR**


**UNIT III INTRODUCTION TO FPGA**


**UNIT IV PROGRAMMING OF FPGA**

- Introduction to Verilog HDL and FPGA Design flow with using Verilog HDL - FPGA Arithmetic Circuits - FPGAs in DSP Applications - Design of SDRAM & Halftone Pixel Converter - Programming FPGAs. Introduction to DSP processor - TMS320C54x and TMS320C6x architecture

**UNIT V APPLICATIONS OF ARM 9 AND FPGA CONTROLLERS**


**TOTAL: 45 PERIODS**

**OUTCOMES:**
- The students learn to develop the controller for the real time application.
- The students will gather the knowledge for the effective use of advanced controllers and its programming in real time product development.
REFERENCES

PD5091 PRODUCT LIFECYCLE MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
To understand history, concepts and terminology of PLM
To understand functions and features of PLM/PDM
To understand different modules offered in commercial PLM/PDM tools
To understand PLM/PDM implementation approaches
To understand integration of PLM/PDM with other applications

UNIT I HISTORY, CONCEPTS AND TERMINOLOGY OF PLM
Introduction to PLM, Need for PLM, opportunities of PLM - Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (cPdm), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM). PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications.

UNIT II PLM/PDM FUNCTIONS AND FEATURES

UNIT III DETAILS OF MODULES IN A PDM/PLM SOFTWARE
Case studies based on top few commercial PLM/PDM tools

UNIT IV ROLE OF PLM IN INDUSTRIES
Case studies on PLM selection and implementation (like auto, aero, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for–business, organisation, users, product or service, process performance.

UNIT V BASICS ON CUSTOMISATION/INTEGRATION OF PDM/PLM SOFTWARE
PLM Customization, use of EAI technology (Middleware), Integration with legacy data base, CAD, SLM and ERP

TOTAL: 45 PERIODS
OUTCOMES:
The students will be able to
- Understand history, concepts and terminology of PLM.
- Apply the functions and features of PLM/PDM.
- Understand different modules offered in commercial PLM/PDM tools.
- Understand PLM/PDM implementation approaches.
- Integrate PLM/PDM with other applications.
- Analyse the case studies.

REFERENCES

MR5008 HUMAN MACHINE INTERFACE

OBJECTIVES:
- The students gain insight into the field of human-computer interaction

UNIT I INTRODUCTION TO HMI

UNIT II ELEMENTS OF HMI

UNIT III PERCEPTION, MEMORY, COGNITION

UNIT IV INTEGRATED MODELING FRAMEWORK
UNIT V  BRAIN COMPUTER INTERFACE  

OUTCOMES:
- The students gather the ideas about the human machine and brain computer interface for the advanced mechatronics system development.

REFERENCES

MR5009  MACHINE LEARNING  L T P C
3 0 0 3

OBJECTIVES:
- To know fundamental behind the various machine algorithms, and also to familiarize the important methods in ANN, Fuzzy and Genetic algorithm.

UNIT I  SUPERVISED AND SEMI SUPERVISED LEARNING METHODS  

UNIT II  UNSUPERVISED & REINFORCEMENT LEARNING METHODS  
Expectation–maximization (EM) - Vector quantization, Clustering Fuzzy K &C means algorithm - Density-based spatial clustering of applications with noise (DBSCAN) - Conceptual clustering-Association rule learning - Apriori algorithm- SVD.

UNIT III  NEURAL NETWORK  
Perceptron – Probabilistic Neural Network (PNN) - Back-Propagation (BPN) - Hopfield Network - Self-Organizing Map (SOM) - Learning Vector Quantization (LVQ)-Adaptive Resonance Theory 1 – Adaptive Resonance Theory 2 - Case studies on GA based algorithm development.

UNIT IV  FUZZY CLASSIFICATION  
UNIT V  GENETIC ALGORITHMS

Introduction to genetic algorithm – initialization, selection, mutation and termination-
Swarm intelligence – PSO-ACO - Tabu search - Reactive search optimization (RSO)-
cross-entropy (CE) methods. Case studies on GA based algorithm development.

TOTAL : 45 PERIODS

OUTCOMES:
• The students will gain the knowledge on artificial learning and classification
algorithms for the implementation of intelligent machine.

REFERENCES:
London.
3. LaureneFausett, “Fundamentals of Neural Networks, Architectures, Algorithms and
4. Randy L. Haupt, Sue Ellen Haupt Practical Genetic Algorithms, Wiley interscience
2004
5. S. Rajasekaran, GA VijayalakshmiPai, “Neural Networks, Fuzzy Logic and Genetic
6. Simon Haykin, “Neural Networks – A comprehensive foundation”, Prentice Hall, 3rd

MR5010  HAPTICS AND AUGMENTED REALITY

OBJECTIVES:
• To learn the human touch perception and Tactile Proprioception.
• To learn the haptic components and virtual models.
• To emphasize the significance of knowledge on haptic and augmented reality.

UNIT I  INTRODUCTION TO HAPTICS
Definition - Importance of Touch - Tactile Proprioception - Tactual Stereo genesis -
Kinesthetic Interfaces - Tactile Interfaces - Human Haptics - Overview of existing
applications.

UNIT II  KINESTHETIC HAPTIC DEVICES
Basics of force feedback devices-Kinesthetic vs. Tactile Haptic Devices-Configurations
of Kinesthetic devices-Types of Kinesthetic Devices-Mechatronics in Haptics System-
Haptic Kinematics-Haptic Dynamics-Existing Kinesthetic Devices-Haptic Device Static
Rendering-Haptic Device Dynamic Rendering-Control of Haptic Devices-Stability
Analysis of Haptic Devices-Stability Analysis of the Rendered Model-Passivity of the
Rendered Model.

UNIT III  TELEOPERATION
Types of Sensors-Measurement of Haptic Parameters-Types of Actuators-Types of
Transmission-Admittance type Kinesthetic Device-Admittance Control-Comparison of
Impedance and Admittance type devices-Genesis of Tele-operation-Tele-operation
Controllers-Tele-operator Transparency-Stability Analysis of Teleoperator-Tracking and
Transparency-Surface Haptics-Exogenous Force Inputs

39
UNIT IV  HUMAN HAPTICS

UNIT V  INTRODUCTION TO HAPTIC PLATFORM

TOTAL: 45 PERIODS

OUTCOMES:
• The students will learn to build and control haptic devices. The students learn the salient properties of human touch perception that are necessary to be recreated in virtual environments.
• The students will gather the knowledge to use the modeling software that used in the Haptics device development.

REFERENCES

MR5011  COMMUNICATION PROTOCOLS  L T P C
3 0 0 3

OBJECTIVES:
• To provide practical knowledge in the basic concepts of wired and wireless communication protocol for automation system development and networking.
• To create the knowledge on standard communication protocols for industrial automation.

UNIT I  WIRED BUSES AND PROTOCOLS

UNIT II  WIRELESS PROTOCOLS
Antenna Technology- Network Topologies - Wireless Local Area Networks (WLAN) - Wireless Personal Area Networks (WPAN) - Wimedia –Wimax - RF – Bluetooth- Wi-Fi – Zigbee – Wireless Industrial Automation
UNIT III INDUSTRIAL AND AUTONOMOUS SYSTEMS WIRED NETWORKS


UNIT IV INDUSTRIAL WIRELESS NETWORKS


UNIT V APPLICATION OF COMMUNICATION PROTOCOLS

Wired machine networking - wireless machine networking – Networking of industry - Communication network layout design- case studies - various automation applications.

TOTAL : 45 PERIODS

OUTCOMES:
Students will gain the knowledge on system communication process in the system and between an industrial networks for automating the simple machine to entire industries.

REFERENCES
1. Dick Caro, Wireless Networks for Industrial Automation, Third Edition,
2. G&L Motion Control, MMC-SD SERCOS Drive, 2005.

MR5012 SOLID STATE DRIVES

OBJECTIVES:
To give the exposure to various switching circuits for electrically operated actuators for the speed, position, direction and breaking task of the automation systems.

UNIT I ELECTRICAL ACUATORS AND DRIVE CHARACTERISTICS


UNIT II SOLID STATE SWITCHING DEVICES

Solid State Relay - Switching Characteristics - Bipolar Junction Transistor (BJT), Metal Oxide Semiconductor - Field Effect Transistor Silicon Controlled Rectifier (SCR) - DIAC-TRIAC- Gate Turn-Off Thyristor (GTO) – Insulated Gate Bipolar Transistor (IGBT) - Classification Of PWM Techniques
UNIT III  D.C. MOTOR DRIVES  9

UNIT IV  A.C. MOTOR DRIVES  9

UNIT V  SPECIAL ELECTRICAL MOTOR DRIVES  9

TOTAL : 45 PERIODS

OUTCOMES:
Student’s able to understand and apply the solid state devices for various electrical actuator for automation applications.

REFERENCES

CM5071 INTELLIGENT PRODUCT DESIGN AND MANUFACTURING  L T P C
3 0 0 3

OBJECTIVE:
• To teach the student the principles and practices of intelligent product design and manufacturing

UNIT I  INTRODUCTION TO INTELLIGENT DESIGN AND MANUFACTURING  9
Need - Internet technology and Manufacturing Industry - Digital enterprises - Manufacturing portals – Benefits.

UNIT II  TECHNIQUES OF KNOWLEDGE REPRESENTATION  9

UNIT III  INTELLIGENT PRODUCT MODELING TECHNIQUES:  9
Intelligent CAD systems, integrating product and process design, manufacturing analysis and CAD/CAM integration, design methodology for automated manufacture, the impacts of intelligent process control on product design, and fuzzy knowledge-based controller design.
UNIT IV  APPLICATION OF NEURAL NETWORKS:  
Neural Networks for Intelligent Process Monitoring and Control: Applications to CNC machining, Metal Forming - Intelligent Manufacturing Planning, Scheduling and Control - Intelligent Assembly and Layout Planning.

UNIT V  INTERNET BASED COLLABORATIVE CAD/CAM:  
Applications to web based CAD, CAPP, CNC, Assembly planning, and Rapid Prototyping - Challenging issues of Collaborative CAD/CAM.  
TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the student will be able to apply Internet technology in manufacturing Industry and use techniques of Knowledge Representation.

REFERENCES

MF5075  INDUSTRIAL SAFETY  
L  T  P  C  
3  0  0  3

OBJECTIVE:
To develop and strengthen the safety ideas and motivate the students to impart basic safety skills and understandings to run an industry efficiently and effectively

UNIT I  OPERATIONAL SAFETY  

UNIT II  SAFETY APPRAISAL AND ANALYSIS  
UNIT III  OCCUPATIONAL HEALTH  9
Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chlorise, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT IV  SAFETY AND HEALTH REGULATIONS  9

UNIT V  SAFETY MANAGEMENT  9

OUTCOME:
At the end of this course the students are expected to gain knowledge and skills needed to run an industry with utmost safety precautions.

REFERENCES:

MR5013  INDUSTRIAL AUTOMATION FOR MECHATRONICS  L T P C  3 0 0 3

OBJECTIVES:
- To impart the knowledge on PLC, Supervisory control and factory automation

UNIT I  INDUSTRIAL INSTRUMENTATION AND CONTROL  9
Introduction and need for automation-Instrumentation system for measurement of process parameters – overview on flow, level, pressure, temperature, speed, current and voltage measurements – proximity and vision based inspection systems – process control systems – continuous and batch process – feedback control system overview.

UNIT II  PROGRAMMABLE LOGIC CONTROLLER  9
UNIT III  DATA COMMUNICATION AND SUPERVISORY CONTROL SYSTEMS

UNIT IV  FACTORY AUTOMATION
Factory layout - Tools and software based factory modeling - case study on automated manufacturing units, assembly unit, inspection systems and PLC based automated systems- Introduction to factory automation monitoring software

UNIT V  BUILDING AUTOMATION

TOTAL: 45 PERIODS

OUTCOMES:
- The students to able to develop the automation models by the use of PLC, Supervisory control and factory and building automated tools.

REFERENCES
OBJECTIVES:
- To learn and model the nonlinear and complex control strategies for advanced mechatronics system developments.

UNIT I  CONVENTIONAL CONTROL SYSTEM DESIGN  9

UNIT II  ENHANCEMENT TO SINGLE LOOP CONTROL  9
Feed-forward control – Ratio control – Cascade control – Inferential control – Split-range – override control-- selective control –Auto tuning

UNIT III  STATE SPACE ANALYSIS  9
Concepts of state variable and state model – State space to Transfer function and Transfer function to State space modes – Solving time invariant state equation – Controllability – Observability – State Observers – Design of control systems with observers.

UNIT IV  NONLINEAR SYSTEMS AND CONTROL  9

UNIT V  OTHER CONTROL METHODS  9
TOTAL : 45 PERIODS

OUTCOMES:
- The students will acquire the knowledge in nonlinear control and methods used to design the stable system.

REFERENCES
OBJECTIVES:
- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario.

UNIT I INTRODUCTION TO IoT
Internet of Things - Physical Design - Logical Design - IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG - IoT Platforms Design Methodology

UNIT II IoT ARCHITECTURE
M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III IoT PROTOCOLS

UNIT IV BUILDING IoT WITH RASPBERRY PI & ARDUINO

UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS
Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to:
- Analyze various protocols for IoT
- Develop web services to access/control IoT devices.
- Design a portable IoT using Raspery Pi
- Deploy an IoT application and connect to the cloud.
- Analyze applications of IoT in real time scenario

REFERENCES:
OBJECTIVES:

- To get the clear understanding of application of mechanics in medicine.
- To study the properties and kinematics of bone and muscles.

UNIT I INTRODUCTION
Introduction to bio-mechanics, relation between mechanics and Medicine, Newton’s laws, stress, strain, shear rate, viscosity, visco elasticity, non-Newtonian viscosity, soft tissue mechanics, mechanical properties of soft biological tissues-Bio fluid mechanics-Introduction to Biomechatronic Systems

UNIT II MECHANICS IN SKELETAL AND MUSCULAR SYSTEM

UNIT III CONTROL MECHANISM OF BIOLOGICAL SYSTEMS
Skeletal muscles servo mechanism, Cardio vascular control mechanism, respiratory control mechanism – interfacing techniques with natural servo mechanism

UNIT IV PROSTHETIC AND ORTHOTIC DEVICES
Analysis of force in orthopaedic implants, Hand and arm replacement, different types of models for externally powered limb prosthetics, Lower limb, Upper limb orthotics, and aterial for prosthetic and orthotic devices, Functional Electrical Stimulation, Sensory Assist Devices.

UNIT V SIMULATION AND MODELLING OF BIOMECHANTRONICS
Physics-based modelling and simulation of biological structures- variables of interest – geometry- Introduction to model the skeletal system using open source software– human leg prosthesis and normal gait vs prosthesis leg analysis - Upper Extremity Kinematic Model

OUTCOMES:

- The students able to understand the skeletal mechanics for rehabilitation and prosthetic developments.
- The students will learn to develop the rehabilitation devices and its interface.
REFERENCES
5. Ranganathan T S, “Text Book of Human Anatomy” S. Chand and company New Delhi, 1994

MR5016 ADVANCED COMPUTER VISION L T P C
3 0 0 3

OBJECTIVES:
- To impart knowledge on imaging machine vision and its applications

UNIT I IMAGE FORMATION AND CAMERA CALIBRATION 6
Projective Geometry - Imaging through lenses and pin-hole – Basic Photometry – Basic model of imaging geometry – Ideal Camera – Camera with intrinsic parameters – Approximate camera models – Camera Calibration – Methods and Procedure

UNIT II BASICS FOR COMPUTER VISION 6

UNIT III SHAPE FROM X 9
Depth Perception in Humans, Cues – Shape from Texture, Shading, Focus, Defocus, Structured Light Reconstruction – Time of Flight Methods

UNIT IV COMPUTATIONAL STEREO AND MOTION 12
Computational Stereopsis – Geometry, parameters – Correspondence problem, correlation based methods, feature-based methods – Epipolar Geometry, essential matrix and fundamental matrix, eight point algorithm – Reconstruction by triangulation, scale factor and up to a projective transformation – Visual Motion – Motion field of rigid objects – Optical Flow – Estimation of motion field – 3D structure and motion from sparse and dense motion fields – Motion based segmentation.

UNIT V ROBOT VISION 12

TOTAL : 45 PERIODS
OUTCOMES:
The students exposed to the techniques used in the computer vision analysis and its Applications

REFERENCES:

MR5017 ONBOARD COMPUTERS AND PROGRAMMING    L T P C
                                3 0 0 3

OBJECTIVES:
- Students will understand the on board system architectures and its peripheral features.
- Students will learn the grammar of python programming language.
- Students will understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
- Students will learn how to use on-board computers for real time applications.

UNIT I   INTRODUCTION TO SINGLE BOARD COMPUTERS    9

UNIT II   REAL TIME OPERATING SYSTEM    7

UNIT III   PYTHON PROGRAMMING    11

UNIT IV   EMBEDDED PYTHON PROGRAMMING    9

UNIT V   APPLICATIONS    10

TOTAL :  45 PERIODS
OUTCOMES:
- The learners will be able know about the architecture, programming strategies and application overview of single board computers.

REFERENCES
3. Mark Lutz, "Learning Python, Powerful OOPs,O’reilly, 2011

MR5018  AUTOMOTIVE ELECTRONICS  L  T  P  C
3  0  0  3

OBJECTIVES:
- To create a learning on various automotive electronic components and its integration for automotive development.

UNIT I  OVERVIEW OF AUTOMOTIVE SYSTEMS  9

UNIT II  SENSORS AND ACTUATORS IN AUTOMOTIVE  9

UNIT III  ENGINE CONTROL & MONITORING SYSTEMS  11
UNIT IV     TRANSMISSION AND SAFETY SYSTEMS & DIAGNOSTICS


UNIT V     AUTOMOTIVE INSTRUMENTATION AND INFOTAINMENT


OUTCOMES:
- The learners will be known to various automotive components and its working.
- The students will gain the knowledge on integration of various components in the automotive systems.

REFERENCES

MR5019     MARINE MECHATRONICS

OBJECTIVES:
- To study the mechanical, electrical, and communication subsystem in marine vehicles.

UNIT I     INTRODUCTION TO MARINE SYSTEMS
UNIT II  MARINE MECHANICAL SUBSYSTEMS  9

UNIT III  MARINE ELECTRICAL SUBSYSTEMS  9

UNIT IV  MARINE MEASUREMENTS, MANOEUVRING AND CONTROL  9
SYSTEMS

UNIT V  COMMUNICATION AND NAVIGATION  9

TOTAL : 45 PERIODS

OUTCOMES:
- Students will familiar about various system in marine vehicles.

REFERENCES
OBJECTIVES:
- To learn about the aircraft system and its automation requirements.
- To study the sensors, measurement, actuators, navigation systems and its control of aircraft systems.

UNIT I  OVERVIEW OF AIRCRAFT ENGINEERING  9

UNIT II  SENSORS AND MEASUREMENTS  9

UNIT III  MECHANISMS AND ACTUATORS  9

UNIT IV  STABILITY AND CONTROL  9

UNIT V  NAVIGATION  9

TOTAL:  45  PERIODS

OUTCOMES:
- The learners will be able to know about the sensors, measurement, actuators, navigation systems and its control of aircraft system in the system integration aspect.

REFERENCES

MR5021 MEDICAL MECHATRONICS

OBJECTIVES:

- To know the principle, design and application of various human measurement and assisted device for the human functional system.

UNIT I INTRODUCTION TO MEDICAL MECHATRONICS

Role of Mechatronics in Medical – Overview of human functional system – cell and origin bioelectric potential–Measurement of blood pressure-invasive and noninvasive methods- transducers role in measurement–Heart rate – pressure-temperature- Heart sound – Pulmonary function measurements

UNIT II ASSISTING AND THERAPEUTIC EQUIPMENTS


UNIT III CARDIAC AND REGULATORY ASSIST SYSTEM


UNIT IV MEDICAL IMAGING


UNIT V SENSORY ASSIST DEVICES AND AUTOMATED ANALYSER

Types of deafness, hearing aids, application of DSP in hearing aids- Ear irrigator- Voice synthesizer, speech trainer. Ultra sonic and laser canes, Intra ocular lens, Braille Reader, Tactile devices for visually challenged, ophthalmoscopy Text voice converter, screen readers and automated analyser and medical equipment’s.

TOTAL: 45 PERIODS
OUTCOMES:
The students able to know the role and importance of artificial assisting devices and also able to gather functionality and development related issues of assisting devices used in the medical field

REFERENCES
1. Albert M Cook and Webster J G – Therapeutic medical devices Prentice Hall New York 1982

MF5074 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

OBJECTIVE:
• To develop and strengthen entrepreneurial quality and motivation in students. To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.

UNIT I ENTREPRENEURIAL COMPETENCE 6

UNIT II ENTREPRENEURIAL ENVIRONMENT 12

UNIT III BUSINESS PLAN PREPARATION 12
UNIT IV LAUNCHING OF SMALL BUSINESS

UNIT V MANAGEMENT OF SMALL BUSINESS
Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.

TOTAL: 45 PERIODS

OUTCOME:
- Students will gain knowledge and skills needed to run a business.

REFERENCES:

CM5092 ENVIRONMENT CONSCIOUS MANUFACTURING

OBJECTIVE:
- To impart the knowledge in sustainable manufacturing, ISO 14000 series standards, green manufacturing, recycling and life cycle assessment.

UNIT I SUSTAINABLE MANUFACTURING AND EMS:

UNIT II GREEN MANUFACTURING:
Green Design and Quality Initiatives - Environmental Cost Accounting and Business Strategy - Accounting for an Environmentally Conscious Setting - The Development of Eco labelling Schemes

UNIT III RECYCLING:
Recycling as Universal Resource Policy - Innovation Towards Environmental Sustainability In Industry - A Systematic Framework for Environmentally Conscious Design
UNIT IV  ENVIRONMENTAL ATTRIBUTES OF MANUFACTURING: 10
Environmental Attributes of Manufacturing Processes - Environmental Decision Support Systems - Decision Models for Reverse Production System Design - Environmentally Sound Supply Chain Management

UNIT V  LIFE CYCLE ASSESSMENT 8
Life Cycle Assessment - Multipath way and Cumulative Risk Assessment - Reclamation And Recycling of Waste

TOTAL: 45 PERIODS

OUTCOME:
On completion of the course the students will be able to follow the guidelines of ISO 14000, implement green design, follow environmental norms in manufacturing and do lifecycle assessment of products and processes.

REFERENCES

CM5073 GREEN MANUFACTURING 3 0 0 3

OBJECTIVES:
To introduce the concept of Green Manufacturing Design to the students

UNIT I  INTRODUCTION 9
Environmental effects of design – Environmental damage – In efficient energy use – Design for recycling.

UNIT II  ENVIRONMENTAL LIFE CYCLE ASSESSMENT 9

UNIT III  GREEN DESIGN METHODS 9

UNIT IV  DESIGN FOR ENVIRONMENT 9
Eco design – Industrial Ecology – Pollution prevention – Reduction of toxic emission.

UNIT V  SUSTAINABLE ECONOMIC ENVIRONMENT 9

TOTAL: 45 PERIODS

OUTCOMES:
• Students will understand the concepts of Green Manufacturing Design
• It will impart green design methods and to assess the life cycle of the product
REFERENCES: