# ANNA UNIVERSITY, CHENNAI
## AFFILIATED INSTITUTIONS
### REGULATIONS 2013
#### M.E. MECHATRONICS
##### I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

### SEMESTER I

<table>
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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 69**

### LIST OF ELECTIVES FOR M.E. MECHATRONICS

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AIM:
- To relate the mathematical concepts in their field of Engineering and apply the same in their respective main stream.

OBJECTIVES:
- The students would be acquainted with the basic concepts of Linear Algebra and numerical methods & their applications, basics in Graph theory

UNIT I VECTOR SPACE AND LINEAR TRANSFORMATION 10
Vector spaces – Subspaces – Linear spans – Linear independence and Linear dependence – Basis and Dimension – Linear Transformation, Null space and range – Dimension theorem (no proof) – Matrix representation of Linear Transformation.

UNIT II LINEAR ALGEBRA, INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION 16

UNIT III NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

UNIT IV FUNDAMENTALS OF GRAPHS 12
Graphs-subgraphs-Graph Isomorphism- vertex degree: Eulerian Graphs- Planar Graphs-Hamiltonian paths

UNIT V ALGORITHMS- GRAPHS 10
Kriskal’s algorithm- Dijkstra’s shortest path Algorithm, Prim’s Algorithm- Transport Networks

TOTAL: 60 PERIODS

REFERENCES:
AIM:
- To impart knowledge on various types of sensors and transducers for Automation in Mechatronics Engineering.

OBJECTIVES:
- To study basic concepts of various sensors and transducers
- To develop knowledge in selection of suitable sensor for mechatronics systems
- To design suitable signal conditioning circuits for mechatronics systems.

UNIT I INTRODUCTION

UNIT II MOTION, PROXIMITY AND RANGING SENSORS

UNIT III FORCE, MAGNETIC AND HEADING SENSORS
Strain Gage, Load Cell Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers

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: 45 PERIODS

REFERENCES:
UNIT I MECHANISMS

UNIT II FRICTION

UNIT III GEARING AND CAMS
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

UNIT V MACHINE TOOLS

TOTAL: 45 PERIODS

REFERENCES:

MR7103 CONCEPTS IN ELECTRONICS ENGINEERING

AIM:
• To understand the basics and working principles of electronic components and their applications

OBJECTIVE:
• This course is intended for learning the Fundamentals, properties and applications of Electronic Components, Devices, analog circuits, digital circuits, test and measuring instruments.

UNIT I ELECTRONIC COMPONENTS AND DEVICES
Resistors, Capacitors, Inductors, Transformers – types and properties.- Junction diodes, Zener diodes, Bipolar transistors, Field Effect transistors, Uni junction Transistors, MOS Devices, LEDs – Characteristics and applications; Thyristor Devices – SCR, DIAC, TRIAC, QUADRAC – operating mechanism, characteristics and applications.
UNIT II ANALOG ELECTRONICS 8
Rectifiers and Filters; Regulated Power Supply – Switching Power Supplies, Thermal Considerations, Feedback and power amplifiers, Sine wave oscillators,

UNIT III OPERATIONAL AMPLIFIERS AND APPLICATIONS 9

UNIT IV DIGITAL ELECTRONICS 10

UNIT V TEST AND MEASURING INSTRUMENTS 6
Measurement of voltage, current, frequency and power using Multi meters, oscilloscopes, recorders, data loggers, signal sources, counters, analyzers and printers. TOTAL: 45 PERIODS

REFERENCES:

MR7104 DYNAMICS AND CONTROL SYSTEMS 3 0 0 3

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

OBJECTIVE:
• This course is intended for learning the all types of Control Systems and their modelling. With reference to mode controls, and determination of stability. In Time and Frequency domain.
  This course also discuss an example case study with reference to design of a servomotor

UNIT I SYSTEM REPRESENTATION AND MODELLING 9

UNIT II DESIGN OF FEEDBACK CONTROL SYSTEM 9

UNIT III TIME DOMAIN ANALYSIS 9
UNIT IV FREQUENCY DOMAIN ANALYSIS

UNIT V CASE STUDY ON CONTROL AND ANALYSIS OF SERVO MOTOR

TOTAL: 45 PERIODS

REFERENCES:

MR7105 DRIVES AND CONTROLS FOR AUTOMATION

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

OBJECTIVE:
- To make the students to learn the basic concepts of hydraulic, pneumatics and electric drives and their controlling elements in the area of Mechatronics systems. To train the students in designing the hydraulics and pneumatic circuits using ladder diagram. And designing control circuits for electric drives.

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

TOTAL: 45 PERIODS
REFERENCES:

MR7111 SENSORS, DRIVES AND CONTROL LAB

AIM
To impart knowledge in the area of sensor characterization, hydraulic, pneumatic, electric actuators and their control with PC as a hardware for the controller.

OBJECTIVES:
To make students get exposed to instrument control, data acquisition and motor control.

1. Familiarization of MATLAB, LABVIEW & VEE packages.
2. Temperature & Optical transducers Characterization.
3. Strain gage, Load cell and Torque transducer characterization & applications
4. LVDT, Acoustics Ranging and Hall effect sensor applications.
5. PC Interfacing of stepper motor - Unipolar & Bipolar.
6. Study of incremental optical encoders and DC brush motor characteristics & modeling.
7. Power control of AC & DC motors.
8. Operational Amplifier application circuits.
9. Closed loop position and velocity control of a DC brush servo motor.
10. Tuning of P, PI and PID controller using Simulink.
11. Study of basic Hydraulics & Pneumatic component and circuits
12. Simulation of sequential circuits using Pneumatic trainer kits.
13. Study of electro pneumatic and electrohydraulic circuits.
14. Study of electro pneumatic and electrohydraulic circuits using PLC.

TOTAL: 60 PERIODS

MR7201 INDUSTRIAL ROBOTICS

AIM:
To impart knowledge in the area of mechanical design, sensors and programming of industrial robots.

OBJECTIVE:
To make the students to learn about the mechanical design of robots, various sensors and its application in the area of industrial robotics.

UNIT I INTRODUCTION
Types of Industrial Robots, definitions – classifications based on work envelope – Generations configurations and control loops, co-ordinate system – need for robot – basic parts and functions – specifications.
UNIT II MECHANICAL DESIGN OF ROBOT SYSTEM

UNIT III SENSORS

UNIT IV ROBOT PROGRAMMING & AI TECHNIQUES
Types of Programming – Teach pendant programming – Basic concepts in A1 techniques – Concept of knowledge representations – Expert system and its components.

UNIT V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS
Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

TOTAL: 45 PERIODS

REFERENCES:

MR7202 MACHINE VISION L T P C 3 0 0 3

AIM:
• To impart knowledge on imaging, machine vision and its applications.

OBJECTIVES:
• To understand and apply the basic concepts of optics in imaging. To learn the various hardware components of an imaging system for machine vision applications. To understand the various image processing and image analysis algorithms and the issues involved in applying them to various machine vision applications. To expose students to various applications of vision and challenges involved in each.

UNIT I INTRODUCTION
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
UNIT III  IMAGE PROCESSING 10

UNIT IV  IMAGE ANALYSIS 6

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

REFERENCES

MR7203  MICROCONTROLLER AND PLC (PROGRAMMABLE LOGIC CONTROLLERS) 3 0 0 3

AIM:
- To understand the programming interfacing and applications of various microcontrollers and programmable logic controller.

OBJECTIVE:
- 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 8
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 8
Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication of 8051.

UNIT III  PROGRAMMING OF PIC18FXXX MICROCONTROLLER 8
Instruction set – Addressing modes – I/O Programming-Timer/Counter - Interrupts – Serial communication, CCP, ECCP PWM programming of PIC18FXXX.

UNIT IV  PERIPHERAL INTERFACING 9
Interfacing of Relays, Memory, key board, Displays – Alphanumeric and Graphic, RTC, ADC and DAC, Stepper motors and DC Motors, I2C, SPI with 8051 and PIC family
UNIT V  PLC PROGRAMMING 12

TOTAL : 45 PERIODS

REFERENCES

MR7204 DESIGN OF MACHINE ELEMENTS  L T P C
3 1 0 4

AIM:
• To impart the knowledge in the design of machine elements used in mechatronics systems.

OBJECTIVE:
• To make the students to learn and design of various machine elements used in mechatronics systems.

UNIT I  INTRODUCTION 9
Introduction to national and international symbols- Engineering materials and their physical properties and applied to design- Selection of materials- 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 10
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.

UNIT III  COUplings AND GEaR 10
Design of couplings- Muff, Flange, Bushed and pin types- design of keys – Design of spur gears.

UNIT IV  DESIGN OF TRANSMISSION ELEMENTS 10

UNIT V  CAD MODELLING AND SIMULATION 6
Simple machine elements in AUTOCAD – Modelling and simulation of simple mechanisms using ADAMS and CATIA.

T= 15,TOTAL : 60 PERIODS
REFERENCES

MR7211 AUTOMATION LAB

L T P C
0 0 4 2

AIM
- To impart knowledge in the area of microcontroller and PLC based automation, machine vision and robotics

OBJECTIVES:
- To make the students to learn the basic concepts of microcontrollers and its interfacing to various peripherals. To train the students in unconventional applications based on PLC. Expose students to machine vision applications such as inspection and gauging. To impart students the knowledge in robot modeling and simulation

1. Assembly language programming and simulation of 8051 in Keil IDE.
2. Assembly language programming and simulation of PIC 18FXXX, MPLAB IDE.
3. Alphanumeric and Graphic LCD interfacing using X8051 & PIC18FXXX.
4. Sensor interfacing with ADC to X8051 & PIC18FXXX.
5. DAC & RTC interfacing to X8051 & PIC18FXXX.
6. Timer, Counter and Interrupt program application for X8051 and PIC18FXXX.
7. Step motor (uni polar & bipolar motor) and PWM servo motor control to interfacing with X8051.
8. Printer interfacing of X8051 and PIC.
9. UART serial programming in X8051 and PIC.
10. Simulation of Ladder diagram program.
11. Closed loop position control of DC brush servo motor using PLC, X8051µc & PIC 18FXXX.
13. Vision based Gear parameter measurement.
14. Forward kinematics, Inverse kinematics & Trajectory planning for PUMA 560 and Stanford arm using Robotic toolbox for MATLAB.
15. Simulation of planar and spatial mechanisms using ADAMS view.

TOTAL: 60 PERIODS

MR7001 VETRONICS

L T P C
3 0 0 3

AIM:
- To understand the design and specifications of various automotive, aircraft and marine electronic control systems.

OBJECTIVE:
- This course is intended for learning the Fundamentals of Automobile Engineering, Automotive applications of all types of sensors and actuators systems, avionics and marine electronics.
UNIT I  FUNDAMENTALS OF VEHICLE ENGINEERING  6
Engine – Types – Modern Engines – Advanced GDI, Turbo-charged engines Transmissions, Chassis systems – Need for Avionics in Civil and Military aircraft and Space systems

UNIT II  AUTOMOTIVE ENGINE CONTROL, MONITORING AND DIAGNOSTICS SYSTEMS  9

UNIT III  AUTOMOTIVE TRANSMISSION AND SAFETY SYSTEMS  12

UNIT IV  AIRCRAFT MECHATRONICS  12

UNIT V  MARINE MECHATRONIC SYSTEMS  6
Basics of Marine Engineering – Marine Propulsion Mechatronics elements in ships, submarines, Variable Buoyancy Systems

TOTAL: 45 PERIODS

REFERENCES:

MR7002  MECHATRONICS ELEMENTS IN METROLOGY AND CNC  L T P C  3 0 0 3

AIM:  
To impart the knowledge in the area of metrology and CNC machine system and programming.

OBJECTIVE:  
This course is intended to expose the mechatronics elements in the modern mechanical measuring instruments and CNC system design and programming.
UNIT I  FUNDAMENTALS CONCEPTS IN METROLOGY  8
Introduction to Metrology and Dimensional Metrology – Angular measurements, Form Measurement, Surface Roughness, Contour Measurements, Roundness, Tool wear measurement.

UNIT II  INSTRUMENTS FOR DIMENSIONAL METROLOGY  12

UNIT III  COMPUTER CONTROL OF MACHINES  8

UNIT IV  MECHATRONICS ELEMENTS IN CNC MACHINE TOOLS  9
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 Types of positional control – Control of Spindle speed – Control of slide movement and velocity. Identification and gauging of work piece. Tool locking system - ball lock mechanism and contact pressure monitoring. Automatic tool changing system - types and benefits - tool magazine.

UNIT V  CNC PROGRAMMING  8

TOTAL : 45 PERIODS

REFERENCES:

MR7003  MECHATRONICS SYSTEM DESIGN  L T P C  3 0 0 3

AIM:
- To impart knowledge in the area of system design in an integrated approach.

OBJECTIVES:
- To make the students to learn system modelling, system identification and simulation.
- To expose students to various
UNIT I  INTRODUCTION

UNIT II  SYSTEM MODELLING AND IDENTIFICATION

UNIT III  SIMULATION

UNIT IV  CASE STUDY ON BASIC SYSTEMS

UNIT V  CASE STUDY ON ADVANCED SYSTEMS

TOTAL: 45 PERIODS

REFERENCES

MF7016  NANO TECHNOLOGY

AIM:
- To inspire the students to expect to the trends in development and synthesizing of nano systems and measuring systems to nano scale.

OBJECTIVES:
- To expose the students to the evolution of Nano systems, to the various fabrication techniques.
- Also to impart knowledge to the students about nano materials and various nano measurements techniques.

UNIT I  OVER VIEW OF NANOTECHNOLOGY
Definition – historical development – properties, design and fabrication Nanosystems, , working principle ,applications and advantages of nano system. Nanomaterials – ordered oxides – Nano arrays – potential health effects
UNIT II  NANODEFECTS, NANO PARTICLES AND NANOLAYERS  8

UNIT III  NANOSTRUCTURING  8

UNIT IV  SCIENCE AND SYNTHESIS OF NANO MATERIALS  12
Classification of nano structures – Effects of nano scale dimensions on various properties – structural, thermal, chemical, magnetic, optical and electronic properties fluid dynamics – Effect of nano scale dimensions on mechanical properties - vibration, bending, fracture

UNIT V  CHARACTERIZATION OF NANO MATERIALS  11

TOTAL: 45 PERIODS

REFERENCES:

MR7004  FUZZY LOGIC AND NEURAL NETWORKS  L T P C
3 0 0 3

AIM
- To understand the various types and applications of Fuzzy Logics and Artificial Neural Networks.

OBJECTIVE:
- This course is intended for learning the basic concepts, Operations and Principles of Fuzzy Logic, applications of various Fuzzy Logic systems, architecture and Taxonomy of Neural Networks. This course is also gives the ideas of ANN Architectures, Genetic Algorithms.
UNIT I  INTRODUCTION TO FUZZY LOGIC  9

UNIT II  FUZZY LOGIC APPLICATIONS  9

UNIT III  INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS  9

UNIT IV  OTHER ANN ARCHITECTURES  9

UNIT V  RECENT ADVANCES  9

REFERENCES:

MR7005  ADVANCED MICROCONTROLLER AND EMBEDDED SYSTEMS  L T P C 3 0 0 3

AIM:
• To impart knowledge in the area of real time embedded system.

OBJECTIVE:
• To teach and understand about the definitions, ARM Processor, high level language descriptions of software for embedded system.

UNIT I  INTRODUCTION TO EMBEDDED SYSTEMS  6
Definitions – Brief overview of micro-controllers - DSPs,-Typical classifications –Memory Devices and application scenarios of embedded systems.

UNIT II  ARM 7 CORE  9
UNIT III ARM 9 CORE

UNIT IV REAL TIME MODELS, LANGUAGE AND OPERATING SYSTEMS
Models and languages – State Machine and state tables in embedded design – High level language descriptions - Java based embedded system design – Petrinet models-Real time languages – The real time Kernel - OS tasks - Task Scheduling - kernel services – Real time languages and their features.

UNIT V CASE STUDIES IN REAL TIME EMBEDDED SYSTEMS

TOTAL: 45 PERIODS

REFERENCES
4. Frank Vahid and Tony Givagis , Embedded System Design
5. Tim Wilmshurst, An Introduction to the design of small – scale Embedded Systems.

MR7006 MACHINE TOOL CONTROL AND CONDITION MONITORING L T P C
3 0 0 3

AIM:
• To impart the knowledge in the area of machine tool control and condition monitoring in a mechatronics perspective.

OBJECTIVE:
• This course intends to expose students to various types of control systems in machine tools and the various methods of condition monitoring for tools used.

UNIT I OVERVIEW OF AUTOMATIC CONTROL IN MACHINE TOOLS
Open loop and closed loop system in machine tools- process model formulation-transfer function-control actions-block diagram representation of mechanical pneumatic and electrical systems. Process computer - peripherals-Data logger-Direct digital control-Supervisory computer control.

UNIT II DRIVE SYSTEMS AND FEED BACK DEVICES IN MACHINE TOOLS

UNIT III ADAPTIVE CONTROL AND PLC
Adaptive control-types – ACC, ACO, Real time parameter estimation, Applications- adaptive control for turning, milling, grinding and EDM. Programmable logic controller-Functions-Applications in machine tools.

UNIT IV VIBRATION, ACOUSTIC EMISSION / SOUND.
UNIT V      CONDITION MONITORING, THROUGH OTHER TECHNIQUES
Visual & temperature monitoring, Leakage monitoring, Lubricant monitoring, condition monitoring of Lube and Hydraulic systems, Thickness monitoring, Image processing techniques in condition monitoring.

TOTAL: 45 PERIODS

REFERENCES:

MR7007      ANALYTICAL ROBOTICS
L T P C 3 0 0 3

AIM:
• To impart knowledge in the advanced area of Robotics

OBJECTIVES:
• To teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors.

UNIT I      INTRODUCTION
Definition, Types and Classifications of robots – control loops, controls and intelligence, specif degrees of freedoms, actuators and end effectors – grippers, force analysis, serial and parallel manipulators.

UNIT II     ROBOT KINEMATICS

UNIT III    ROBOT DYNAMICS AND TRAJECTORY PLANNING
Lagrangeon mechanics, dynamic equations for single , double and multiple DOF robots – static force analysis of robots, Trajectory planning – Joint space, Cartesian space description and trajectory planning – third order, fifth order - Polynomial trajectory planning

UNIT IV     ROBOT PROGRAMMING & AI

UNIT V      MODELLING AND SIMULATION
Modeling and simulation of robotic joints,- position , velocity and acceleration analyses of simple mechanisms and robots,-synthesis of robots,- simulation of robot configuration.

TOTAL: 45 PERIODS

REFERENCES
MR7008 ADVANCED COMPUTER VISION

L T P C
3 0 0 3

AIM:
- To impart knowledge in the area of 3D computer vision and its application to Robotics

OBJECTIVES:
- To understand the various fundamental mathematics behind computer vision algorithms
- To expose students to various 3D surface reconstruction algorithms.
- To impart knowledge on stereo vision and structure from motion.

UNIT I BASIC CONCEPTS FOR COMPUTER VISION 6

UNIT II 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 III SURFACE RECONSTRUCTION TECHNIQUES 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

UNIT V ROBOT VISION 12

TOTAL: 45 PERIODS

REFERENCES

MR7009 ADVANCED CONTROL SYSTEMS

L T P C
3 0 0 3

AIM:
- To impart knowledge on advanced techniques in control engineering.

OBJECTIVES:
- To introduce various control algorithms and their implementations
- To expose students to the state space representation and its analysis.
- To introduce non-linear systems and their control.
- To impart knowledge on advanced control techniques.
UNIT I  CONVENTIONAL CONTROL SYSTEM DESIGN  12
Review of feedback systems and design of PID Controllers - Electronic PID controller – Digital PID
algorithm – Auto/manual transfer - Reset windup – Practical forms of PID Controller - Evaluation
criteria – IAE, ISE, ITAE and ¼ decay ratio – Tuning using Process reaction curve method, Continuous
 cycling method and Damped oscillation method – pole placement – Lamda tuning.

UNIT II  ENHANCEMENT TO SINGLE LOOP CONTROL  8
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  10
Non-linear Systems – Common physical nonlinearities – Linearization of Nonlinear systems –
Phase portrait analysis – Isocline method – Liapnov’s stability concept – Popov criterion – Kalman
algorithm.

UNIT V  CONTROL METHODS  6
Adaptive Control – Optimal Control – Robust Control – Model Predictive Control – Multivariable
Control systems.

TOTAL: 45 PERIODS

REFERENCES:
4. Bequette, B.W., “Process Control Modeling, Design and Simulation”, Prentice Hall of India,
2004.

MR7010  PC BASED AUTOMATION  L T P C
3 0 0 3

AIM:
• To impart knowledge on architectural information about PC as a hardware for controllers.

OBJECTIVES:
• To expose students to various communication protocols in PC standard for test, measurement
and automation. To impart knowledge on the fundamentals of data acquisition systems and
theory and structure of programming languages.

UNIT I  COMPUTER BASICS AND COMMUNICATION PROTOCOLS  7
Basic Computer Architecture – Components of a PC – Serial and Parallel Communications

UNIT II  NETWORK PROTOCOLS  7
LAN, WAN and MAN Networks – RS485, RS 422, LXI Protocols – Modbus – Field bus – Ethernet
– CAN bus – SCADA and DCS.
UNIT III DATA ACQUISITION SYSTEMS

UNIT IV PROGRAMMING TECHNIQUES

UNIT V GRAPHICAL PROGRAMMING

REFERENCES:

MR7011 MATERIALS MANAGEMENT AND LOGISTICS
AIM:
• To introduce to the students the various functions of materials management and logistics

OBJECTIVE:
• To make the students familiar with the various concepts and functions of material management, so that the students will be in a position to manage the materials management department independently.

UNIT I INTRODUCTION
Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II MANAGEMENT OF PURCHASE

UNIT III MANAGEMENT OF STORES AND LOGISTICS
UNIT IV MATERIALS PLANNING

UNIT V INVENTORY MANAGEMENT
ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

REFERENCES

MF7013 FINANCIAL MANAGEMENT

AIM:
- To introduce the concepts of financial and various functions of financial management so that the students will be able to handle higher level financial decisions.

OBJECTIVES:
- To train students in various functions of finance such as working capital management, current assets management so that students will be able to make high investment decisions when they take up senior managerial positions.

UNIT I FINANCIAL ACCOUNTING
Accounting principles - Basic records - Preparation and interpretation of profit and loss statement - balance sheet - Fixed assets - Current assets.

UNIT II COST ACCOUNTING

UNIT III MANAGEMENT OF WORKING CAPITAL
Current assets - Estimation of working capital requirements - Management of accounts receivable - Inventory - Cash - Inventory valuation methods.

UNIT IV CAPITAL BUDGETING
Significance of capital budgeting - payback period - present value method - accounting rate of return method - Internal rate of return method.

UNIT V PROFIT PLANNING AND ANALYSIS
Cost - Volume profit relationship Relevant costs in decision making profit management analysis - Break even analysis.

TOTAL: 45 PERIODS
REFERENCES:

MR7009 NON-DESTRUCTIVE EVALUATION  
L T P C  3 0 0 3

AIM:  
- To stress the importance of NDT in engineering.

OBJECTIVE:  
- To introduce all types of NDT and their applications in Engineering.

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION, VISUAL INSPECTION & LIQUID PENETRANT TESTING  6
Introduction to various non-destructive methods, Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications. Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods-water washable, Post – Emulsification methods, Applications

UNIT II EDDY CURRENT TESTING & ACOUSTIC EMISSION  10

UNIT III MAGNETIC PARTICLE TESTING & THERMOGRAPHY  10
Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications. Principle of Thermography, Infrared Radiometry, Active thermography measurements, Applications – Imaging entrapped water under an epoxy coating, Detection of carbon fiber contaminants.

UNIT IV ULTRASONIC TESTING  10
Principle, Ultrasonic transducers, Ultrasonic Flaw detection Equipment, Modes of display A- scan, B-Scan, C- Scan, Applications, Inspection Methods - Normal Incident Pulse-Echo Inspection, Normal Incident Through-transmission Testing, Angle Beam Pulse-Echo testing, TOFD Technique, Applications of Normal Beam Inspection in detecting fatigue cracks, Inclusions, Slag, Porosity and Intergranular cracks - Codes, standards, specification and procedures and case studies in ultrasonics test.

UNIT V RADIOGRAPHY  9
Principle of Radiography, x-ray and gamma ray sources- safety procedures and standards, Effect of radiation on Film, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique, Real Time Radiography - Codes, standards, specification and procedures and case studies in Radiography test. Case studies on defects in cast, rolled, extruded, welded and heat treated components - Comparison and selection of various NDT techniques

TOTAL: 45 PERIODS
REFERENCES:
4. www.ndt.net