UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO IV SEMESTERS (FULL TIME)

M.E. MECHATRONICS

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA9119	Numerical Methods & Graph Theory	3	1	0	4
2	MR9111	Sensors in Automation	3	0	0	3
3	MR9112	Concepts in Mechanical Engineering	3	0	0	3
	MR9113	Concepts in Electronics Engineering				
4	MR9114	Fluid Power Automation	3	0	0	3
5	E1	Elective I	3	0	0	3
6	E2	Elective II	3	0	0	3
PRACTICAL						
7	MF9125	Automation Lab	0	0	3	2
		TOTAL	**18**	**1**	**3**	**21**

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MR9121	Industrial Robotics	3	0	0	3
2	MF9124	MEMS & Nanotechnology	3	0	0	3
3	MR9122	Microcontroller & PLC	3	0	0	3
4	MR9123	Control System Engineering	3	0	0	3
5	E3	Elective III	3	0	0	3
6	E2	Elective IV	3	0	0	3
PRACTICAL						
7	MR9124	Microcontroller Lab	0	0	3	2
		TOTAL	**18**	**0**	**3**	**20**

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	E5	Elective V	3	0	0	3
2	E6	Elective VI	3	0	0	3
3	E7	Elective VII	3	0	0	3
PRACTICAL						
4	MR9131	Project Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	MR9141	Project Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 68

ELECTIVES FOR M.E. MECHATRONICS ENGINEERING

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MR9150	Industrial Instrumentation	3	0	0	3
2	MF9162	Artificial Intelligence	3	0	0	3
3	MR9151	Metrology and Inspection	3	0	0	3
4	MR9152	Machine Vision and Applications	3	0	0	3
5	MR9153	Mechatronics elements and programming of CNC machines	3	0	0	3
6	MR9154	Automotive Electronics	3	0	0	3
7	MR9155	Opto Electronic Instrumentation	3	0	0	3
8	MR9156	Machine Tool Control and Condition Monitoring	3	0	0	3
9	MR9157	Network and Distribution System	3	0	0	3
10	MR9158	Medical Electronics and Instrumentation	3	0	0	3
11	MR9159	Real Time Embedded System	3	0	0	3
12	MR9160	Mechatronics System Design	3	0	0	3
13	MR9161	Telematics	3	0	0	3
14	MR9162	Mechatronics for Aircraft	3	0	0	3
15	MF9163	Lean Manufacturing system and Implementation	3	0	0	3
16	MF9161	Non-Destructive Evaluation	3	0	0	3
17	MR9164	Material Handling, Storage And Assembly Automation	3	0	0	3
18	MF9153	Materials Management & Logistics	3	0	0	3

MA 9119 NUMERICAL METHODS AND GRAPH THEORY L T P C
3 0 0 3

AIM:

To solve some engineering models and problems by using Numerical Analysis and Graph Theoretical concepts.

OBJECTIVES:

The engineers will have an exposure on various topics such as Systems of Equation, Interpolation and Numerical Integration, Initial and Boundary Value Problems, Fundamentals of Graphs, Graphs Algorithms to understand their applications in engineering problems.

UNIT I SYSTEMS OF EQUATIONS 12

Simultaneous linear equations – Direct method – LU decomposition methods - Gauss elimination, Gauss Jordan methods – Iterative methods – Jacobi and Gauss-Seidel methods.

UNIT II INTERPOLATION AND INTEGRATION 12

Hermite's interpolation – Cubic Spline Interpolation – Gaussian – Numerical Integration – Trapezoidal and Simpson rules – Newton-Cotes formula – Gaussian quadrature – cubature.

UNIT III NUMERICAL METHODS FOR ODE 12

Single step methods – multi step methods – Taylor series and Euler methods – Runge Kutta method of fourth order – Multi step methods – Adams-Bashforth, Milnes Predictor-Corrector methods – Boundary value problems by Finite difference method.

UNIT – IV FUNDAMENTALS OF GRAPHS 12

Graphs – sub graphs - Complements – Graph isomorphism – vertex degree: Eulerian graphs – Planar graphs – Hamiltonian paths, tree and Cut-sets.

UNIT – V TREES AND ALGORITHMS 12

Kruskal's algorithm – Dijkstra's shortest path algorithm, Prim's algorithm – Transport Networks.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Jain, M.K., Iyengar, S.R.K., and Jain, R.K., Numerical Methods for Scientific & Engineering computation, Wiley Eastern Ltd., 1987.
2. Froberg, C.E. Numerical Mathematics, The Benjamin/Cummings Publishing Co., Inc., 1985.
3. Grimaldi R.P., Discrete and Combinatorial Mathematics, Pearson Education Inc., 1999.

REFERENCES:

1. Froberg, C.E. Numerical Mathematics, The Benjamin/Cummings Publishing Co., Inc., 1985.
2. Jain, M.K., Iyengar, S.R.K., and Jain, R.K., Numerical Methods for Scientific & Engineering computation, Wiley Eastern Ltd., 1987.
3. Bondy, J.A. and Murthy, U.S.R., Graph Theory with Applications, Macmillan,

MR 9111 SENSORS IN AUTOMATION

L	T	P	C
3	0	0	3

AIM:

To impart knowledge on various types of sensors and transducers for Automation in Manufacturing Engineering.

OBJECTIVE:

- To study basic concepts of various sensors and transducers in Manufacturing Engineering
- To develop knowledge in selection of suitable sensor in manufacturing requirement

UNIT I INTRODUCTION 9

Definition – Measurement Techniques – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – calibration techniques – Potentiometer – strain gauges – optical encoders.

UNIT II INDUCTANCE AND CAPACITANCE TRANSDUCER 9

LVDT – RVDT – Synchro – Microsyn – Applications: Pressure, position, angle and acceleration. Capacitance circuitry – Feed back type condenser microphone – frequency modulating oscillator circuit – Dynamic capacitance variation – A.C. Bridge for Amplitude Modulation – Applications: Proximity, microphone, pressure, displacement.

UNIT III PIEZOELECTRIC & MAGNETIC SENSORS 9

Piezoelectric Materials and properties – Modes of deformation – Multimorphs – Environmental effects – Applications: Accelerometer, ultrasonic. Magnetic Sensors – types, principle, requirement and advantages: Magneto resistive – Hall effect - Eddy current.

UNIT IV RADIATION AND ELECTRO CHEMICAL SENSORS AND APPLICATIONS 9

Photo conductive cell, photo voltaic, Photo resistive – Fiber optic sensors – X-ray and Nuclear radiation sensors – Electrochemical sensors: Electrochemical cell, polarization, sensor Electrodes and electroceramics in Gas Media.

UNIT V RECENT TRENDS IN SENSORS AND APPLICATIONS 9

Film sensors – micro-scale sensors – Particle measuring systems – Applications and case studies of Sensors in Automobile Engineering, Aeronautics, Machine tools and Manufacturing processes

TOTAL: 45 PERIODS

REFERENCES:

1. Patranabis D.,Sensor and Actuators, Prentice Hall of India (Pvt) Ltd., 2005.
2. Renganathan S.,Transducer Engineering, Allied Publishers (P) Ltd., 2003
3. Ernest O. Doeblin, Measurement system, Application and design, , Tata McGraw Hill Publishing Company Ltd., Fiftieth Edition, 2004
4. Bradley D.A., and Dawson, Burd and Loader, Mechatronics, Thomson Press India Ltd., 2004
5. Bolton W., Mechatronics, Thomson Press, 2003.

MR 9112 CONCEPTS IN MECHANICAL ENGINEERING L T P C
3 0 0 3

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

OBJECTIVE:
To make the students to understand the concepts, design, construction and properties of mechanical elements

UNIT I MECHANISMS 11
Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinametic 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 TRANSMISSION SYSTEMS 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 – basics of brakes, journal and rolling element bearings hydrostatic and aerostatic bearings – recirculating ball screw and nut assembly.

UNIT III VIBRATION 8
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 IV DESIGN OF MACHINE ELEMENTS 7

Design of shafts – Springs – screw and fasteners – Gear profile and geometry – nomenclature of spur & helical gears – worm and worm wheel.

UNIT V MACHINE TOOLS 7
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: 45 PERIODS

REFERENCES:

1. Bansal Dr.R.K."Theory of Machines" Laxmi Publications (P) ltd., New Delhi 2001.
2. G.C.Sen . and A. Bhattacharya, "Principles of machine tools" , New Central book Agency, 1999.
3. Joseph Edward Shigley, Charles R.Mischke, "Mechanical Engineering Design" Mcgraw Hill International Edition, 1992.
4. S.G. Kulkarni, "Machine Design", Tata McGraw Hill,2003.
5. Malhotra .D.R. and Gupta .H.C. "The Theory of machines" Satya Prakasam, Tech. India Publications, 1989.
6. Acherkan.N, "Machine tool Design" , vol 3, MIR Publishers, 1978

MR 9113 CONCEPTS IN ELECTRONICS ENGINEERING L T P C
3 0 0 3

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, Characteristics and applications of all types of power circuits, principles and operations of Operational Amplifiers. This course is also gives the ideas of Digital Electronics and all types of Analog and Digital Modulation techniques.

UNIT I ELECTRONIC COMPONENTS AND DEVICES 9
Resistors, Capacitors, Inductors, Transformers – Properties, types and applications; Junction diodes, Zener diodes, Bipolar transistors, Field Effect transistors, Unijunction Transistors, MOS Devices, LEDs – Characteristics and applications; Feedback amplifiers, Oscillators, Power amplifiers.

UNIT II POWER CIRCUITS 6
Rectifiers and Filters; Regulated Power Supply – Switching Power Supplies, Thermal Considerations, Thyristor Devices – SCR, DIAC, TRIAC, QUADRAC – operating mechanism, characteristics and applications.

UNIT III OPERATIONAL AMPLIFIERS 12
Principles, Specifications, Ideal characteristics, Arithmetic Operations using Op-Amps, Integrator, Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, Active filters, Linear Rectifiers, Waveform Generators, D/A converters.

UNIT IV DIGITAL ELECTRONICS 12
Number systems – Logic gates – Boolean algebra – Simplification of Boolean functions using Map method. Tabulation method – Combinational logic circuits: Full adder, Code Converters, Multiplexers, Decoders – Sequential logic circuits: Flip-flops, Counters, Shift registers – A/D Converters.

UNIT V COMMUNICATION PRINCIPLES 6
Modulation: Need, Principles, Types – Analog Modulation, AM, FM – Digital Modulation: PWM, PCM, FSK – Demodulation techniques – Transmitters and receivers.

TOTAL: 45 PERIODS

REFERENCES:

1. Jocob Mill Man, Micro electronics Digital and Analog circuits & Systems – McGraw-Hill 2004.
2. Fanco, design with Operational amplifiers and Analog Integrated Circuits, TMH, 2005
3. Taub and Schilling, Principles of Communicating systems, 3rd edition TMH, 2005
4. Ray & Chaudary, Linear Integrated Circuits, New Age 1991.
5. Malvino & Leach, Digital Principals & application, TMH 2002

MR 9114 FLUID POWER AUTOMATION L T P C
3 0 0 3

AIM:

To impart knowledge in the area of hydraulics, pneumatic and fluid power components and its functions.

OBJECTIVE:

- To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.
- To train the students in designing the hydraulics and pneumatic circuits using ladder diagram.

UNIT I INTRODUCTION 5

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

UNIT II FLUID POWER GENERATING/UTILIZING ELEMENTS 8

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

UNIT III CONTROL AND REGULATION ELEMENTS 8

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports-pressure and temperature compensation, overlapped and underlapped spool valves-operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance.

UNIT IV CIRCUIT DESIGN 10

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade, method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

UNIT V ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS 7

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

TOTAL: 45 PERIODS

REFERENCES:

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall, 1988
2. Herbert R. Merritt, Hydraulic control systems, John Wiley & Sons, Newyork, 1967
3. Dudbey.A.Peace, Basic Fluid Power, Prentice Hall Inc, 1967
4. Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd.,London, 1979
5. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill, 1978.
6. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.
7. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem, 1994.

MF 9125 AUTOMATION LAB

L	T	P	C
0	0	4	2

AIM:

To impart knowledge in the area of hydraulics and pneumatic components and its functions.

OBJECTIVE:

- To make the students to learn the basic concepts of hydraulics and pneumatics and its applications in the area of manufacturing process.

1. To simulate the various hydraulics and pneumatics circuits
2. Study of Sensors and Transducers.
   Potentiometer, Strain gauge, Torque, LVDT, Hall-effect, speed, Vibration, Pressure.
3. Study of Temperature Transducer.
4. Study of optical Transducer.
5. Exercises on Operational amplifier circuits.
6. Study of Fiber optic sensors.
7. Electronic Power controls of DC and AC motors.
8. Study of Hydraulic and Pneumatic components.
9. Exercise on Hydraulic circuits.
10. Exercise on Electro hydraulic circuits.
11. Study of Electro Pneumatic Sequencing circuits.
12. Study of Hydraulic and Pneumatic Circuits using simulation software.
13. Exercise on Hydraulic and Pneumatic circuits using PLC.

MR 9121 INDUSTRIAL ROBOTICS L T P C
3 0 0 3

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 **10**

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 12

Robot motion – Kinematics of Robot motion – Direct and Indirect kinematics Homogeneous transformations – linkages and joints – mechanism – method for location and orientation of objects – drive systems – end effectors – types, selection, classification and design of grippers – gripper force analysis.

UNIT III SENSORS 8

Functions of Sensors – Position and proximity's sensing – tactile sensing – sensing joint forces – vision system – object recognition and image transformation – safety monitoring sensor systems – image analysis – application of image processing.

UNIT IV ROBOT PROGRAMMING & AI TECHNIQUES 8

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 7

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

TOTAL: 45 PERIODS

REFERENCES:

1. Yoram Koren Robotics, McGraw Hill 1992
2. Groover.M.P. Industrial Robotics, Prentice Hall, 1992
3. Janakiraman P.A. Robotics and Image Processing, Tata McGraw Hill, 1995

MF 9124 MICRO ELECTRO MECHANICAL SYSTEMS AND NANO TECHNOLOGY

L	T	P	C
3	0	0	3

AIM:

To inspire the students to expect to the trends in manufacturing micro components and measuring systems to nano scale.

OBJECTIVES:

- To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be award of micro actuators.
- Also to impart knowledge to the students about nano materials and various nano measurements techniques.

UNIT I OVER VIEW OF MEMS AND MICROSYSTEMS 6

Definition – historical development – fundamentals – properties, micro fluidics, design and fabrication micro-system, microelectronics, working principle and applications of micro system.

UNIT II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING 10

Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation – thermal oxidation, silicon diode, chemical vapour deposition, sputtering - deposition by epitoxy – etching – bulk and surface machining – LIGA process Micro system packaging – considerations packaging – levels of micro system packaging die level, device level and system level.

UNIT III MICRO DEVICES AND MATERIALS 8

Sensors – classification – signal conversion ideal characterization of sensors micro actuators, mechanical sensors – measurands displacement sensors, pressure and flow sensors, micro actuators – smart materials – applications.

UNIT – IV SCIENCE OF NANO MATERIALS 10

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Top down processes – bottom up process.

UNIT – V CHARACTERIZATION OF NANO MATERIALS 11

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

TOTAL: 45 PERIODS

REFERENCES:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
3. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
4. The MEMS Hand book, Mohamed Gad-el-Hak, CRC Press, New York, London.
5. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
6. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

MR 9124 MICROCONTROLLER LAB L T P C
3 0 0 3

1. Programming exercises on 8051 Microcontroller.
2. Programming exercises on PLC.
3. Programming exercises on PIC Microcontroller.
4. PIC and 8051 Microcontroller simulation exercises.
5. Exercises on A/D and D/A converter interfacing.
6. Exercises on PC Interface with Microcontroller.
7. Exercises on Pick and place Robotic interfacing.
8. Exercises on Pulse width Modulation using Microcontrollers (DC motor control).
9. Exercise on stepper motor interfacing.
10. Data Acquisition system using Microcontroller.
11. Exercises on servo motor interfacing.
12. Mini Project with Microcontroller.

MR 9122 MICROCONTROLLER & PROGRAMMABLE LOGIC CONTROLLERS L T P C
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 Micrcontroller. 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 6

Architecture of Microcontroller – CISC and RISC - : 8051 family, - PIC 16FXXX – family – Memory organization – Addressing modes – Fundamentals of Assembly language Programming – Instruction to Assembler – Compiler and IDE – Introduction to Embedded systems.

UNIT – II PROGRAMMING OF MICROCONTROLLER 12

Instruction set – Addressing modes – Programming- Timer/Counter, Interrupts – Serial communication of 8051 and PIC family-program examples.

UNIT- III INTERFACING OF MICROCONTROLLER 9

Interfacing of Memory-key board-Displays- ADC and DAC-stepper motors with 8051 and PIC family using Assembly language programming.

UNIT- IV INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER 6

Fundamentals of programmable logic controller – Functions of PLCs – PLC operations – Evaluation of the modern PLC – State Based Design – Memory – Serial communication – Human machine Interfacing – Selection of PLC – Features of PLC.

UNIT - V PLC PROGRAMMING 12

Architecture – Basics of PLC programming – Developing Fundamental wiring diagrams – Problem solving using logic ladder diagrams – communication in PLCs – Programming Timers – programming counters..

TOTAL : 45 PERIODS

REFERENCES

1. Muhammad Ali Mazidi and Janice Gillispic Mazdi, “The 8051 Microcontroller and Embedded Systems” Pearson Education, Inc 2006.
2. John B. Peatman, Design with Micro controllers, McGraw Hill International, USA, 2005.
3. Kenneth Hint, and Daniel Tabak, Micro controllers, Architecture, Implementation and programming, McGraw Hill International, USA, 1992.
4. Kenneth J. Aylala, “The 8051 Micro controller, the Architecture and Programming applications”:2003.
5. Frank D. Petro Zella, “Programmable logic controller” McGraw – Hill Publications, 1998.
6. James W. Stewart, “The 8051 Micro controller hardware, software and interfaciung, regents Prentice Hall, 2003.
7. John B. Peatman, PIC programing, McGraw Hill International, USA, 2005.

MR 9123 CONTROL SYSTEM ENGINEERING L T P C
3 0 0 3

AIM:

To understand the various types of control systems and their design and specifications

OBJECTIVE:

This course is intended for learning the all types of Control Systems and their Representations. Block diagrams, Time and Frequency domain specifications, stability of control systems and stability criterion. This course is also gives the ideas of Analysis and Design of State Variables and components of control systems.

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in Control Systems – Mathematical Models – Mechanical translational – Mechanical rotational – Electrical systems – Transfer functions – Block diagrams. Reduction techniques – signal flow graph – Thermal – Hydraulic – Pneumatic Systems.

UNIT II TIME AND FREQUENCY RESPONSE 9

Time domain specifications-types of test inputs-I and II order systems-response-generalized error series-steady state error-frequency domain specifications-polar-plot-bode plot

UNIT III STABILITY OF CONTROL SYSTEMS 9

Characteristic equation-location of roots in S plane for stability – Routh Hurwitz criterion-root locus technique construction-Gain and phase margin-Nyquist stability criterion.

UNIT IV STATE VARIABLE ANALYSIS AND DESIGN 9

Concepts of state variables and state model – state models for linear continuous – time systems – Solution of state equations – Concepts of controllability and observability – State variables and Linear Discrete – time systems – problems.

UNIT V CONTROL SYSTEM COMPONENTS 9

Servomotor-stepper motor- synchro -resolver- amplidyne - planar motor: types, principle, Application and Selection– Passive Compliances

TOTAL : 45 PERIODS

REFERENCES:

1. K.ogata, :modern controls engineering " Prentice Hall of India Pvt. Ltd., New Delhi, 2005.
2. B.C. kuo, "Automatic Control Systems", Prentice Hall of India Pvt. Ltd., New Delhi, 2004
3. I.J.Nagrath and Gopal. "Control system engineering", new age international (P) Ltd., 2006.
4. A. Nagoor Kani, "Control Systems", RBA publications (P) Ltd., 2007.
5. M. Gopal, " Control Systems priniciples and Design" Tata MV Graw Hill Publishing Ltd, 2003

MR 9150 INDUSTRIAL INSTRUMENTATION

L	T	P	C
3	0	0	3

AIM:

To understand and know the measurements of various industrial instruments and data presentation systems.

OBJECTIVE:

This course is intended for learning the Pressure Measurement. All types of Flow Measurements, All types of temperature, humidity, strain and vibration measurements, classification and characteristics of Data Presentation Systems.

UNIT – I PRESSURE MEASUREMENT 9

Pressure Standards – Dead weight gauge, Manometers – Elastic elements: Diaphragms, Bellows, Bourdon tubes – Low pressure measurement: McLeod gauge, Knudsen gauge, Thermocouple and Pirani gauge, lonization gauge – High pressure measurement – I/P and P/I Converters, Transmitters.

UNIT – II FLOW AND LEVEL MEASUREMENTS 9

Head-type flow meters: Orifice, Venturi, Nozzle – Rotameter – Anemometers: Hot wire and Hot film – Electromagnetic flowmeters – Turbine flowmeter – Ultrasonic Flowmeter – Electric methods for level measurement: Resistance switching type, Conductance probe type, Capacitance type – Ultrasonic, Nuclear Radiation methods of Level measurement.

UNIT – III TEMPERATURE AND HUMIDITY MEASUREMENT 9

Temperature Standards Range – Resistance Temperature Detectors (RTDs), Two wire and Three wire configuration – Thermocouples: Lead and Cold Junction Compensation Techniques – Radiation pyrometers – Humidity measurements – Transmitters.

UNIT – IV STRAIN AND VIBRATION MEASUREMENTS 6

Stress – strain relation – Strain measurement considerations – Static and Dynamics Measurements – Calibration of Strain gauges – Load Cells – Vibration Measurements.

UNIT – V DATA PRESENTATION SYSTEMS 12

Classification – Characteristics – Digital display elements, LEDs, LCDs, - Dot matrix systems, alphanumeric displays – Graphic display: CRT – Recording: Chart recorders, CRO, X-Y Recorders, Printers, Magnetic recorders, Digital recording techniques Signal conditioning methods – Data Acquisition Systems – Data Loggers – Outline and Features of PC Based Instruments – Virtual Instruments.

TOTAL: 45 PERIODS

REFERENCES

1. Ernest O.Doebelin, Measurement systems Application and Design, International Student Edition, IV Edition, McGraw-Hill Book Company, 1998.
2. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.
3. B.C.Nakra and K.K.Chaudary, Instrumentation Measurement and Analysis, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1985.
4. D.Patranabis, Principles of Industrial Instrumentation, Tata McGraw-Hill Publishing Ltd., New Delhi, 1999.

MF 9162 ARTIFICIAL INTELLIGENCE

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. Meta Heuristic techniques and Applications in Design and Manufacturing.

UNIT – I INTRODUCTION TO FUZZY LOGIC 8

Basic concepts in Fuzzy Set theory – Operations of Fuzzy sets – Fuzzy relational equations – Propositional, Predicate Logic – Inference – Fuzzy Logic Principles – Fuzzy inference – Fuzzy Rule based systems – Fuzzification and defuzzification – Types.

UNIT – II FUZZY LOGIC APPLICATIONS 10

Fuzzy logic controllers – Principles – Various industrial Applications of Fuzzy logic control – Adaptive Fuzzy systems – Fuzzy Decision making – Fuzzy classification – Fuzzy pattern Recognition – Image Processing applications – Fuzzy optimization.

UNIT – III INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 8

Fundamentals of Neural networks – Neural network architectures – Learning methods – Taxonomy of Neural Network Architectures – Standard back propagation Algorithms – Selection of various parameters – Variations.

UNIT – IV OTHER ANN ARCHITECTURES 10

Associative memory – Exponential Bidirectional Associative Memory – Adaptive Resonance Theory – Introduction – Adaptive Resonance Theory 1 – Adaptive Resonance Theory 2 – Applications – Kohen Self organizing maps – counter propagation networks – Industrial Applications.

UNIT – V RECENT ADVANCES 10

Fundamentals of Genetic Algorithms – Hybrid systems – Meta heuristic techniques like simulated Annealing, Tabu Search, Ant colony optimization, Perpetual self organizing, Artificial immune systems – Applications in Design and Manufacturing.

TOTAL: 45 PERIODS

REFERENCES:

1. Klir, G.J. Yuan Bo, 'Fuzzy sets and Fuzzy Logic: Theory and Applications', Prentice Hall of India Pvt. Ltd., 1997.

2. Jacek M. Zurada, 'Introduction to Artificial Neural Systems' Jaico Publishing House, 1994
3. Simon Haykin, 'Neural Networks – A comprehensive foundation', Prentice Hall, 2nd Edition, 1998.
4. Laurene Fausett, 'Fundamentals of Neural Networks, Architectures, Algorithms and Applications, Prentice Hall, Englewood cliffs, 1994.
5. S. Rajasekaran, GA Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic and Genetic Algorithms', Prentice Hall of India Private Limited, 2003.

MR9151 METROLOGY AND INSPECTION

L	T	P	C
3	0	0	3

AIM:

To enable the learner to get familiar with the fundamental and advanced aspects of manufacturing metrology and quality control.

OBJECTIVE:

To make the learner to design and fabricate inspection methods and systems in corporating 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

Inspection of gears and threads – Tool makers' microscope – Universal measuring machine – use of Laser interferometer in machine tool Inspection – use of laser in on-line Inspection – Laser micrometer – Laser Alignment telescope.

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

Fundamentals of Image Processing – Steps involved in Image Processing – Machine Vision applications in manufacturing and metrology.

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

REFERENCES

1. Jain R.K. Engineering Metrology – Khanna Publishers – 2000
2. Robert G. Seippel – Opto Electronics for technology and engineering – Prentice Hall – New Jersey 1989.
3. Anil.K.Jain Fundamentals of digital Image Processing – Prentice Hall of India Pvt. Ltd., - 2004
4. Dale.H. Besterfield Total Quality Management Pearson Education Asia – 2002
5. Manuals of C.M.M. and systems.

MR 9152 MACHINE VISION AND APPLICATIONS

L	T	P	C
3	0	0	3

AIM:

To impart knowledge on image processing and machine vision applications

OBJECTIVE:

To understand and apply the machine vision analysis and applications.

UNIT – I INTRODUCTION 9

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.

UNIT – II IMAGE ACQUISITION 12

Scene constraints-lighting sources, types and setups – Lighting parameters – working principle – Analog and Digital Cameras – General problem in capturing the image – selection of camera – optics in camera.

UNIT – III IMAGE PROCESSING 9

Image formation – filtering technique – Pixel processing – Processing of binary and grey scale images – Operators – types – segmentation – edge detection – Morphology.

UNIT – IV IMAGE ANALYSIS 6

Feature extraction-decision making – pattern recognition – colour image processing – 3D image processing.

UNIT – V MACHINE VISION APPLICATION 9

Machine vision applications in manufacturing, electronics, printing, pharmaceutical, textile and Bio medical field - Case studies

TOTAL: 45 PERIODS

REFERENCES

1. Springer, 'Digital Image Processing', 2003
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing Analysis and machine vision publisher, 1995.
3. Richard.O.Duda, Peter.E.Hurt, Pattern Classification and Scene Analysis Publishers, 2000.
4. Rafael C.Gonzales, Richard.E.Woods, 'Digital Image Processing Publishers, 1992.
5. Nello Zuech, 'Understanding and Applying Machine Vision Marcel dekker Inc. 2000.

MR 9153 MECHATRONICS ELEMENTS AND PROGRAMMING OF CNC MACHINES

L	T	P	C
3	0	0	3

AIM:

To introduce the application of Mechatronics in machine tools**.**

OBJECTIVE:

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 12

Measuring systems - feedback devices - velocity feedback - analog and digital - position feedback - rotary and linear. Tooling - requirement and planning - preset, qualified and semi qualified tools. Fixtures – requirement - unified and modular fixtures - tool identification - touch trigger probe- tool coding - EEPROM tools.

Tool condition monitoring - various indirect and direct methods. 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 –sensors in CNC.

UNIT – IV CNC PROGRAMMING 14

Machine axes identification - primary, secondary and tertiary - manual CNC programming - Milling programming fundamentals - compensation and offset in milling -fixed cycles in milling - repetitive programming - loops, sub programs and macros. Turning programming fundamentals - compensation and offset in turning - fixed cycles in turning.

Computer assisted programming in APT - basic geometry definition - cutter motion definition - postprocessor statements - generation and execution of APT programs.

UNIT – V TESTING AND MAINTENANCE OF CNC MACHINES 5

Verification of technical specification and functional aspects, Verification during idle running & machine tool and the work piece accuracy - Installation of CNC machines - Maintenance of CNC machines - machine elements – hydraulic elements - electrical and electronic elements – maintenance schedules.

TOTAL: 45 PERIODS

REFERENCES:

1. Jonathan Lin,S.C., “Computer Numerical Control (From Programming to Networking)”, Delmar Publishers Inc., 2000.
2. HMT Limited, “Mechatronics”, Tata Mcgraw-Hill Publishing Co Ltd, 2002.
3. Groover,M.P., “Automation, Production System and CIM”, Prentice Hall of India Pvt. Ltd, 2003.
4. Grahamt.Smith, “Advanced Machining: The Handbook of Cutting Technology”, IFS Publications Ltd., 1989
5. Sehrawatt,M.S., and Narang,J.S., “CNC Machine”, Dhanpat Rai And Co, 2002.
6. Jayakumar,V., and Mahendran,B., “Computer Aided Manufacturing”, Lakshmi Publications 2005.
7. Radhakrishnan,P., “CNC Machine”, New Central Book Agency, 2000.
8. Stenerson and Curran, “Computer Numerical Control-Operation and Programming”, PHI Learning Pvt. Ltd., 2008.

MR 9154 AUTOMOTIVE ELECTRONICS

L	T	P	C
3	0	0	3

AIM:

To understand the design and specifications of various automotive 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. This course is gives the brief ideas of automotive engines, Engine control functions, Fuel delivery systems. All types of transmission control systems, Electromagnetic Interference and Electronic Dashboard Instruments.

UNIT – I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 6

Introduction to Automobile Engineering, Automotive Engines, Automotive Control Systems – Components of Electronic Engine Management – Current trends in Automobiles.

UNIT – II AUTOMOTIVE SENSORS AND ACTUATORS 9

Introduction – Basic Arrangement – Automotive applications of Pressure, Flow, Temperature sensors – Position, Speed and Acceleration Sensors – Exhaust gas sensors – Engine knock, Engine torque sensors – Automotive actuators.

UNIT – III AUTOMOTIVE ENGINE CONTROL SYSTEMS I: ENGINE CONTROL 12

Objectives – Spark Ignition Engines: Engine control functions, Engine control modes, Fuel delivery systems, MPFI, Ignition Systems, Diagnostics – Compression Ignition Engines – Emission control.

UNIT – IV Automotive Transmission Control Systems II 12

Transmission control – Cruise control – Braking control – Traction control – Suspension control – Steering control – Stability control – Integrated engine control.

UNIT – V AUTOMOTIVE MONITORING AND DIAGNOSTICS 6

Electromagnetic Interference (EMI) Suppression – Electromagnetic Compatibility – Electronic Dashboard Instruments – On board and off board Diagnostics – Security and warning Systems.

TOTAL: 45 PERIODS

REFERENCES:

1. William B.Ribbens, “Understanding Automotive Electronics – 5th Edition, Butterworth, Heinemann Wobum, 1998.

2. Tom Weather Jr and Cland C. Hunter, “Automotive Computers and Control System” Prentice Hall Inc., New Jersey.
3. Young A.P. and Griffths, L., Automobile Electrical Equipment “English Language Book Society and New Press.
4. Crouse, W.H. Automobile Electrical Equipment, McGraw Hill Book Co Inc., New York, 1955.
5. Robert N Brady, Automotive Computers and Digital Instrumentation, Areston Book Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
6. T. Mellard, Automotive Electronics.
7. R.K. Jurgen, Automotive Electronics Handbook, McGraw Hill 2nd Edition.

MR 9155 OPTO - ELECTRONIC INSTRUMENTATION

L	T	P	C
3	0	0	3

AIM:

To understand the basic concepts, properties and applications of optical fibers and lasers.

OBJECTIVE:

This course is intended for learning the Principles of light propagation through a fiber, types and properties of fibers. Fiber optic sensors, types of modulators, Industrial Application of Optical Fibers, Measurements of pressure, temperature, current, voltage liquid level and strain. This course is also gives the ideas of Fundamentals and characteristics of lasers, properties of lasers, All types of laser, Industrial Application of Lasers and Medical Applications of Optical Fibers and lasers.

UNIT – I OPTICAL FIBERS AND THEIR PROPERTIES 9

Principles of light propagation through a fiber – types of fibers and their properties transmission characteristics of optical fiber – absorption losses – scattering losses – dispersion – optical fiber measurement – optical sources –optical detectors – LED – LD – PIN and APD

UNIT – II INDUSTRIAL APPLICATION OF OPTICAL FIBERS 9

Fiber optic sensors – fiber optic instrumentation system – types of modulators – detectors – application in instrumentation – interferometric method of measurement of length – moiré fringes – measurements of pressure, temperature, current, voltage liquid level and strain – fiber optic gyroscope – polarization maintaining fibers.

UNIT – III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – three level and four level lasers – properties of laser – laser modes – resonator configuration – Q-switching and mode locking – cavity dumping – types of laser: gas lasers, solid lasers, liquid lasers and semi conductor lasers.

UNIT – IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, length velocity, acceleration, current voltage and atmospheric effect – material processing laser heating, welding melting and trimming of materials – removal and vaporization.

UNIT – V HOLOGRAM AND MEDICAL APPLICATION 9

Holography – basic principle: methods: holographic interferometry and applications, holography for non – destructive testing – holographic components – medical applications of lasers, laser and tissue interaction – laser instruments for surgery, removal of tumors of vocal cords, brain surgery, plastic surgery, gynecology and oncology.

TOTAL: 45 PERIODS

REFERENCES:

1. Ghatak A.K. and Thiagarajar K, Optical electronics foundation book, TMH, New Delhi, 1991 Keiser G, Optical Fiber Communication, McGraw Hill, 1991.
2. John and Harry, Industrial lasers and their applications McGraw Hill, 1974.
3. John F Read, Industrial applications of lasers, Academic Press, 1978
4. MonteRoss, Laser applications, McGraw-Hill 1968.

MR 9156 MACHINE TOOL CONTROL AND CONDITION MONITORING

L	T	P	C
3	0	0	3

AIM:

To impart knowledge on machine tool control and conditioning monitoring.

OBJECTIVE:

To introduce various types of machine tool control and various condition monitoring techniques.

UNIT – I OVERVIEW OF AUTOMATIC CONTROL IN MACHINE TOOLS 11

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 9

Hydraulic and Pneumatic drives, Electrical drives – A.C. Motor, D.C. Motor, Servo motor and Stepper motor. Feed back devices - Syncro, resolver, diffraction gratings, potentiometer, Inductosyn and encoders-application in machine tools.

UNIT – III ADAPTIVE CONTROL AND PLC 10

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. 8

Primary & Secondary signals, Online and Off-line monitoring. Fundamentals of Vibration, Sound, Acoustic Emission. Machine Tool Condition Monitoring through Vibration, Sound, Acoustic Emission, Case Studies

UNIT – V CONDITION MONITORING, THROUGH OTHER TECHNIQUES 7

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:

1. Manfred Weck, “Hand Book of Machine Tools” –Vol.3, John Wiley & Sons, 1984.
2. Sushil Kumar Srivstava, “Industrial Maintenance Management”S.Chand & Company Ltd., New Delhi, 1998.
3. Mikell P.Groover, “Automation Production system and Computer Integrated Manufacturing”, Prentice Hall of India Pvt. Ltd., 1995.

MR 9157 NETWORKS AND DISTRIBUTION SYSTEMS

L	T	P	C
3	0	0	3

AIM:

To impart the knowledge of networking and distribution systems to the students

OBJECTIVE:

This course is intended for learning the Introduction to networks, definition of layers, reference models, Different Architectural Protocols and Standards, different protocols, Network interconnection, Distribution system models, and distribution file system.

UNIT – I NETWORK FUNDAMENTALS 6

Introduction to networks, definition of layers, services, interfaces and protocols, communication themes, switching techniques-circuit switched, package switched and message switched networks – reference models, (OSI, TCP/IP, ATM) layers and duties comparison of models.

UNIT – II ARCHITECTURAL PROTOCOLS AND STANDARDS 9

Physical Layer-General Description, Characteristics, Signalling Limits, Media Types and Comparison, Topologies, Examples of Physical Layer (RS232-C, ISDN, ATM, SONNET) Data link layer – sliding window protocols, A104A protocols, LAN protocols – Performance, specification and verification IEEE-Standards.

UNIT – III NETWORK INTERCONNECTION 6

Internet working – interconnection issues, bridges-transparent & source routing bridges, routers, flow and congestion command algorithms, gateways - Network security Internet protocols.

UNIT – IV DISTRIBUTED SYSTEMS 12

Models: Hardware concepts-software concepts-claint server models-communication: Layout protocals-Remote procedure call-Remote object invocation-message oriented communication-synchronization Mechanism: clock-logical clocks-Election Algorithms-mutual exclusion- Case study:Amoeba-Mach-Chorus.

UNIT – V DISTRIBUTED FILE SYSTEM 12

Design:File service interface-Directory server Interface- Implementation:File useage-system structure-Caching replication- Trends in distributed file systems: New

Hardware-scalability-Wide area networking-Mobile users-Fault tolerances-Multimedia.

TOTAL: 45 PERIODS

REFERENCES:

1. Stallings, S.W. Data and computer communications, IV Edition, Prentice Hall of India, 2006.
2. Tanenbaum, A.S. Computer Networks, Prentice Hall of India, III Edition, 2006.
3. Keiser, Local Area Network, Tata Mc GrawHill, 1999.
4. Kesav S. An engineering approach to computer networking, Addision – Wesley, 1999.
5. Comerd E-Internetowrking with TCP/IP(Volume 1), Principles, Protocols and architecture, III Edition, Prentice Hall of Indoa, 1999.
6. Forauzan B, - Introduction to Data Communication & Networking McGraw Hill 1998.
7. Tanenbaum, A.S, Marten vansteen.“Distributed systems principles and paradigms” Prentice Hall of India, 2006.
8. Tanenbaum, A.S, “Distributed operating systems” Pearson Educatoon, 1995.

MR 9158 MEDICAL ELECTRONICS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

AIM:

To understand the concepts and operations of various medical electronic instruments.

OBJECTIVE:

This course is intended for learning the brief review of human physiology and anatomy, different types of sensors used I biomedicine, selection criteria for transducers and electrodes, different types Electro-Physiological Measurement, Measurement of blood pressure, gas volume, flow rate of CO_2 and O_2 in exhaust air, Medical Imaging Parameter Measurements, Cardiac pacemakers, defibrillators ventilators and Therapetic devices.

UNIT – I ANATOMY, PHYSIOLOGY AND TRANSDUCERS 9

Brief review of human physiology and anatomy – cell and their structures – electrical mechanical and chemical activities – action and resting potential – different types of electrodes – sensors used in biomedicine – selection criteria for transducers and electrodes – necessity for low noise pre-amplifiers – differential amplifiers –Chopper amplifiers – electrical safety – grounding and isolation.

UNIT – II ELECTRO – PHYSIOLOGICAL MEASUREMENT 9

ECG – EEG – EMG - ERG – lead system and recording methods – typical waveforms – applications.

UNIT – III NON-ELECTRICAL PARAMETER MEASUREMENTS 9

Measurement of blood pressure – blood flow cardiac output – cardiac rate – heart sound – measurement of gas volume – flow rate of CO_2 and O_2 in exhaust air – pH of blood – ESR and GSR measurements.

UNIT – IV MEDICAL IMAGING PARAMETER MEASUREMENTS 9

X-Ray machine – computer aided tomography – magnetic resonance imaging system – ultra sonography – endoscopy – different types of telemetry system – laser in biomedicine.

UNIT – V ASSISTING AND THERAPETIC DEVICES 9

Cardiac pacemakers – defibrillators ventilators – muscle stimulators – diathermy – introduction to artificial kidney artificial heart – heart lung machine – limb prosthetics – orthotics – elements of audio and visual aids.

TOTAL:45 PERIODS

REFERENCES

1. Webster J.G., Medical Instrumentation: Application and Design, 3rd Edition, John Wiley and Son, 1999.
2. Khandpur R.S. Hand book of Biomedical instrumentation and Measurements, Tata McGraw-Hill New Delhi 1987.
3. Geddes and Baker, Principles of Applied Biomedical Instrumentation, John Wiley and Sons, USA, 1975.
4. Well G. Biomedical Instrumentation and Measurements, Prentice Hall, New Jersey, 1980.
5. Koryla J., Medical and Biological Application of Electro chemical devices John Wiley and Sons, Chichester, 1980
6. Wise D.L., Applied Bio-sensors, Butterworth USA, 1989
7. Jackson and Webster, Medicine and Clinical Engineering Prentice Hall, New Delhi, 1979.

MR 9159 REAL TIME EMBEDDED SYSTEM

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, high level language descriptions of software for embedded system.

UNIT – I INTRODUCTION TO EMBEDDED SYSTEMS 6

Definitions – Brief overview of micro-controllers, microprocessors and DSPs, - Typical classification and application scenarios of embedded systems.

UNIT – II EMBEDDED SYSTEM COMPONENTS AND INTERFACE 9

Embedded processors – Memory Devices – Interface and Peripherals – Power and its Management.

UNIT – III EMBEDDED SYSTEM DESIGN AND DEVELOPMENT 9

Design Methods and techniques – Models and languages – State Machine and state tables in embedded design – High level language descriptions of S/W for embedded system, Java based embedded system design – Simulation and Emulation of embedded systems.

UNIT – IV REAL TIME MODELS, LANGUAGE AND OPERATING SYSTEMS 12

Event based, process based and graph based models, Petrinet models-Real time languages – The real time Kernel, OS tasks, task states, task scheduling, interrupt processing, clocking communication and synchronization, control blocks, memory requirements and control, kernel services – Real time languages and their features.

UNIT – V CASE STUDIES IN REAL TIME EMBEDDED INSTRUMENTS 9

Specific examples of time-critical and safety-critical embedded systems applications in automotives, aerospace, medicine and manufacturing.

TOTAL: 45 PERIODS

REFERENCES

1. Ball S.R., Embedded microprocessor Systems – Real World Design, Prentice Hall, 1996
2. Herma K., Real Time Systems – Design for distributed Embedded Applications, Kluwer Academic, 1997.
3. Gassle.J., Art of Programming embedded systems, Academic Press, 1992.

4. Gajski, D.D. Vahid, F., Narayan S., Specification and Design of Embedded Systems, PTR Prentice Hall, 1994.
5. Intel manual on 16 bit embedded controllers, Santa Clara, 1991
6. C.M. Krishna, Kang G. Shin, Real Time systems, McGraw Hill 1997
7. Raymond J.A. Buhr, Donaid L, Balley: An Introduction to Real time Systems, Prentice Hall international, 1999.

MR 9160 MECHATRONICS SYSTEM DESIGN

L	T	P	C
3	0	0	3

AIM:

To understand the basic concepts, properties and interfacing off controls and drives in Mechatronics System Design.

OBJECTIVE:

This course is intended for learning the Mechatronics systems and their design process. Different types of Controls and Drives, Real time interfacing, data acquisition system, sensors for condition monitoring, mechanitronic controlin automated manufacturing. De-icing temperature control system and skip control of a CD player. This course is also gives the case studies on design of mechatronics product, pick and place robot, car park barriers, car engine management and bar code reader.

UNIT – I SYSTEMS AND DESIGN 9

Mechatronics systems – Integrated design issue in Mechatronics – Mechatronic key elements, Mechatronics approach – Adaptive control and distributed control system – Design process – Type of design – Integrated product design – Mechanism, load condition, design and flexibility – structures – man machine interface, industrial design and ergonomics, information transfer, safety.

UNIT – II CONTROL AND DRIVES 9

Control devices – Electro hydraulic control devices, electro pneumatic proportional controls – Rotational drives – pneumatic motors: continuous and limited rotation – Hydraulic motor: continuous and limited rotation – motion converters, fixed ratio, invariant motion profile, variators.

UNIT – III REAL TIME INTERFACING 9

Real time interface – Introduction, Elements of a data acquisition and control system, over view of I/O process, installation of I/O card and software – Installation of the application software – over framing.

UNIT – IV CASE STUDIES – I 9

Case studies on data acquisition – testing of transportation surface materials transducer calibration system for automotive application – Strain gauge weighing system – solenoid force – Displacement calibration system – Rotary optical encoder – controlling temperature of a hot/cold reservoir – sensors for condition monitoring – mechatronic control in automated manufacturing.

UNIT – V CASE STUDIES II 9

Case studies on data acquisition and control – thermal cycle fatigue at a ceramic plate – PH control system. De-icing temperature control system – skip control of a CD player – Auto focus camera. Case studies on design of mechatronics product – pick and place robot – car park barriers – car engine management – bar code reader.

TOTAL: 45 PERIODS

REFERENCES

1. Brian morriss, "Automated manufacturing Systems – Actuators Controls, sensors and Robotics", McGraw Hill International Edition, 1995.
2. Bolton, "Mechatronics – Electronic control systems in mechanical and electrical engineering, 2nd edition, Addison Wesley Longman Ltd., 1999.
3. Devadas Shetty, Richard A.Kolkm, "Mechatronics system design, PWS publishing company, 1997.
4. Bradley, D. Dawson, N.C.Burd and A.J. Loader, "Mechatronics: Electronics in product and process", Chapman and Hall, London, 1991
5. Gopal, "Sensors A comprehensive survey Vol I & Vol VIII", BCH publisher, New York.

MR 9161 TELEMATICS

L	T	P	C
3	0	0	3

AIM:

To impart the knowledge in the area of Telematics.

OBJECTIVE:

This course is intended for learning the applications of telemetry, in either commercial or defense/space organizations. Applications include telemetry as applied to control and monitoring of space vehicles as well as telecommunications, automotive testing, in-plant industrial system control and electrical power transmission telemetry systems.

UNIT – I INTRODUCTION 6

Types of telemetry systems - Basic radio telemetry system - Radio Frequency (RF) Link - Components of telemetry system - Antennas - Near-Earth and Deep Space Applications - Telemetry standards - Understanding dB: Decibels, Power Ratio, Voltage Ratio, dB Conversions.

UNIT – 2 TELEMETRY TECHNIQUES 12

Carrier Modulation - Amplitude and Frequency Modulation (AM and FM) -FM: Ground Station, Frequencies, Techniques, Modulation Index Spectra - Guard Bands - FM Channel Mixing - Signal Sampling - Pulse Amplitude Modulation

(PAM), PAM Ground Station -PCM Encoder -- PCM Ground Station - Data Bus: ARINC-429 - MIL-STD-1553 - IRIG-106, Chapter 8 (1553 and 429) - Recent Updates - MIL-STD-1553 Future - Other Buses

UNIT – 3 THE COMPUTER AND THE TELEMETRY SYSTEM 12

Data Words - Data Transfer Mechanisms - PC Computers - Getting Data to Disk - Buffer Servicing: CVT vs. Data Driven - Bus Standards - PC Systems - PC Software –Environment: Portability and Ruggedness - Buses: ISA, PCMCIA (PC Card) - PCI, VME - USB, FireWire (IEEE 1394) - SCSI (Internal), Fibre Channel - ATA and Serial ATA
RAID and Networked Storage - Networking Growth - Ethernet: Rates, Components, Physical Medium - Fiber Connectors - Software Protocols - UDP vs. TCP - Data Flow Down - Display Devices - Graphics Display Engines: Tabular, Bar Charts, Strip Charts, Alarm Pages, Quick Look - IADS - ILIAD - LabView - MatLab - Global Majic - Quinn Curtis - DataViews - Parameter Databases - Telemetry Attribute Transfer Standards (TMATS) - "Hard" Programming (Patch Panels) - Strip charts
RF Transmission: UHF Bands - Digital Signal Transmission - Popular Modulation Types - Antennas - Bit Error Rate (BER) - System BER Testing - Future Visions…JTRS

UNIT – 4 MISSION PLANNING AND DATA MINING 7

Mission Planning - Work Breakdown Structure - Mission Support Process - The Next Challenge (Data Mining) - Data Mining Tool Requirements - brief discussion of future trends, including iNet.

UNIT - 5 APPLICATIONS 8

Applications in healthcare, fleet management, intelligent transportation, automotive, advanced manufacturing, supply chain management and defence & security as case studies to explain the deployment and effectiveness of telematic systems.

TOTAL : 45 PERIODS

REFERENCE:

1. Telemetry Systems Engineering, Frank Carden, Russ Jedlicka, Robert Henry, Artech House Publishers Boston, MA, USA, ISBN-13: 9781580532570.
2. Practical Radio Engineering and Telemetry for Industry, David Bailey, Elsevier, ISBN-13: 978-0-7506-5803-4.
3. Telematics and Transport Behaviour (Advances in Spatial Science) by Peter Nijkamp, G. Pepping, D. Banister, Springer-Verlag Telos (May 1996) ISBN-13: 978-3540609193.

4. Handbook of Telemetry and Remote Control by Elliot L Gruenberg, McGraw-Hill, 1967.

MR 9162 MECHATRONICS FOR AIRCRAFT

L	T	P	C
3	0	0	3

AIM:

To understand the Design, Architecture and Operations of Aircraft Systems

OBJECTIVE:

This course is intended for learning the architecture and design of Avionics systems, components of airplane, sensors and actuation systems in Aircraft, Testing methodologies and Aircraft navigation systems. This course is gives the ideas of air speed, air temperature, Angle of attack measurements, pressure, torque, fuel flow, engine vibration, monitoring and integration of GPS and INS utilization of navigation systems in aircraft.

UNIT – I AVIONICS SYSTEM ARCHITECTURE & DESIGN 9

Need for Avionics in Civil and Military aircraft and Space systems, integrated avionics, Avionics system architecture, design and evaluation. Fault tolerant systems - hardware, and software, Future architecture. Data buses- MIL-STD-1553B, ARINC-429 and 629, STANAG-3910 and 3838, DOD-STD-1773, HSDB, CAN bus, Avionics Full Duplex Switched Ethernet (AFDX) comparison of buses

UNIT – II CONFIGURATION OF AIRPLANE AND ITS COMPONENTS 9

Fundamentals - components of an airplane and their functions - motions of a plane - Cockpit displays - MFDs, MFK, HUD, DVI, HOTAS, Helmet mounted display,

UNIT – III AIRCRAFT SENSORS AND ACTUATION SYSTEMS 9

Gyroscope- Principles , Gyro equations, Rate Gyros - Rate integration and free Gyro, Vertical and Directional Gyros, Laser Gyroscopes, Accelerometers. Types of actuation systems-Linear and non-linear actuation system, modeling of actuation systems, Servo-loop analysis actuator design - testing methodologies, Performance testing equipments for sensors and actuation systems.

UNIT – IV AIRCRAFT INSTRUMENTS 12

Air data instruments-airspeed, altitude, Vertical speed indicators. Static Air temperature, Angle of attack measurement. Direct reading compass, magnetic heading reference system-detector element, Pressure , temperature fuel quantity and engine power measurement and control instruments-measurement of RPM, manifold pressure, torque, exhaust gas temperature, EPR, fuel flow, engine vibration, monitoring. Electrical Power requirement for Military and Civil standards. Solar battery design.

UNIT – V AIRCRAFT NAVIGATION SYSTEMS 6

Inertial Navigation – Satellite navigation - GPS -system description -basic principles - position and velocity determination-signal structure-DGPS, Integration of GPS and INS-utilization of navigation systems in aircraft

TOTAL: 45 PERIODS

REFERENCES:

1. Collinson R.P.G. 'Introduction to Avionics', Chapman and Hall, 1996
2. Cary R .Spitzer, The Avionics Handbook,Crc Press, 2000.
3. Pallet, E.H.J. 'Aircraft Instruments & Integrated systems', Longman Scientific and Technical, McGraw-Hill, 1992.
4. Myron Kyton, Walfred Fried, 'Avionics Navigation Systems', John Wiley & Sons,1997
5. Pallett, E.H.J. 'Aircraft instruments, principles and applications', Pitman publishing Ltd., London, 1981.

MF 9163 LEAN MANUFACTURING SYSTEM AND IMPLEMENTATION

L	T	P	C
3	0	0	3

AIM:

To introduce the concepts of lean manufacturing system.

OBJECTIVES:

- To study the various tools for lean manufacturing (LM).
- To apply the above tools to implement LM system in an organization.

UNIT – I INTRODUCTION TO LEAN MANUFACTURING 7

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT – II CELLULAR MANUFACTURING, JIT, TPM 9

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT – III SET UP TIME REDUCTION, TQM, 5S, VSM 10

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT – IV SIX SIGMA

9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation

UNIT – V CASE STUDIES **10**

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

REFERENCES:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003
2. Rother M. and Shook J, 1999 'Learning to See: Value Stream Mapping to Add Value and Eliminate Muda' , Lean Enterprise Institute, Brookline, MA.
3. Mikell P. Groover (2002) 'Automation, Production Systems and CIM.

MF 9161 NON-DESTRUCTIVE EVALUATION

L	T	P	C
3	0	0	3

AIM:

To stress the importance of NDT in engineering.

OBJECTIVES:

To introduce all types of NNDT 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

Principles, Instrumentation for ECT, Absolute, differential probes, Techniques – High sensitivity techniques, Multi frequency, Phased array ECT, Applications.

Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.

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 & RADIOGRAPHY 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, Applications of Normal Beam Inspection in detecting fatigue cracks, Inclusions, Slag, Porosity and Intergranular cracks.

Principle of Radiography, Effect of radiation on Film, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique, Real Time Radiography

UNIT – V CASE STUDIES, COMPARISON AND SELECTION OF NDT METHODS 9

Case studies on defects in cast, rolled, extruded, welded and heat treated components.
Comparison and selection of various NDT techniques. Codes, standards, specification and procedures.

TOTAL: 45 PERIODS

REFERENCES:

1. Baldev Raj, Jeyakumar,T., Thavasimuthu,M., “Practical Non Destructive Testing” Narosa publishing house, New Delhi, 2002
2. Krautkramer. J., “Ultra Sonic Testing of Materials”, 1st Edition, Springer – Verlag Publication, New York, 1996.
3. Peter J. Shull “Non Destructive Evaluation: Theory, Techniques and Application” Marcel Dekker, Inc., New York, 2002
4. www.**ndt**.**net**

MR 9164 MATERIAL HANDLING, STORAGE AND ASSEMBLY AUTOMATION

L	T	P	C
3	0	0	3

AIM:

To make the learner to understand the importance of layout and the productivity improvements due to the automation of material handling storage and assembly.

OBJECTIVE:

To make the learner to develop skills of analyzing the automation concepts and develop the need based design and fabrication of automated materials handling, storage and assembly system.

UNIT – I INTRODUCTION TO LAYOUT 9

Techniques for Analysing material flow – Assembly chart – Operation process chart – multi process chart – flow process chart – flow diagram – man – machine chart – two handed process chart – string diagram – Travel chart – Visualizing Layout – Drafting and sketching – template and 3-D Block models.

UNIT – II MATERIAL HANDLING 9

Overview of material handling equipment – Considerations in material handling system design – 10 principles of material handling – Industrial trucks – AGV systems – mobile Robots – Mono Rails and other Rail Guided Vehicles – Conveyors systems – Cranes and Hoists – Analysis of Material transport systems.

UNIT –III STORAGE SYSTEM 9

Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage systems. Engineering Analysis of Automated storage systems - AS/RS.

UNIT –IV TRANSFER LINES AND AUTOMATED MANUFACTURING SYSTEMS 8

Fundamentals of Automated production lines – Application of Automated production lines – Analysis of Transfer lines with no internal storage – Analysis of Transfer lines with internal storage buffer.

UNIT – V AUTOMATED ASSEMBLY SYSTEMS 9

Fundamentals of Automated Assembly systems – Design for Automated Assembly – Quantitative Analysis of Assembly systems – Automatic data capture - over view of Automatic identification methods. Bar-code techniques – other Automatic Identification Systems.

TOTAL: 45 PERIOD

REFERENCES:

1. Mikell.P.Groover – Automation, Production System and Computer integrated manufacturing, prentice Hall of India Pvt. Ltd., New Delhi – 2003
2. S.Kant. Vajpayee – Principles of Computer Integrated Manufacturing, Prentice Hall of India Pvt. Ltd., 2006.
3. G.K. Agarwal – Plant Layout and material handling – M/s Jain Brothers, Delhi 2000
4. Mulcahy.D.E. Material handling hand book – McGraw Hill, New York 1999
5. Kulwiec R.A. Editor Material Handling Hand book 2nd Edition, JohnWiely & Sons Inc., New York 1985.

MF 9153 MATERIALS MANAGEMENT AND LOGISTICS

L	T	P	C
3	0	0	3

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 6

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

UNIT – II MANAGEMENT OF PURCHASE 7

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

UNIT – III MANAGEMENT OF STORES AND LOGISTICS 12

Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

UNIT – IV Materials Planning 10

Forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production.

UNIT – V Inventory Management 10

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

Total: 45

REFERENCES

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, 1996.
2. Gopalakrishnan.P, Handbook of Materials Management, Prentice Hall of India, 1996.
3. Guptha P.K. and Manmohan, Problems in Operations Research, Suttan Chand & Sons, 2003.

4. Dr. R. Kesavan, C.Elanchezian and T.SundarSelwyn, Engineering Management – Eswar Press – 2005.
5. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008.
6. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.