



ANNA UNIVERSITY
Chennai-25.
Syllabus for

B.E.(Full Time) Mechatronics Engineering

EC339 Sensor and Signal Processing

3 0 0 100

1 . UNIT I 10

General Concept of Measurement: Basic block diagram stages of generalised measurement system state characteristics; accuracy precision resolution reproductability sensitivity zero drift linearity Dynamic characteristics zero order instrument first order instrument time delay

2 . UNIT II 10

Sensors and Principles: Resistive sensors Potentiometer and strain gauges Inductive sensors: Self inductance type, mutual inductance type, LVDT Capacitive sensors- piezoelectric sensors thermocouples thermistors radiation pyrometry - Fibre optic temperature sensor photo electric sensors pressure and flow sensors.

3 . UNIT III 9

Signal conditioning: Amplification Filtering Level conversion Linearisation Buffering sample and hold circuit quantisation multiplexer/ demultiplexer analog to digital converters digital to analog converters.

4 . UNIT IV 8

Data acquisition and conversion: General configuration single channel and multichannel data acquisition system Digital Filtering data logging data conversion introduction to digital transmission systems PC based data acquisition system.

5 . UNIT V 8

Interface systems and standards: Block diagram of a typical interface IEE 488 standard bus British Standard interface (BS 4421) CAMAC Interface MEDIA interface RS232C standard.

Total No of periods: 45

TEXT BOOKS:

1. *RANGAM C.S., SARMA, G.R. MANI, V.S.V., "Instrumentation - devices and Systems", Tata Mcgraw Hill publishing Company Ltd., 1997.*
2. *SAWHNEY, A.K., " A Course in Electrical and Electronic Measurements and instrumentation," Dhanpat Rai & Sons, 1995.*
3. *DOEBLIN, E.O. Measurement Systems, McGraw Hill, 1995.*

1 . UNIT I 8

System and System Environment: Component of a system Continuous and discrete systems Models of a system modeling.

2 . UNIT II 12

Random Number Generation: Midsquare The midproduct method Constant multiplier method Additive congruential method Test for random numbers: the Chi-square test the Koimogrov Smimov test Runs test Gap test

3 . UNIT III 10

Random Variable Generation: Inverse transform technique Exponential distribution Poission distribution Uniform distribution Weibull distribution Empirical distribution Normal distribution Building and empirical distribution The Rejection method.

4 . UNIT IV 8

Simulation of Systems: Simulation of continuous system Simulation of discrete system Simulation of an event occurrence using random number table. Simulation of component failures using Exponential and weibull models.

5 . UNIT V 7

Simulation of single server queue and a two server queue. Simulation of inventory system Simulation of a network problem Simulation using Simulation languages/ packages.

Total No of periods: 45

TEXT BOOKS

- 1) *Banks J., Carson. J.S., and Nelson B.L., Discrete Event System Simulation, Prentice Hall of India, New Delhi, 1996.*
- 2) *Gottfried B.S., Elements of Stochastic Process Simulation, Prentice Hall, London , 1984.*

REFERENCES

- 1) *Geoffrey Gordon., System Simulation, Prentice Hall of India, 1984.*
- 2) *Narsingh Deo., System simulation with Digital Computer, Prentice Hall of India, 1979*

1 . UNIT I 7

Robotics: Introduction- Robotic Mechanism - Classification of Robots - Drive Systems Robots - Co-ordinate system - Degrees of Freedom Spatial Descriptions -Transformations Position and orientation - Description of Frames - Mapping involving frames - Transform equations.

2 . UNIT II 8

Kinematics of Manipulators Link parameters Link frame assignment and forward kinematics Inverse manipulator kinematics Velocities and static forces Velocity transformation Force control system Interfacing computers to Robots RS 232 Interface Hardware Handshaking Software Handshaking RS 232 communication.

3 . UNIT III 10

Machine Vision: Introduction Image Geometry Co ordinate Systems Sampling and Quantization Image Definitions Levels of Computation Point Level Local Level Global level Object Level, Binary Image Processing Thresholding , Geometric properties Size Position Orientation Projections Binary Algorithms Morphological Operators Basic Lighting Techniques.

4 . UNIT IV 10

Optics - Lens Equation Image Resolution Depth of Field View Volume Exposure Shading Image radiance Surface orientation Reflectance Map Shape from Processing Color constancy : Statistical methods of Texture analysis- Structural analysis of Ordered Texture Model based methods for Texture analysis Shape from Texture Depth stereo imaging Stereo matching Shape from X-Range Imaging Active Vision.

5 . UNIT V 10

Dynamic Vision Change Detection Segmentation using motion Motion Correspondence Image flow Segmentation using a moving camera Tracking Shape from motion Object recognition System components Complexity of Object Recognition Object Representation Feature Detection Recognition Strategies Verification.

Total No of periods: 45

TEXT BOOKS

1. *P.A.Jananki Raman, " Robotics and Image Processing ", Tata McGraw Hill 1991.*
2. *Ramesh Jain, Rangachar Kasturi, Brian G.Schunck, Machine Vision, Mc Graw Hill International Edition, 1995.*

REFERENCE BOOKS

1. *K.S.Fu, R.C. Gonzalez, C.S.G.Lee," Robotics Control, Sensing, Vision, and Intelligence, McGraw-Hill Inc., 1987.*
2. *Michael C.Fairhurst, " Computer Vision for Robotic Systems- An Introduction , Prentice Hall Inc., 1988.*
3. *Rembold and others, " Computer Integrated Manufacturing,*
4. *Mikell P. Groover, Mitchell Weiss, Roger N.Nagel, Nicholas G.Odrey Industrial Robotics Technology, Programming and Applications, McGraw- Hill International Editions, 1986.*
5. *Awcock and R.Thomas, "Applied Image Processing ", McGraw Hill, Inc, 1996.*
6. *Rembold, " Microsystem Technology and Micro Robotics " Springer Ferlog, Publishers, 1998.*

1 . THE DESIGN PROCESS 4

The design process Morphology of design - Product cycle - Sequential and concurrent engineering - Role of computers - Computer Aided Engineering - Computer Aided Design - Design for Manufacturability - Computer Aided Manufacturing - Benefits of CAD.

2 . INTERACTIVE COMPUTER GRAPHICS 10

Creation of Graphic Primitives - Graphical input techniques - Display transformation in 2-D and 3-D - Viewing transformation - Clipping - hidden line elimination - Mathematical formulation for graphics - Curve generation techniques - Model storages and Data structure - Data structure organisation - creation of data files - Accessing data files - Concepts of data processing and information system. Data Bank Concepts - Data bank information storage and retrieval - Data life cycle - Integrated data processing - Information system. Engineering Data Management System. Hierarchical data structure. Network data structure - Relational data structure. Data storage and search methods.

3 . SOLID MODELING 3

Geometric Modeling - Wireframe, Surface and Solid models - CSG and B-REP Techniques - Features of Solid Modeling Packages - Parametric and features - Interfaces to drafting, Design Analysis.

4 . FINITE ELEMENT ANALYSIS 13

Introduction - Procedures - Element types - Nodal approximation - Element matrices, vectors and equations - Global connectivity - Assembly - Boundary conditions - Solution techniques - Interfaces to CAD - Introduction packages - Software development for design of mechanical components.

5 . PRACTICALS 30

Total No of periods: 60

Text Book:

1. *Sadhu Singh, " Computer Aided Design and Manufacturing ", Khanna Publishers, New Delhi, 1998.*

References:

1. *D.F. Rogers and J.A.Adams, " Mathematical Elements in Computer Graphics ", McGraw-Hill Book Company, New York, 1976.*
2. *P.Radhakrishnan and C.P.Kothandaraman, " Computer Graphics and Design ", Dhanpat Rai and Sons, New Delhi, 1991.*
3. *E.Dieter George, " Engineering Design ", McGraw-Hill International Edition, 1991.*
4. *P.Radhakrishnan and S.Subramanyan, " CAD / CAM / CIM ", Wiley Eastern Ltd., New Age International Ltd., 1994.*
5. *Groover and Zimmers, " CAD / CAM : Computer Aided Design and Manufacturing ", Prentice Hall of India, New Delhi, 1994.*
6. *V.Ramamurthi, " Computer Aided Mechanical Design and Analysis ", Tata McGraw Hill Publishing Co Ltd., 1998.*
7. *Ibrahim Zeid, " CAD - CAM Theory and Practice ", Tata McGraw Hill Publishing Co. Ltd., 1991.*

1 . BASIC CONCEPTS OF MEASUREMENTS	2
Need for measurement - Precision and Accuracy - Reliability - Errors in Measurements - Causes - Types.	
2 . LINEAR AND ANGULAR MEASUREMENTS	7
Measurement of Engineering Components - Comparators, Slip gauges, Rollers, Limit gauges - Design and Applications - Auto collimator - Angle dekkor - Alignment telescope - Sine bar - Bevel protractors - Types - Principle - Applications.	
3 . FORM MEASUREMENTS	7
Measurement of Screw thread and gears - Radius measurement - Surface finish measurement - Straightness, Flatness and roundness measurements - Principles - Application.	
4 . LASER METROLOGY	7
Precision instrument based on Laser - Use of Lasers - Principle - Laser Interferometer - Application in Linear and Angular measurements - Testing of machine tools using Laser Interferometer.	
5 . ADVANCES IN METROLOGY	7
Co-ordinate measuring machine - Constructional features - Types - Applications of CMM - CNC CMM applications - Computer Aided Inspection - Machine Vision - Applications in Metrology.	
6 . LABORATORY EXERCISE	30
i) Straightness measurement using Autocollimator.	
ii) Measurement of Taper angle using Tool Makers Microscope.	
iii) Measurement of various elements of screw thread using Tools Makers Microscope.	
iv) Measurement of composite error using gear tester.	
v) Calibration of optical comparator and measurement of dimension	
vi) Determining the accuracy of electrical and optical comparator.	
vii) Measurement of taper angle using sine bar.	
viii) Measurement of various angles using Bevel Protractor.	
ix) Measurement of dimensions using Vernier Height Gauge.	
Total No of periods:	60

Text Book:

1. R.K.Jain, " *Engineering Metrology* ", Khanna Publishers, 1994.

References:

1. Gaylor, Shotbolt and Sharp, " *Metrology for Engineers* ", O.R.Cassel, London, 1993.
2. Thomas, " *Engineering Metrology* ", Butthinson & Co., 1984.
3. Books an *Workshop Technology and Manufacturing Processes*.

1 . INTRODUCTION	12
Evolution of Computer Numerical Control - Components - Co-ordinate system - Working principle of CNC Lathe, Turning Centers, Milling Machine, Machining Center, Drilling Machine, Boring Machine, Punching and Nibbling Maching, Pipe-Bending Machine, Spot Welding Machine, Electro Discharge Machine, Grinding Machine, Laser and Electron Beam Machining Equipment - DNC and adaptive control	
2 . CONSTRUCTIONAL FEATURES OF CNC MACHINES	10
Machine structure - Slideways - Ballscrews-Accessories-Spindle drives-Axes feed drives - Open and closed loop control - Types of positional control-Machine Tool control-Control of Spindle speed-Control of slide movement and velocity.	
3 . CNC PART PROGRAMMING	9
Part Program Terminology-G and M Codes -Types of interpolation-Methods of CNC part programming-Manual part programming-Computer Assisted part programming-APT language - CNC part programming using CAD/CAM-Introduction to Computer Automated Part Programming.	
4 . TOOLING AND WORK HOLDING DEVICES	9
Cutting tool materials - Hard metal insert tooling - Choosing Hard Metal tooling-ISO specification-Chip breakers-Non insert tooling - Qualified and pre-set tooling-Tooling System- Turning center-Maching center. Principles of location-Principes of clamping-Work holding devices for rotating work pieces-Chucks. Collets-Centers and Face Drivers - Mandrels-Workholding devices for fixed workpieces, Machine Vice, Clamping set, Angle plate, V block, Step block.	
5 . ECONOMICS AND MAINTENANCE	5
Factors influencing selection of CNC Machines-Cost of operation of CNC Machines-Cost of Operatin of CNC Machines-Practical aspects of introduction of CNC-Maintenanace features of CNC Machines-Preventive Maintenance.	
Total No of periods: 45	

References:

1. *BERRY LEATHAM-JONES, Computer Numerical Control, Pitman, London, 1987.*
2. *STEAVE KRAR and ARTHUR GILL, CNC Technology and Programming, McGraw-Hill Publishing Company, 1990.*
3. *RADHAKRISHNAN,P., Computer Numerical Control (CNC) Machines, New Central Book Agency, 1992.*
4. *HANS B.KIEF and T.FREDERICK WATERS, Computer Numerical Control Macmillan/McGraw-Hill, 1992.*
5. *G.E.THYER, Comuter Numerical Control of Machine Tools. Second Edition, B/H NEWNES, 1993.*
6. *BERNARD HODGES, CNC Part Programming Work Book, City and Guilds/Macmillan, 1994.*
7. *DAVID GIBBS, An Introduction to CNC Machining, Cassell, 1987.*
8. *GROOVER, M.P., Automation, Production Systems and Computer Integrated Manufacturing, Prentice Hall 1998*

EC344 Sensor and Signal Processing Lab

0 0 3 100

1 . 45

1. Wave shaping circuit
2. Analog to Digital Converters
3. Digital Comparator
4. Speed measurement using Inductive pickup/Proximity sensor
5. Voltage to frequency converter
6. Frequency to Voltage Converter
7. Measurement to temperature using thermocouple, thermistor and RTD
8. Measurement of displacement using LVDT & Capacitive transducer
9. Position and velocity measurement using encoders
10. Position measurement using linear scales
11. Absolute encoders

Total No of periods: 45

MF335 CNC Machine Tools Lab

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Study of specifications of CNC Milling Machines and Lathes.

Study of ISO G&M Codes

Study of CNC Control Systems such as Fanuc, Heidenhein, Denford, Sinumeric CNC MILLING.

Programming, simulation of machining using the following features.

1. Linear and Circular interpolation
2. Pocker milling, slotting, peck drilling and other fixed cycles.

CNC LATHE:

Programming, simulation and machining using the following features:

1. Straight and step turning
2. Taper turining and thread cutting
3. Machining and internal surfaces.

Total No of periods: 60

EC348 Microcontroller and Applications

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1 . UNIT I 9

8051 Architecture: Comparison of Microprocessors and Microcontrollers - A Microcontroller Survey - 8051 Microcontroller Hardware- I/O Pins, Ports - External memory - Counters and Timers - Serial data I/O - Interrupts.

2 . UNIT II 9

8051 Assembly Language Programming: Instruction set of 8051 Addressing modes Data transfer Instructions Arithmetic and Logical Instructions Jump and Call Instructions Interrupts and Returns Interrupt handling.

3 . UNIT III 9

8051 Microcontroller Design: 8051 Microcontroller Specification 8051 Microcontroller System Design Testing the Design Timing Subroutines Look up Tables Serial Data Transmission.

4 . UNIT IV 9

8051 Microcontroller Applications I: Interfacing of Keyboards Interfacing of Display Devices Pulse measurement Analog to Digital and Digital to Analog Converter Interfacing Hardware Circuit Multiple Interrupts.

5 . UNIT V 9

8051 Microcontroller Applications II: Serial Data Communication Introduction - Network Configuration - 8051 Data communication modes A Complete 8051 Microcontroller based System Design: Interfacing of alphanumeric LCD display and keyboard.

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Total No of periods: 45

TEXT BOOKS

1. Kenneth J. Ayala. The 8051 Microcontroller Architecture, Programming and Applications , Penram International publishing (India), Second Edition, Mumbai, 1996.

REFERENCE BOOKS

- 1. B.P. Singh, Microprocessors and Microcontrollers, Galcotia Publications (P) Ltd, First edition, New Delhi, 1997.*
- 2. Embedded Controller Hand book, Intel Corporation, USA.*

1 . UNIT I	10
Programmable Logic Introduction, programmable Logic structures Programmable Logic Arrays (PLAs), Programmable Array Logic (PALs), Programmable Gate Arrays (PGAs), Field Programmable Gate Arrays (FPGAs) Sequential network design with Programmable Logic Devices (PLDs) Design of sequential networks using ROMs and PLAs Traffic light controller using PAL.	
2 . UNIT II	10
Programmable Logic Controllers (PLCs) Introduction Parts of PLC Principles of operation PLC sizes PLC hardware components I/O section Analog I/O section Analog I/O modules, digital I/O modules CPU Processor memory module Programming devices Diagnostics of PLCs with Computers.	
3 . UNIT III	10
PLC programming Simple instructions Programming EXAMINE ON and EXAMINE OFF instructions Electromagnetic control relays Motor starters Manually operated switches Mechanically operated and Proximity switches Output control devices Latching relays PLC ladder diagram Converting simple relay ladder diagram in to PLC relay ladder diagram.	
4 . UNIT IV	8
Timer instructions ON DELAY timer and OFF DELAY timer counter instructions Up/Down counters Timer and Counter applications program control instructions Data manipulating instructions math instructions.	
5 . UNIT V	7
Applications of PLC Simple materials handling applications Automatic control of warehouse door Automatic lubricating oil supplier Conveyor belt motor control Automatic car washing machine Bottle label detection Process control application.	
	Total No of periods: 45

Text Books:

1. *Charles H. Roth, Jr " Fundamentals of Logic Design ", Fourth Edition, Jaico Publishing house, 1999,*
2. *Frank D. Petruzella " Programmable Logic Controllers ", McGraw- Hill book, company, 1989*
3. *Siemens " PLC Handbook ".*

References:

1. *William I. Fletcher " An Engineering Approach to Digital Design ", Prentice, Hall of India Ltd., New Delhi, 1999.*

1 . INTRODUCTION 9

Characterization and classification of signals - examples of signals - multichannel - multi-dimensional - continuous versus discrete - analog versus digital - concept of frequency. Concepts of signal processing - typical applications - advantages of digital signal processing compared with analog processing.

2 . DISCRETE TIME SYSTEMS 9

Representations - classifications - time domain and frequency domain characterization - transfer functions - Z-transform and applications.

3 . FREQUENCY ANALYSIS OF SIGNALS 9

Analysis of analog and discrete signals - using Fourier series, Fourier transform, Fourier transform of discrete sequence and discrete Fourier transform - properties of transforms - computation of discrete Fourier transforms - Radix 2. FFT algorithms.

4 . DIGITAL PROCESSING OF CONTINUOUS SIGNALS 9

Sampling of continuous signals - analog filter design - anti aliasing filters - sample and hold circuit - reconstructing filters - analog to digital and digital to analog converters.

5 . DIGITAL FILTERS 9

Discretization of analog filters - direct discrete design - IIR and FIR structures - window functions - filter realization - introduction to digital signal architecture.

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Total No of periods: 45

Text Books:

1. S.K. Mitra, " *Digital signal processing - A Computer based approach* ", Tata McGraw - Hill Edition, 1998.

References:

1. Lonnie C. Lumen, " *Fundamentals of Digital Signal Processing* ", John Wily and Sons, 1987.
2. J.G. Prookis and D.G.Manolakis, " *Introduction to Digital Signal Processing* ", Macmillan Publishing company, 1989.
3. Oppenheim and Schafer, " *Discrete Time Signal Processing* ", Prentice Hall of India, 1992.
4. R.G.Lyons, " *Understanding Digital Signal Processing* ", Addison Wesley, 1997.

1 . INTRODUCTION 5

Introduction to File and Database System-Database system Structure-Data Models-E.R Model.

2 . RELATIONAL MODEL 10

Relational model-relational algebra and calculus -commercial query language-security and integrity-fuctional dependency -normalizarion-relational data bases design.

3 . ADVANCED CONCEPTS 10

Query processing-crash recovery-concurrency control-distributed databases-file and system structures-indexing and hashing.

4 . OTHER DATABASES 10

Hierarchical model-network model -active and deductive data bases -temporal databases-parallel databases-multimedia databases.

5 . CURRENT TRENDS 10

Object oriented databases-design of object oriented databases-data warehousing-data warehousing-data mining-association rules-application of data mining -classification and prediction -XML-case studies.

6 . PRACTICALS 30

Total No of periods: 75

Text Book :

1. Ramez Elmasri, Shamkant B. Navathe. "Fundamentals of database system" 3rd Edition. Addison Wesley, McGrawHill, 2000.

2. Abraham Silberschatz, Henry F. Korth and S. Sudharshan " Database system concepts" 4th Edition. 2002

Reference:

1. C.J. Date, "Introduction to database systems" Addison Wesley, 7th Edition, 2001.

2. Hector Garcia-Molina, J.D. Ullman and J. Widom, "Database System Implementation", Addison Wesley, 2001.

3. J.D. Ullman, J. Widom, "A first Course in Database Systems", Addison Wesley, 2001.

4. Raghu Ramakrishnan, "Database Management Systems", McGraw Hill, publishing company, 1998.

5. Jan L. Harrington, "Object oriented database design" Harcourt India private limited, 2000.

6. Jiawei Han, Micheline Kamber, "Data Mining concepts and techniques", Harcourt India Private Limited, 2001.

1 . BASIC PRINCIPLES 10

Hydraulic Principles - Hydraulic pumps - Characteristics - Pump Selection -Pumping Circuits - Hydraulic Actuators - Linear Rotary - Selection -Characteristics - Hydraulic Valves - Pressure - Flow - Direction Controls - Applications - Hydraulic Fluids-Symbols.

2 . HYDRAULIC CIRCUITS 8

Hydraulic circuits - Reciprocating - Quick return - Sequencing synchronizing - Accumulator circuits - Safety circuits - Industrial circuits - Press - Milling Machine - Planner - Fork Lift, etc.

3 . DESIGN & SELECTION 8

Design of Hydraulic circuits - Selection of components.

4 . PNEUMATIC SYSTEMS 9

Pneumatic fundamentals - Control Elements - Logic Circuits - Position - Pressure Sensing - Switching - Electro Pneumatic - Electro Hydraulic Circuits - Robotic Circuits.

5 . DESIGN & SELECTION 10

Design of Pneumatic circuits - Classic-Cascade-Step counter - Combination -Methods - PLC-Microprocessors - Uses - Selection criteria for Pneumatic components - Installation and Maintenance of Hydraulic and Pneumatic power packs - Fault finding - Principles of Low Cost Automation - Case studies

Total No of periods: 45

Text Books:

1. *J. Michael, Pinches and John G. Ashby, " Power Hydraulics ", Prentice Hall, 1989.*
2. *Andrew Parr, " Hydraulics and Pnematics (HB) ", Jaico Publishing House, 1999.*

References:

1. *Dudleyt, A. Pease and John J. Pippenger, " Basic Fluid Power ", Prentice Hall, 1987.*
2. *Anthony Esposite, " Fluid Power with Applications ", Prentice Hall, 1980.*

1 . UNIT I 8

Rotational drives - Pneumatic Motors: continuous and limited rotation - Hydraulic Motors: continuous and limited rotation - Brushless DC Motors - Motion convertors, Fixed ratio, invariant motion profile, variators, remotely controlled couplings Hydraulic Circuits and Pneumatic Circuits.

2 . UNIT II 10

Mechanical Systems and Design - Mechatronic approach - Control program control, adaptive control and distributed systems - Design process - Types of Design - Integrated product design - Mechanisms, load conditions, design and flexibility Structures, load conditions, flexibility and environmental isolation - Man machine interface, industrial design and ergonomics, information transfer from machine from machine to man and man to machine, safety.

3 . UNIT III 7

Real time interfacing - Introduction Elements of data acquisition and control Overview of I/O process - Installation of I/O card and software - Installation of application software- Overframing.

4 . UNIT IV 10

Case studies on Data Acquisition - Testing of transportation bridge surface materials - Transducer calibration system for Automotive applications Strain Gauge weighing system - Solenoid force - Displacement calibration system - Rotary optical encoder - Inverted pendulum control - Controlling temperature of a hot/cold reservoir - Pick and place robot - Carpark barriers.

5 . UNIT V 10

Case studies on Data Acquisition and Control - Thermal cycle fatigue of a ceramic plate - pH control system - De-Icing Temperature Control System - Skip control of a CD Player - Autofocus Camera, exposure control. Case studies on design of Mechatronic products - Motion control using D.C. Motor, A.C. Motor & Solenoids - Car engine management - Barcode reader.

Total No of periods: 45

Text Books

- 1) *Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999.*
- 2) *Devdas shetty, Richard A. Kolk, -Mechatronics System Design,- PWS Publishing company, 1997*
- 3) *Bradley, D.Dawson, N.C. Burd and A.J. Loader, Mechatronics: Electronics in Products and Processes, Chapman and Hall, London, 1991.*

Reference Books :

- 1) *Brian Morriss, Automated Manufacturing Systems - Actuators, Controls, Sensors and Robotics;, Mc Graw Hill International Edition, 1995.*
- 2) *Gopel Sensors A comprehensive Survey Vol I & Vol VIII, BCH Publisher, New York.*

EC352 Digital Micro Controller and PLC Lab

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1 . 45

1. Study of Micro controller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C motor controller interface.
5. Study of interrupt structure of 8051.
6. Interfacing high power devices to microcomputer port lines, LED, relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydrometer rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

Total No of periods: 45

1 . Design and testing of the circuits such as 45

- i) Pressure control
- ii) Flow control
- iii) Direction control
- iv) Driving of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

2 . Design and testing of the circuits such as

- i) Pressure control
- ii) Flow control
- iii) Direction control
- iv) Circuits with logic controls
- v) Circuits with timers
- vi) Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.

3 .

Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using MATLAB/LAB VIEW software

4 .

Simulation of basic hydraulic, pneumatic and electric circuits using automation studio software

5 .

Programming in simple Computer Integrated Manufacturing system such as FMC/FMS models.

6 .

Practice in modeling and analysis software (IDEAS Master series / PRO-E / ANSYS / CATIA)

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Total No of periods: 45

1 . COMPONENTS OF ENVIRONMENT 9

Components - Water, air and land - Inter-relationship between components - Subcomponents; Ecosystem - Structure and functional components of ecosystem - Development and evolution of ecosystem - Energy flow and material cycling in ecosystem - Natural and man made impacts on water, air and land; Environment and development - Concept of sustainable development.

2 . SCIENCE OF ENVIRONMENT 9

Chemistry, Physics and biology of water, air and land; Stress on the Chemistry, Physics and Biology of water, air and land owing to the impacts; Environmental quality objective and goals - Policies on development projects and their impacts, with emphasis on the branch of engineering of the student.

3 . CURRENT ENVIRONMENTAL ISSUES 9

Current Environmental issues at Country level - management of municipal sewage, municipal solid waste, Hazardous waste and Bio-medical waste - Air pollution due to industries and vehicles; Global issues - Biodiversity, Climatic change, Ozone layer depletion.

4 . ENGINEERING INTERVENTIONS TO REDUCE THE ENVIRONMENTAL STRESSES 9

Minimisation of Stress - Principles of Physics, chemistry and biology in engineering interventions such as waste treatment - Flow sheets of engineering interventions relevant to the Engineering discipline of the student - Waste minimisation techniques - Clean technology options - Standards of performance of the interventions.

5 . 9

(A) TOOLS FOR ENVIRONMENTAL MANAGEMENT 6

Environmental impact assessment; Precautionary Principle and Polluter Pays Principle; Constitutional provisions, Legal and economic instruments in Environmental Management; Role of Non-government organisations - Community participation environmental management works; International conventions and protocols; Pollution Control Boards and Pollution Control Acts.

(B) FIELD STUDY 3

In-depth study of environmental issues at least one environmentally sensitive site relevant to the discipline of the student and preparation of a report thereupon.

Total No of periods: 45

Text Books:

1. *G.M.Masters, " Introduction to Environmental Engineering & Science ", Prentice Hall, New Delhi, 1997*
2. *J.G. Henry and G. W. Heike, " Environmental Science & Engineering ", Prentice Hall International Inc., New Jersey, 1996.*

References:

1. *S. K. Dhameja, Environmental Engineering and Management, S. K. Kataria and Sons, New Delhi, 1999.*
2. *State of India's Environment - A Citizen's Report, Centre for Science and Environment and Others, 1999.*
3. *Shyam Divan and Armin Rosencranz, Environmental Law and Policy in India, Cases, Materials and Statutes, Oxford University Press, 2001.*

1 . UNIT I 10

Introduction : Automotive component operation Electrical wiring terminals and switching Multiplexed wiring systems Circuit diagrams and symbols. Charging Systems and Starting Systems : Charging systems principles alternations and charging circuits New developments requirements of the starting system Basic starting circuit.

2 . UNIT II 10

Ignition systems: Ignition fundamental, Electronic ignition systems. Programmed ignition distribution less ignition direct ignition spark plugs. Electronic Fuel Control : Basics of combustion Engine fuelling and exhaust emissions Electronic control of carburation Petrol fuel injection Diesel fuel injection.

3 . UNIT III 8

Instrumentation Systems: Introduction to instrumentation systems Various sensors used for different parameters sensing Driver instrumentation systems vehicle condition monitoring trip computer different types of visual display

4 . UNIT IV 7

Electronic control of braking and traction introduction and discription control elements and control methodology Electronic control of Automatic Transmission: Introduction and description Control of gear shift and torque converter lockup Electric power steering Electronic clutch.

5 . UNIT V 10

Engine Management Systems: Combined ignition and fuel management systems Exhaust emission control Digital control techniques Complete vehicle control systems Artificial intelligence and engine management Automotive Microprocessor uses.

Lighting and Security Systems: Vehicles lighting Circuits Signaling Circuit Central locking and electric windows security systems Airbags and seat belt tensioners Miscellaneous safety and comfort systems

Total No of periods: 45

TEXT BOOK

1. TOM DENTON, Automobile Electrical and Electronic Systems, Edward Arnold pb., 1995

REFERENCES

- 1. DON KNOWLES, Automotive Electronic and Computer controlled Ignition Systems, Don Knowles, Prentice Hall, Englewood Cliffs, New Jersey 1988.*
- 2. WILLIAM, T.M., Automotive Mechanics, McGraw Hill Book Co.,*
- 3. WILLIAM, T.M., Automotive Electronic Systems, Heiemann Ltd., London ,1978.*
- 4. Ronald K Jurgen, Automotive Electronics Handbook, McGraw Hill, Inc, 1999.*

1 . ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - professions and professionalism - professional ideals and virtues - theories about right action - self-interest-customs and religion - uses of ethical theories

2 . ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics-a balanced outlook on law-the challenger case study

3 . ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and risk - assessment of safety and risk - risk benefit analysis-reducing risk-the three mile island and Chernobyl case studies.

4 . RESPONSIBILITIES AND RIGHTS 9

Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - intellectual property rights (IPR)-discrimination.

5 . GLOBAL ISSUES 9

Multinational corporations - environmental ethics-computer ethics-weapons development-engineers as managers-consulting engineers-engineers as expert witnesses and advisors-moral leadership-sample code of conduct.

Total No of periods: 45

Text Book:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York 1996.

References :

- 1. Charles D. Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.*
- 2. Laura Schlesinger, "How Could You Do That: The Abdication of Character, Courage, and Conscience", Harper Collins, New York, 1996.*
- 3. Stephen Carter, "Integrity", Basic Books, New York, 1996.*
- 4. Tom Rusk, "The Power of Ethical Persuasion: From Conflict to Partnership at Work and in Private Life", Viking, New York, 1993.*

1 . ENGINEERING ECONOMICS 10

Introduction - Demand and Revenue Analysis - Demand Forecasting - Production Analysis - Cost and Supply Analysis, Price and output Determination - Investment Analysis - Plant Location - Economic Optimization.

2 . MANAGEMENT OF WORK 8

Types of Business Organisation, Forms, Planning - Organising - Designing effective organisations - Coordination.

3 . THE MANAGEMENT OF ENGINEERS 10

Human Resource Development - Motivating individuals and workgroups - Leadership for Managerial Effectiveness - Team working and Creativity - Managerial Communication - Personal Management - Time Management - Stores Management - Career Planning.

4 . THE MANAGEMENT OF ENGINEERING 10

Financial Management - Product development - Management techniques in product development - Nature of controlling - Operations Management - Just-in-Time.

5 . CONTEMPORARY MANAGEMENT ISSUES 7

Managing World Economic Change - The global environment - Multinational Strategies - Economic Cycles and Director Investment - Change and Organisation Development - Managerial Ethics and Social responsibilities.

Total No of periods: 45

Text Books:

1. *Gail Freeman - Bell and Janes Balkwill, " Management in Engineering - Principles and Practive ", Prentice Hall of India Pvt.Ltd., 1998.*
2. *Gene Burton and Manab Thaker, " Management Today Principles and Practice ", Tata McGraw Hill, 1995.*

References:

1. *M. Joesph, Putti Management - " A Functional Approach ", McGraw Hill, 1999.*
2. *R.R. Barathwal, " Engineering Economics ", McGraw Hill, 1997.*

1 . CREATIVE THINKING AND ORGANIZING FOR PRODUCT INNOVATION 8

The product-design function. The process design function. Locating ideas for new products. Selecting the right product. Qualifications of the production design engineer, Creative thinking curiosity and imagination.

2 . CRITERIA FOR PRODUCT SUCCESS 8

Areas to be studied preparatory to design market research functional design. The value of appearance - Principles and laws of appearance - Incorporating quality and reliability into the design. Man Machine considerations-Designing for ease of maintenance.

3 . COST AND PRODUCT DEVELOPMENT 9

Sources of funds for development cost - Product costs - Estimating product costs - Kinds of cost procedures- Value Engineering - Cost reduction.

4 . PATENTS 8

Classes of exclusive rights-Patents-Combination versus aggregation-Novelty and Utility-Design patents-patent disclosure-patent application steps-Patent office prosecution- Sales of patent rights-Trade marks-Copy rights.

5 . QUALITY CONTROL AND RELIABILITY 12

Quality Control procedure-Inspection and test equipment- Statistical quality control Techniques-Manufacturing Reliability-Probability the tool of reliability- Reliability operations- Developing a quality-control and reliability programme.

Total No of periods: 45

Text Book:

1. *BENJAMIN W.NIEBEL and ALANB.DRAPER-Product Design and Process Engineering-McGraw Hill Book Company.*

References:

1. *S.DALELA and MANSOOR ALI, Industrial Engineering and Management Systems, Standard Publishers Distributors, 1997.*
2. *A.ZAIDI, SPC Concepts, Methodologies and Tools, Prentice Hall of India Pvt.Ltd., 1995.*
3. *PRADHEEPH.N. KANDWALA, Fourth Eye.*

The objective of " Comprehension " is to provide opportunity for the student to apply knowledge acquired during the academic program to real-life problems which he/she may have to face in future as an engineer. Three periods per week shall be allotted in the time table for this activity and this time shall be utilized by the students to receive guidance from the members of faculty on solving real-life problems, practice solving these problems and on group discussions, seminar presentations, library reading as assigned by the faculty member in-charge.

For internal assessment, there will be 3 or 4 written tests covering all the courses studied in previous semesters. The written tests may be of objective type of questions, short answer questions, etc.

Total No of periods:

MF434 Design and Fabrication Project

0 0 8 100

120

The Main objective is to give the students hands on training in the fabrication of one or more component of a complete working model which has been designed by them. The students may be grouped into small groups and work under a Project supervisor. The components to be fabricated may be decided in consultation with the Supervisor and if possible with in industry.

Total No of periods: 120

1 . ELECTRO-PHYSIOLOGY AND BIOPOTENTIAL RECORDING 9

The origin of Biopotentials; biopotential electrodes; biological amplifiers; ECG,EEG, EMG, PCG, EOG, lead systems and recording methods, typical waveforms and signal characteristics.

2 . BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENTS 9

pH, PO₂, PCO₂, PHCO₃, Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood cell counters.

3 . ASSIST DEVICES 9

Cardiac pacemakers, DC Debrillators, Dialyser, HeartLung machine, Hearing aids.

4 . PHYSICAL MEDICINE AND BIO-TELEMETRY 9

Diathermies- Short-wave, ultrasonic and microwave type and their applications, Medical stimulator, Telemetry principles, frequency selection, Bio-telemetry, radio-pill and tele-stimulation.

5 . RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Thermography, endoscopy unit, Laser in medicine, Surgical diathermy, cryogenic application, Electrical safety.

Total No of periods: 45

Text Books:

1. *John G.Webster, " Medical Instrumentation Application and Design ", John Wiley and Sons, New York, 1998.*
2. *Leslie Cromwell, " Biomedical instrumentation and measurement ", Prentice Hall of India New Delhi, 1997.*

References:

1. *Khandpur.R.S., " Handbook of Biomedical Instrumentation ", Tata McGraw-Hill, New Delhi, 1997.*
2. *Joseph J.Carr and John M.Brown, " Introduction to Biomedical equipment technology ", John Wiley and Sons, New York, 1997.*

1 . PROTOCOLS AND ARCHITECTURE 5

Protocols, Layered approach - OSI model - Hierarchical Approach - DOD model -SNA architecture - Local network Technology - Bus/Tree topology - Ring topology - Medium access control protocols - Details of IEEE 802 standards - LAN protocol performance.

2 . NETWORKS ACCESS PROTOCOLS AND INTERNET WORKING 10

Network interface - Circuit switched network access - packet Switched network access - broadcast network access - principles of internetworking - bridges, gateways - X.75 - Internet protocol - ISO internet protocol standard - DOD internet protocol standard.

3 . TRANSPORT AND SESSION SERVICE PROTOCOLS 10

Transport services protocol mechanisms - Networks Services - ISO Transport standards - DOD transport protocols - session characteristics - ISO session service definition - ISO session protocol definition - other session approaches.

4 . PRESENTATION APPLICATION PROTOCOLS 10

Virtual Terminal protocols - File Transfer protocols - Electronic Mail - Overview of ISDN - ISDN protocols.

5 . NETWORK MANAGEMENT 10

Architecture of network management protocols - Information extraction - Configuration Management - Fault Management - Performance management - Security Management - Accounting Management - Capacity planning - Standards.

Total No of periods: 45

Text Books:

1. Starlings. " *Data and Computer Communication* ", Maxwell and Macmillan 1988.

References:

1. Starlings, " *Computer Communications: Architectures, Protocols and Standards* ", IEEE Computer Society, 1987.

2. Andrew Tannenbaum, S. " *Computer Networks* ", 2nd Edition, Prentice Hall of India, 1988.

3. Kernel Explain A.S., " *Communication Network Management* ", Prentice Hall of India, 1992.

4. " *Network Management Standards* ", Uylers Black, McGraw Hill, 1995.

5. Corner and Stevens, " *Internetworking with TCP/IP* ", val

6. " *Client Server Programming and Application* ", Prentice Hall, USA 1994.

1. INTRODUCTION**9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

2. TQM PRINCIPLES**9**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDCA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

3. STATISTICAL PROCESS CONTROL (SPC)**9**

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

4. TQM TOOLS**9**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

5. QUALITY SYSTEMS**9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

TEXT BOOK:

1. Dale H.Besterfield, et al., Total Quality Management, Pearson Education Asia, 1999. (Indian reprint 2002).

REFERENCES:

1. James R.Evans & William M.Lindsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. “Total Quality Management, McGraw-Hill, 1991.
3. Oakland.J.S. “Total Quality Management Butterworth – Heinemann Ltd., Oxford. 1989.
4. Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.
5. Zeiri. “Total Quality Management for Engineers Wood Head Publishers, 1991.