REGULATION 2015

M.TECH ELECTRONICS AND INSTRUMENTATION ENGINEERING

CURRICULUM ANDSYSLLABUS

SEMESTER –I

Sl. No.	Sub Code	Subject Title	L	T	P	C
1	MMA101	Applied Mathematics	3	1	0	4
2	MEI101	Transducer Engineering	3	1	0	4
3	MEI102	Digital Signal Processing	3	1	0	4
4	MEI103	Process Dynamics & Control	3	1	0	4
5	MEI104	Industrial Instrumentation 1	3	0	0	3
6	MEI105	Advanced Control Theory	3	1	0	4
		Total Contact Hours – 19				23

SEMESTER -II

Sl. No.	Sub Code	Subject Title	L	T	P	C
1	MEI201	Industrial Instrumentation Ii	3	0	0	3
2	MEI202	Computer Control Of Process	3	1	0	4
3	MEI203	Networks And Distributed Control System	3	0	0	3
4		Elective 1	3	0	0	3
5		Elective 2	3	0	0	3
PRACTICAL						
7	MEI2L1	Computer Control Processes Lab	0	0	4	2
		Total Contact Hours – 22				18

SEMESTER III

Sl.No.	Sub Code	Subject name	L	T	P	C
1		Elective 3	3	0	0	3
2		Elective 4	3	0	0	3
3		Elective 5	3	0	0	3
4	MEI3P1	Project Work Phase I	0	0	12	6
Total Contact Hours – 21						**15**

SEMESTER IV

Sl. No.	Sub Code	Subject Title	L	T	P	C
1	MEI4P2	Project Work Phase II	0	0	24	12
		Total Contact Hours – 24				**12**

Total credits for the programme = 68

LIST OF ELECTIVES

Sub Code	Subject Title	L	T	P	C
MEI001	Parameter Identification And Adaptive Control	3	0	0	3
MEI 002	Neural Network & Fuzzy Logic Control	3	0	0	3
MEI003	Biomedical Instrumentation	3	0	0	3
MEI 004	Robotics & Automation	3	0	0	3
MEI005	Analytical Instrumentation	3	0	0	3
MEI 006	Instrumentation & Control In Petrochemical Industry	3	0	0	3
MEI 007	Microcontroller Based System Design	3	0	0	3
MEI 008	Fiber optics & Laser Instrumentation	3	0	0	3
MEI 009	Digital Image Processing	3	0	0	3
MEI 010	Power Electronics	3	0	0	3
MEI 011	Power Plant Instrumentation	3	0	0	3
MEI012	Artificial And Intelligence And Expert System	3	0	0	3
MEI013	Personal Computer & Instrumentation	3	0	0	3
MEI014	Digital Instrumentation	3	0	0	3
	Research Methodology	3	0	0	3

MMA101 **APPLIED MATHEMATICS**

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce Fourier series analysis this is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time

After successful completion of this course, the students should be able

CO1: Solve a set of algebraic equations representing steady state models formed in engineering problems

CO2: Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables

CO3: Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration

CO4: Solve PDE models representing spatial and temporal variations in physical systems through numerical method

CO5: Have the necessary proficiency of using MATLAB for obtaining the above solution.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S				
CO2	M		M				
CO3	S	M		M			
CO4	S	S	M		S		
CO5				M	S		

Assessment method:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I

ADVANCED MATRIX THEORY **12**

Eigen values using QR transformations generalized Eigen vectors – canonical forms, singular valued composition and application – matrix norms and induced norms pseudo inverse – least square approximations.

UNIT II

CALCULUS OF VARIATIONS **12**

Variation and its properties – Euler's Equation – Functional dependent on first and higher order derivatives. Functional dependent on functions of several independent variables – constraints in the form of a functional isometric problem – Direct method – Ritz and Kantorovich methods – Boundary value problems.

UNIT III

SPECIAL FUNCTIONS **12**

Series solutions – Bessel's equations – Bessel functions – Recurrence relations a generating functions and orthogonal of Bessel's functions of the first kind Legendary's equations, Legendary polynomials – Rodriguez's formula applications to boundary value problems

UNIT IV

PROBABILITY **12**

Probability concepts- Random variable Discrete and continuous dissimulations –Correlations – partial, multiple, rank analysis of variance on way, two way process.

UNIT V

RANDOM PROCESS **12**

Poisson process, Gaussian Process, Markov Process – Anti Correlations – Cross Correlations – Queuing models – quality control – control charts – tolerance limits.

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References:

1. Sankar Rao K, Introduction to Partial Differential Equations, Prentice Hall of

India. New Delhi. 1995
2. Elsgoth, Differential Equations and Calculus of variations, MIR Publishers, Moscow.
3. Grewal B.S., Higher Engineering Mathematics, Khanna Publications, New Delhi. 1989
4. Andrews LA, Special Function of Scientist and Engineers.

L	T	P	C
3	1	0	4

MEI 101 TRANSDUCER ENGINEERING

OBJECTIVES:

- To understand how physical quantities are measured and how they are converted to electrical or
- Other forms.
- To have an adequate knowledge in resistance, transducers.
- To develop the knowledge of inductance and capacitance transducers.
- To study the characteristics of Transducers.
- To impart knowledge on various types of transducers

After successful completion of this course, the students should be able t

CO1: Define units and standards, elements of measurement system and error analysis

CO2: Understand the static and dynamic characteristics of transducers.

CO3: Describe resistive transducers which are used for measuring various parameters like displacement, temperature, humidity etc.

CO4: Describe the principle of operation, construction and characteristics of inductance and capacitance & other transducers.

CO5: Identify the various transducers used for various applications.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S						
CO2	S	S			W		
CO3	S	S					
CO4	S	S					
CO5	S	M	W				

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni

5.	Online Test		
6.	End Semester Exam		

UNIT I

SCIENCE OF MEASUREMENT **9**

Unit and standards-calibration methods-static calibration-classification of errors-error analysis – statistical methods – odds and uncertainty, problem based on this approach.

UNIT II

CHARACTERISTICS OF TRANSDUCERS **9**

Static characteristics – accuracy, precision, sensitivity, and linearity etc. – mathematical model of transducers – zero, first – order and second – order transducers – response to impulse step ramp and sinusoidal inputs with simple application.

UNIT III

VARIABLE RESISTANCE TRANSDUCERS **9**

Principle of operation, construction details, characteristics and applications of resistance potentiometers, strain gauges, resistance thermometers, thermistors, hot-wire anemometer, piezo resistive sensors and humidity sensors.

UNIT IV **9**

VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS

Induction potentiometer-variable reluctance transducers, EI pickup, LVDT, capacitor transducers-variable air gap type-variable area type-variable permittivity type – capacitor microphone-industrial application.

UNIIT V

OTHER TRANSDUCERS **9**

Piezoelectric transducer – magnetostrictive transducer & magneto resistance transducer – IC. Sensor, Hall Effect transducer, digital transducers – smart sensor & its application – fiber optic transducers. Introduction to HART and field bus protocol.

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Text Books:

1. Renganathan.S., Transducer Engineering, Allied Publishers, Chennai 1999.

References:

1. Doebelin,5.0., Measurement Systems, McGraw Hill Book Co.,1998
2. Neubert, H.K.P. Instrument Transducers, Clarendon Press, Oxford, 1988.
3. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997.
4. A.K.sawhney, A course in Electrical and Electronic measurement & instrumentation, Dhanpatrai & sons 1982.

MEI 102 DIGITAL SIGNAL PROCESSING

L	T	P	C
3	1	0	4

OBJECTIVES:

- To classify signals and systems & their mathematical representation.
- To analyze the discrete time systems.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

After successful completion of this course, the students should be able to

CO 1: Understand the characteristics of discrete-time signals and discrete systems
CO 2: Analyze signal / system properties using mathematical tools
CO 3: Apply and develop algorithms for digital systems
CO 4: Illustrate efficient computation of DFT
CO 5: Discuss advanced features and architecture of generic P-DSP

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M						
CO2		S					
CO3			S				
CO4	S						
CO5				S			

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I

DISCRETE TIME SIGNALS AND SYSTEMS **9**

Periodic and pulse signals - examples of sequences - pulse step, impulse, ramp, sine and exponential - differential equations - linear time invariant - stability, causality - DT systems time domain analysis.

UNIT II

Z-TRANSFORM **9**

Z-transform and its properties - convolution - inverse Z-transform - discrete Fourier series - properties - sampling the Z-transform - discrete Fourier transform - properties for frequency domain analysis - linear convolution using discrete Fourier transform - overlap add method, overlap save method.

UNIT III

FAST FOURIER TRANSFORM (FFT) **9**

Introduction to Radix 2 FFT's - decimation in time FFT algorithm - decimation in frequency FFT algorithm - computing inverse DFT using FFT –Introduction to Radix 4 FFT algorithm – decimation in time FFT Algorithm-decimation in frequency FFT algorithm.

UNIT IV

IIR AND FIR FILTER DESIGN **9**

Classification - reliability constrains - IIR design - bilinear transform method - impulse invariant method - step invariance method - FIR design - Fourier series method - window function method**.** Triangular window, rectangular window, hamming window, hanning window, keiser window.

UNIT V

PROGRAMMABLE DSP CHIPS **9**

Architecture and features of TMS, 320C, 240 and ADSP 2181 signal processing chips- introduction to stenography- image processing.

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Text Books:

1. Oppenheim A.V., and Shaefer R.W., Discrete Time Signal Processing, Prentice Hall, New Delhi, 1980.
2. Proakis J.G. and Manolakis, D.G., Introduction to Digital Signal Processing, Maxwell Mac William International Edition, London, 1989.

References:

1. Antonian A., Digital Filters analysis and Design, Tata McGraw Hill Publishing Co., New Delhi, 198.
2. Stanley W.D., Digital Signal Processing, Restion Publishing House, 1989.

MEI103 PROCESS DYNAMICS & CONTROL

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce dynamics of various processes
- To educate on the effect of various control actions
- To impart knowledge on the final control elements
- To introduce the evaluation criteria and tuning techniques of controllers
- To introduce the concept of multi loop control techniques

Course Outcomes After successful completion of this course, the students should be able to

CO1: Identify the basic components of a Process Control & Distinguish between the servo and Regulatory operations & Self Regulation and Integrating Process

CO2: Compute the Mathematical Model for different process

CO3: Distinguish the characteristics of different types of Control Strategies

CO4: Analyze the behavior of different control loop

CO5: Identify the basic components of a final control element and distinguish the different Characteristics of control valve

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M						
CO2		S					
CO3			S				
CO4	S						
CO5				S			

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I INTRODUCTION 9

Dynamic Response of simple temperature, Pressure, Flow & level process- study of interacting and non interacting systems– continuous and batch process – self-regulation – servo and regulator operation, Degree of freedom and calculation based on simple process.

UNIT II CONTROL ACTIONS AND CONTROLLERS 9

Characteristics of on-off, proportional, single-speed floating, integral and derivative control modes, study of composite control modes-Response of controllers for different types of test inputs- selection of control modes for different applications- Feed forward control – ratio control – cascade control – inferential control – split range control –multivariable control.

UNIT III OPTIMUM CONTROLLER SETTINGS 9

Various controllers tuning based on continuous cycling method. Process reaction curve method – Ziegler Nichols method & modified tuning method. Introduction to various performance criteria- ISE, IAE, ISTE, IATE etc, Frequency response & tuning of controllers.

UNIT IV FINAL CONTROL ELEMENT 9

I/P&P/I converters – pneumatic, electric & hydraulic actuators, valve positioners – characteristics of control valves – Different types of valves - control valve sizing – cavitations' and flashing in control valves.

UNIT V INSTRUMENTATION IN CONTROL SYSTEM 9

Introduction to adaptive & robust controllers – study of different controller operations in distillation columns, heat exchanger & steam piping instrumentation diagram of various control loops.

Text books

1. Stephanopoulos, G, Chemical Process Control, Prentice Hall of India, New Delhi, 1990
2. Eckman. D.P., Automatic Process Control, Wiley Eastern Ltd., New Delhi, 1993

References:

1. Pollard A. Process Control, Heinemann educational books, London, 1971
2. .arriott. P., Process Control, Tata McGraw-Hill Publishing Co., New Delhi, 1991

MEI104 INDUSTRIAL INSTRUMENTATION – I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the measurement techniques of force, torque and speed
- To introduce the measurement techniques of acceleration, Vibration and density
- To introduce the pressure measurement techniques
- To introduce the temperature measurement techniques
- To introduce the high temperature measurement techniques

Course Outcomes After successful completion of this course, the students should be able to

CO1: Understand the Basic construction, principle and working of various type of transducers/sensor to measure physical quantities like temperature, vibration, velocity, Humidity**.**

CO2: Equip to analyze, formulate and select suitable sensor and how to calibrate also knows to apply for the given applications.

CO3: Understand technical terms and nomenclature used in industrial measurement, industrial processes, process measurement and industrial process control

CO4Demonstrate a working knowledge of safety practices used in the measurement and control of industrial processes

CO5: Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S			M			
CO2		S		M			
CO3			S				
CO4						S	M
CO5		S	M				

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry

4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I **12**

NON ELECTRICAL METHODS OF TEMPERATURE MEASUREMENT

Primary & Secondary standard for calibration of temperature Measuring devices – Different types of filled system thermometers – Source of error & the compensation Methods – Installation & maintenance of filled system thermometers – Construction & Characteristics of Bimetallic thermometers-overall comparison between the temperature measuring Instruments.

UNIT II **12**

ELECTRICAL METHODS OF TEMPERATURE MEASUREMENT

Thermocouple-Industrial circuits-Isothermal block reference junction compensation technique-RTD 3 lead & 4 lead compensation-thermistors IC-Temperature sensors-radiation methods-broad band radiation thermometer-2 color radiation Thermometry-Installation of temperature measuring device special material configuration & techniques.

UNIT III **12**

MEASUREMENT OF PRESSURE

Types of pressure measurement-Manometric and Elastic type of Pressure gauges-Motion balance & force balance design using bellows & diaphragms-Bourdon tubes, Bellow type & slack diaphragms pressure gauge-pressure gauge using strain gauge-Capacitive, inductive & Piezo-electric transducers-Carbon pile-semi conductor gauges-Vacuum pressure measurement-Pirani Gauge-Knudsen gauge testing Macleod gauge, calibration and Testing of Pressure gauge transmitter.

12

UNITIV

SPEED, VELOCITY &ACCELERATION MEASUREMENT

Relative velocity-Translational & rational velocity Measurement-Revolution counters & Timers – Magnetic & Photo electric pulse counting stroboscopic methods-Accelerometers different types-Gyroscopes.

UNIT V **12**

FORCE, TORQUE, FREQUENCY & VIBRATION MEASUREMENT

Force measurement – Different methods. Vibration Measurement – Vibration shapes Piezo electric & variable reluctance picks ups. Torque measurement mechanical, optical & Electrical methods. Frequency Measurement -Oscilloscope Methods and Frequency counters.

Text Books: **60**

1. D.P. ECKMAN, Industrial Instrumentation, Wiley Eastern Ltd., 1980
2. D. Patranabis, Principles of Industrial Instrumentation , Mc Grew Hill Publishing, co., Ltd.

References:

1. E.O. Doblin, Measurement System & Applications, Mc Grew Hill International, 2001

B.G. Liptak, Industrument Engineering Handbook, (Measurement), Chilton book Co.,

MEI 105 ADVANCED CONTROL THEORIEY

L	T	P	C
3	1	0	3

OBJECTIVES:

- To introduce analysis of discrete time systems in state variable form To introduce system identification techniques
- To educate on direct discrete design techniques To introduce multi-loop regulatory control
- To introduce multivariable regulatory control

Outcomes after successful completion of this course, the students should be able to
Assessment methods:

CO1: Develop skills in mathematical modeling.
CO2: Describe auto tuning, adaptive control and model predictive control techniques. **CO3:** Develop mathematical model for different case studies.
CO4: Apply the knowledge gained in model identification and adaptive control to analyze case studies
CO5: Implement advanced control techniques in modern software's

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	M					M
CO2	M	M					M
CO3	M	M					M
CO4	M	M					M
CO5	M	M					M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni

5.	Online Test		
6.	End Semester Exam		

UNIT-1 **12**

Properties of transfer function-impulse response matrices-poles & zeroes of transfer function matrices-critical frequencies, resonance-steady state & dynamic response bandwidth-singular value. Analysis-multivariable Nyquist plots.

UNIT-2 **12**

Review to sate model for systems-state transition matrix & its properties-free and forced response-controllability & observability- kalman's decomposition-minimal realization.

UNIT-3 **12**

State feedback and state estimators, single variable case, compensation design-design concepts-realization of basic compensation-cascade compensation in time domain and frequency domain.

UNIT-4 **12**

Types of non-linearity-typical examples-phase plane analysis-isoclines method-limit cycle-equation - linearization-describing function-describing function analysis of simple non linear systems.

UNIT-5 **12**

Stability concepts-equilibrium points –BIBO& asymptotic stability-direct method of liapnov-variable gradient method of generating liapnov functions-application to non linear problems-krasakovski's theorem on global asymptotic stability of non linear systems.

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Text Book

1. Gopal M, modern control system theory. New age international pvt.ltd, 2002.

References:

1. Nagrath & Goal, control system engineering, wiley & soms, 1982.
2. Ogata K.H., modern control engineering, pill, 1982.
3. Ogata.K.H., state space analysis of control systems, PHL, 1982
4. Tou.J.T., Modern control theory, McGraw hill.

SEMESTER - II

MEI201 **INDUSTRIAL INTRUMENTATION-II**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce variable head type flow meters
- To introduce quantity meters , air flow meters and mass flow meters

- To educate on electrical type flow meters
- To educate on the level measurement techniques
- To educate on Viscosity, Humidity and Moisture content

Outcomes after successful completion of this course, the students should be able to

CO1: Understand the Basic construction, principle and working of various type of transducers/sensor to measure physical quantities like pressure, flow, level.

CO2: Equip to analyze, formulate and select suitable sensor and how to calibrate also knows to apply for the given applications.

CO3: Understand technical terms and nomenclature used in industrial measurement, industrial processes, process measurement and industrial process control

CO4Demonstrate a working knowledge of safety practices used in the measurement and control of industrial processes

CO5: Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S			M			
CO2		S		M			
CO3			S				
CO4						S	M
CO5		S	M				

ASSESMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni

5.	Online Test		
6.	End Semester Exam		

UNIT-1

DIFFERENTIAL PRESSURE FLOWMETER **9**

D.P Flow meter; physical properties of flow-fundamentals of flow measurements- differential pressure low meters-operating principle-different types –orifice, venture meters-installation and maintenance of flow meter.

UNIT-2

MECHANICAL TYPE FLOWMETERS **9**

Mechanical type flow meter- principle of operation element of construction and application of positive displacement meters-inferential flow meter-rotameters-turbine flow meters-installation and maintenance.

UNIT-3

ELECTRICAL TYPE AND OPEN CHANNEL FLOWMETERS **9**

Electrical type flow meter-principle of operation-construction application sizing-installation and maintenance of electromagnetic flow meters-ultrasonic flow meters-cross correlation flow meter-vortex shedding flow meters. Open channel flow measurement-momentum, weirs, and flumes.

UNIT-4

CALIBRATION OF FLOW METERS **9**

Guidelines for selection of flow meters-methods of calibration of flow meters with liquids-dynamic weighing, pipe prober method, master meters, combination of master meter and calibrator. Indirect methods for calibration at high flow rates-methods of calibrating flow meters for gases-bell prober system- gravimetric system.PVT system.

UNIT-5

LEVEL MEASUREMENT **9**

Float actuated device-sight glass-displacer devices-torque tube-purge system-diaphragm box type-manometer type-boiler drum level measurement-differential pressure methods-hydra step method-resistance, capacitive, nucleonic of ultrasonic type level gauges, solid level measurement-gamma ray absorption method , Ponder cone, rotating paddle wheel and slack detector-level switches.

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Text book

1. Dr.S.Renganathan, flow meters. Allied publisher’s pvt ltd. first edition, 2003.

References:

1. Flow measurement, practical guides or measurement and control.ISA Publication.1991
2. Cheremixsinsoff N.P Process flow instrumentation and control, marcal decker inc.1992

MEI 202 COMPUTER CONTROL OF PROCESS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce analysis of discrete time systems in state variable form To introduce system identification techniques
- To educate on direct discrete design techniques To introduce multi-loop regulatory control
- To introduce multivariable regulatory control

Outcomes after successful completion of this course, the students should be able to

CO1: Develop skills in mathematical modeling

CO2: Describe auto tuning, adaptive control and model predictive control techniques.

CO3: Develop mathematical model for different case studies.

CO4: Apply the knowledge gained in model identification and adaptive control to analyze case studies.

CO5: Implement advanced control techniques in modern software's.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	W		W	S		
CO2		M	S	M	S		
CO3	S		M				
CO4	S	W	S	W	M		
CO5	W	W		M	S		

Assessment method:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni

5.	Online Test		
6.	End Semester Exam		

UNIT I
COMPUTER AS A CONTROLLER **9**

Building blocks of computer control system, hybrid architecture, DDC and DCS – computer based PLC building block, expert control system and heuristic control system.

UNIT II
ANALYSIS OF DISCRETE DATA SYSTEM **9**
Mathematical representation of SDCS- Z- transform and properties modified z-transform open loop and closed loop response of SDCS- Pulse transfer function. Analysis of stability in z-domain- jury's test, schur Cohn test and root locus method.

UNIT III
DESIGN OF DIGITAL CONTROLLER **9**

Requirement of digital controller- deadbeat, Dahlins - position and velocity form of PID controller, smith predictor algorithm- IMC controller design.

UNIT IV
MULTIVARIABLE CONTROLLER DESIGN **9**
Dynamics and mathematical modeling of multivariable controller design- study of interacting effect in control loops- relative array and selection loops- designing of decoupling control- partial decoupling controller.

UNIT V
CASE STUDIES **9**
Computer application of thermal and nuclear power plant, inverted pendulum and distillation column.

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Text book:
1. Despande P.B and ash R.H., computer process control, ISA publication, USA.1995.

Reference:
1. Franking G.F. and power J.D., digital control of dynamo systems, Addison Wesley publishing co., 1992.
2. Kutshiko ogata. Discrete time control system, second edition, university of Minnesota, 2001.

MEI203 NETWORKS AND DISTRIBUTED CONTROL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:
- To give an introductory knowledge on OSI Model

- To give adequate knowledge about applications of OSI model
- To give basic knowledge about Computer Controlled Systems
- To give basic knowledge on the architecture and local control unit of Distributed Control System
- (DCS)
- To give adequate information with respect to interfaces used in DCS

Course Outcomes After successful completion of this course, the students should be able to

CO 1: To describe the networks used in PLC and DCS.

CO 2: Get adequate knowledge about operator interface used in DCS.

CO 3: To describe the HART and field bus in DCS

CO 4: To understand the systems used in distributed control system.

CO 5: To get an adequate knowledge application of networks and distributed control system

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S						
CO2		S					
CO3			S				W
CO4						S	
CO5					S		

ASSESMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I **9**

DATA NETWORK FUNDAMENTALS

Objects of Networks – data communication fundamentals – circuit switched – Message switched, packet switched networks – OSI reference model – ARPA; SNA and other networks

UNIT II

NETWORK STANDARDS **9**

IEEE 802, Standardization in OSI model, IEEE 802.2 and Ethernet – IEEE Standard 8024 – Token bus – IEEE standard 802.5 – Token ring

UNIT III

DCS **9**

Evolution – Different architectures – Functional elements – Local control unit – Operator station – comparative study of Industrial DCS, Reliability factors – Redundancy – case studies.

UNIT IV

NETWORKS FOR CONTROL **9**

Requirements of communication network for control purpose – communication hierarchy – Networks – Access protocols – Topologies – OSI Layers Data Transmission in OSI layers, Fiber optic LAN – MAP and TOP

UNIT V

FIELD BUS CONTROL SYSTEM **9**

Overview aspects and benefits – smart transmitters – Design and Integration – DCS integration of field bus – foundation field bus – specification – comparisons of field bus – Profit bus .Hart, FIP BUS and MOD BUS

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References:

1. Lucas M.P.., Distributed control systems. Van Nostrand Reinhold company Neyork, 1982.
2. Moore, Digital control Devices, ISA press, 1986.
3. Stallings W. Data and Computer Communication.PIII, 1993.
4. Tenanbaum A.S., Computer Network, PHI, Second Edition, 1992.
5. http//kernow.cartis.edu.an, www/fieldbus/ fieldbus.htm

B.U.Liptak, process control, Chilton Book co, 1972

ELECTIVE 1

L	T	P	C
3	0	0	3

ELECTIVE 2

L	T	P	C
3	0	0	3

MEI2L1 COMPUTER CONTROL LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

To experimentally verify the process control concepts on the selected process control loops.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the usage of various processes

CO2: Develop and test the control loop

CO3: Identify the type controller

CO4: understand and use the different microcontroller programming languages

CO5: write simple programs to find control parameters

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak						
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S						
CO2		S					
CO3	S	S	M				
CO4	S						
CO5	S				M		

Assessment methods:

DIRECT		**INDIRECT**	
1.	Lab Records & Observation Books	**1.**	Student exit survey
2.	Model Exam	**2.**	Faculty Survey
3.	End Semester Exam	**3.**	Industry
		4.	Alumni

1. Design and implementation of smith predictor algorithm
2. Design and implementation of dead beat and Dahlins algorithm
3. Design of digital filter(Low pass, High pass, Band pass)
4. Study of any one of popular DCS
5. PC based PLC programming using LADDER building software
6. Study of one SCADA s/w
7. Process identification using least square distinguishing algorithm

8. PC based control of thermal process
9. PC based control of Pressure process
10. PC based control of Flow process
11. Study of static and dynamic characteristics of thermocouple
12. Study of characteristics of load cell
13. Study of characteristics of RTD
14. Viscometer
15. Stroboscope

SEMESTER III

ELECTIVE 3

L	T	P	C
3	0	0	3

ELECTIVE 4

L	T	P	C
3	0	0	3

ELECTIVE 5

L	T	P	C
3	0	0	3

MEI3P1 PROJECT PHASE1

L	T	P	C
0	0	12	6

SEMESTER IV

MEI4P2 PROJECT PHASE2

L	T	P	C
0	0	24	12

LIST OF ELECTIVES

MEI001 PARAMETRIC IDENTIFICATION AND ADAPTIVE CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce Non parametric methods
- To impart knowledge on parameter estimation methods To impart knowledge on Recursive identification methods To impart knowledge on Adaptive control schemes
- To introduce stability, Robustness and Applications of adaptive control method

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Ability to apply advanced control theory to practical engineering problems.
CO2: will able to introduce Non parametric methods
CO3: will get knowledge on Adaptive control schemes
CO4: will design Recursive identification methods
CO5: will get knowledge on parameter estimation methods

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1						M	M
CO2						M	M
CO3						M	M
CO4						M	M
CO5						M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

9

UNIT – I CONVENTIONAL METHOD OF SYSTEM MODELLING

Impulse response- Frequency response-step response methods-signal modeling-dissertation techniques-Runge kutta methods-Simulation of 1st order systems with and without dead time.

UNIT-II **9**

Least square estimation-Recursive least square-Modified recursive least squares –Fixed memory-R's algorithm-maximum likelihood-instrumental variable –stochastic approximation techniques.

UNIT-III **9**

NEED AND CLASSIFICATION OF ADAPTIVE CONTROL

Introduction-use-definitions-Auto tuning-Types of adaptive control-Gain Scheduling-MRAC-STC.

UNIT-IV **9**

MODEL REFERENCE ADAPTIVE CONTROL AND SELF TUING CONTROLLER

MRAC-Approaches-The Gradient approach-Liapnov functions-passivity theory-Self tuning controller-control policies-Pole placement control-minimum variance control.

UNIT-V **9**

ADAPTIVE PREDICTIVE CONTROL

Adaptive predictive control systems-Fuzzy logic-inverse modeling-Neural network methods-Application of Adaptive control.

References:

1. Mendel J.M. Discerete techniques of parameter estimation, Marcal dekkar, Newyorrk, 1973.
2. Astrom.K.J. & Willtenmerk B., Adaptive control, Addison Wesley Publishing Co., USA 1989
3. Sastry S and Bodson M., Adaptive control-stability, convergence & robustness, Prentice Hall Inc., Newjersey, 1989.

MEI002 NEURAL NETWORKS AND FUZZY LOGIC CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and machine learning.

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Identify and describe soft computing techniques

CO2: Recognize the feasibility of applying a soft computing methodology for particular problems

CO3: Apply NN to pattern recognition and regression problems.

CO4: Apply FL and reasoning to handle uncertainty and solve engineering problems.

CO5: Apply NN to optimization

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak						
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1						M	M
CO2						M	M
CO3						M	M
CO4						M	M
CO5						M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I **9**

INTRODUCTION AND DIFFERENT ARCHITECTURES OF NEURAL NETWORKS

Artificial neuron – MLP – Back propagation – Hope field networks – Cohen Self – organizing maps – adaptive resonance theory

UNIT II **9**
NEURAL NETWORKS FOR CONTROL

Schemes of neuron-control – identification and control of dynamical systems – adaptive neuron controller – case study

UNIT III **9**
INTRODUCITON TO FUZZY LOGIC

Fuzzy sets – fuzzy relation – fuzzy conditional statements – fuzzy rules – fuzzy algorithm

UNIT IV FUZZY LOGIC CONTROL SYSTEM

Fuzzy logic controller – fuzzification interface – knowledge base – decision making logic – defuzzification interface design of fuzzy logic controller case study.

UNIT VNEURO – FUZZY LOGIC CONTROL

Optimization of membership function and rules base of fuzzy logic controller using neural networks – genetic algorithm – fuzzy neuron adaptive fuzzy systems – case study

Text Books:

1. Laurence Faucet, Fundamentals of Neural Networks, Prentice Hall, Englewood clifs, N.J. 1992
2. Zimmermann H.J., Fuzzy set theory and its applications. Allied Publication Ltd., 1996

References:

1. Tsoukalas L.H, and Robert E. Uhrigh, Fuzzy and Neural approach in Engineering John Wiley and sons, 1997
2. Jacek M. Zurads, Introduction to artificial Neural System, Jaico Publication House Mumbai, 1997
3. Klir G. J. and Yuan 5.6, Fuzzy Sets and fuzzy logic. Prentice Hall of India, New Delhi.
4. Driankov D., Helendron, H. Rein frank M., An Introduction to Fuzzy control, Narosa publishing House, New Delhi, 1996
5. Million W. T., Sutton R. S. and Webrose P.J., Neural Networds for control, MIT Press, 1992

MEI003 BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Choose the appropriate instrument required for measurement of any non-electrical, physiological parameter

CO2: Interpret the outcome of any instrument and analyze the stability of the quantity measured **CO3:** Acquire knowledge in electro-physiological measurements and non-electrical parameters

CO4: Acquire knowledge in medical imaging, PMS, assisting and therapeutic equipments.

CO5: Design a project as a team

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1						M	M
CO2						M	M
CO3						M	M
CO4						M	M
CO5						M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I **9**

BIOSIGNALS AND BIOMECHANISM

Origination of nervous system-CNS-PNS-axons-synapse-action potential-resting potential-resting potential-Bioelectric potentials, bioelectric impedance and conductivity, Total body electrical conductivity (TOBEC).Fluid flow in cardiovascular respiratory and execratory system-Electric signal conduction in CNS.

UNIT-II **9**

BIOPOTENTIAL ELECTRODES AND RECORDRES

Half cell potential, Electrode impedance, surface electrodes, micro electrodes and their equivalent circuits ,Polaris able and Non Polaris able electrodes, desirable characteristics of electrodes.Bio potential recorders: ECG,EEG,EMG-instrumentation, Electronic circuits, Calibration and electrical safety aspects.

UNIT-III **9**

PHYSIIOLOGICAL ASSIST DEVICES

Pace maker-Synchronous, demand fixed types. Defibrillators-AC and DC –defibrillators: Synchronous and Asynchronous types-Stimulators-stimulator waveforms, peripheral nerve stimulator-Bladder stimulator. Heart lung machines-Normal and Extracorporeal circulation. Various types of orygenerators, Blood pumps.

UNIT-IV **9**

DIAGNOSTIC IMAGING INSTRUMENTS (BASIC CONCEPTS ONLY)

General X-ray machines: X-ray tube construction, stationary anode, Rotating anode type. Various controls-mA, KVp and Timer. Fluoroscopy: construction and operation details of image intensifier tube-Digital Subtraction techniques. Computer aided Tomography: X-ray tube, Collimators, Tube rotation, Gantry and couch motion. Various controls, Artifacts. Ultrasound scanner: Transducer construction. Different types of probes. Gray scale imaging, various controls, Doo Gantry movements, Static and dynamic study, Gated Sect and PET ,MRI Scanner –Principles of MRI, Electromagnet and Superconducting magnets ,RF coils, cooling mechanism, NMR parameters, larmor frequency, MR sequence, MR spectroscopy, Magnet quench, Helium filling.

UNIT-V **9**

THERAPEUTIC INSTRUMENTS (BASIC CONCEPTS ONLY)

Surgical Instruments: Surgical diathermy machines, microwave, diathermy unit, ESWL, Surgical LASER instruments. Teletheraphy Instruments-Telecobalt machine, Linear accelerators, simulators, various shutter systems and controls, Radio therapy instruments: Branchy therapy instruments-Low dose rate (LDR) branchy therapy machines, High dose rate (HDR) Branchy therapy machines.

Radiation safety regulations.

References:

1. Gadddes and Baker, Principles of Applied Bio-Medical Instrumentation, John Wiley & Sons, 1975.
2. Well G, Biomedical Instrumentation & Measurements, Prentice Hall Inc, 1980.
3. Khanpur, R.S, Handbook of Biomedical Instrumentation and Measurements, Tata Mc-Grew Hill, 1987.
4. Wise D.L, Applied Bio-Sensors, Butterworth, USA, 1989.
5. Lesile Cromwell, Fred J Weibell, Erich A Preiffer, Biomedical Instrumentation and measurements. Second Edition, PHI, 1997.
6. Christenson's Introduction to Diagnostic Radiology, IV Edition.

MEI004 ROBOTICS AND AUTOMATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

Course Outcomes after successful completion of this course,

The students should be able to

CO 1: To describe about virtual instrumentation.

CO 2: Get adequate knowledge VI tool sets

CO 3: To describe data acquisition

CO 4: To understand VI programming techniques.

CO 5: To get an adequate knowledge application of virtual instrumentation

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M				M	M
CO2	S	M				M	M
CO3	S	M				M	M
CO4	S	M				M	M
CO5	S	M				M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT – I **9**
BASIC CONCEPTS

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

UNIT – II **9**

POWER SOURCES AND SENSORS

Hydraulic, pneumatic and electric drives determination of HP of motor and gearing ratio variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

UNIT – III **9**

MANIPULATORS, ACTUATORS AND GRIPPERS

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – various types of grippers – design considerations.

UNIT – IV **9**

KINEMATICS AND PATH PLANNING

Solutions of inverse kinematics problem – multiple solution jacobian work envelop – hilt climbing techniques – robot programming languages.

UNIT – V **9**

CASE STUDIES

Multiple robots – machine interface – robots in manufacturing and non – manufacturing applications – robot cell design – selection of robot.

L = 45

Text Books:

1. Mikell P. Weiss G. M. Nagel R. N, Odraj N. G, Industrial Robotics, McGraw Hill Singapore, 1996.
2. Ghosh. Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998

References:

1. Deb. S. R, Robotics technology and flexible Automation, John Wiley. USA 1992.
2. Agahl, C. R, Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter P. O., Chimielewski T. A., Negin M, Robotic Engineering – An integrated approach. Prentice Hall of India, New Delhi, 1994

MEI005 ANALYTICAL INSTRUMENTATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand various techniques and methods of analysis which occur in the various regions of the spectrum.
- To study important methods of analysis of industrial gases.
- To understand the important radio chemical methods of analysis.

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Ability to understand and analyze Instrumentation systems and their applications to various
Industries
CO2: will study important methods of analysis of industrial gases
CO3: Ability to understand various techniques and methods of analysis
CO4: will analyze processes analysis which occur in the various regions of the spectrum.
CO5: Ability to understand various techniques

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		S	M			M	M
CO2		S	M			M	M
CO3		S	M			M	M
CO4		S	M			M	M
CO5		S	M			M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT 1

PH CONDUCTIVITY & DISSOLVED COMPONENT ANALYSER 9

Sampling systems– ion selective electrodes– conductivity meters- pH meters- dissolved oxygen analyzer– sodium analyzer -silica analyzer– moisture measurement

UNIT II

GAS ANALYSER **9**

Oxygen analyzer– CO monitor – NO, analyzer– H,S analyzer– dust and smoke measurement-thermal conductivity – thermal analyzer– industrial analyzers.

UNIT III

CHROMATOGRAPHY **9**

Gas chromatography – liquid chromatography, principles, types and applications – high-pressure liquid chromatography-detectors.

UNIT IV

SPECTRO PHOTOMETERS **9**

Spectral methods of analysis– Beer's law UV– visible spectrophotometers – single beam and double beam instruments – source and detectors – IR spectrophotometers – sources and detectors– FTIR spectrometer – atomic absorption spectrophotometer – flame emission spectrophotometers – sources of flame photometry– applications.

UNIT V

NUCLEAR MAGNETIC RESONANCE AND RADIATION TECHNIQUES - 9 NMR basic principle – NMR spectrometers applications– introduction to mass spectrophotometer– nuclear radiation detectors – GM counter – proportional counter – solid state detectors introduction – to x-ray spectroscopy.

45

TEXT BOOKS:

1. Willard, H.H., Merrit L.L., Dean J.A Seattle F.L., 'Instrumental Methods of Analysis', CBS Publishing and Distribution, 1995

2. Robert D.Braun, Introduction to industrial Analysis, McGraw Hill, Singapore 198

3. S.K.Singh., Mechanical &Industrial Measurements, Tata McGraw Hill-New Delhi

REFERENCES:

1. Skoog, D.A. and West D.M., Principles of Instrumental Analysis, Holt Sounder Publication, Philadelphia, 1985

2.Liptak, B.G, Process Measurement and Analysis, Chilton Book Company, 1995 Frank A. Settle, Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, New Jersey, 1997

3. Ewing G.W., Instrumental Methods of Analysis', McGraw Hill, 1992

4. Mann C.K. Vickers, T.J. and Guillick W.H Instrumental Analysis, Harper and Row Publishers, New York, 1974.

5. Robert D.Braun, Introduction to industrial Analysis, McGraw Hill, Singapore 1987

MEI006 INSTRUMENTATION & CONTROL IN PETROCHEMICAL INDUSTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To provide sound knowledge about

- To introduce the methods of crude oil extraction, processing and refining
- To educate on Unit operations in petroleum refinery and petrochemical industry
- To introduce Production routes of important petrochemicals, and
- To provide knowledge on Control of selected petrochemicals production processes.
- To educate on the safety in instrumentation systems

After successful completion of this course, the students should be able to

CO1: Demonstrate the working of field instruments.

CO2: Explain the various control Schemes used in petrochemical industry industries.

CO3: Describe the operation of various measurements in petrochemical industries.

CO4: Explain the control loops in petrochemical industries.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1				S		S	
CO2			S				
CO3		M	S	S			
CO4			S			W	

Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni

5.	Online Test		
6.	End Semester Exam		

UNIT I **9**

PETROLEUM PROCESSING

Petroleum exploration, recovery techniques, oil gas separation processing, wet gases refining of crude oil.

UNIT II **9**

OPERATIONS IN PETROLEUM INDUSTRY

Thermal cracking - catalytic cracking - catalytic reforming - polymerization – alkylation-isomerization- production of ethylene, acetylene and propylene from petroleum.

UNIT III **9**

CHEMICALS FROM PETROLEUM PRODUCTS

Chemicals from petroleum - methane derivatives - acetylene derivatives-Ethylene derivatives - propylene derivatives - other products.

UNIT IV **9**

MEASUREMENT IN PETROCHEMICAL INDUSTRY

Parameters to be measured in refinery and petrochemical industry – selection and maintenance of measuring instruments – intrinsic safety of instruments.

UNIT V **9**

CONTROL LOOPS IN PETROCHEMICAL INDUSTRY

Process control of refinery and petrochemical industry – control of distillation column control of catalytic crackers and pyrolysis unit – automatic control of polyethylene production – control of vinyl chloride and PVC production.

Text Books:

1. Waddams A.L. Chemical from petroleum, Butter and Janner Ltd., 1968.
2. Balchand .J.G. and Mumme K. L. , Process control structures and Applications Van Nostrand Reinhold Company, New York. 1988.

Reference:

1. Austin G.T. Shreeves, Chemical process industries, McGraw Hill International student edition, Singapore, 1985.
2. Liptak B.G. Instrumentation in process industries, Chilton Book Company, 1994.

MEI007 MICRO CONTROLLER BASED SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the Architecture of uC 8051
- To study the addressing modes & instruction set of 8051.

- To introduce the need & use of Interrupt structure 8051.
- To develop skill in simple applications development with programming 8051
- To introduce commonly used peripheral / interfacing

Course Outcomes After successful completion of this course, the students should be able to

CO1: Explain the architecture of 8085 microprocessor and 8051 microcontroller

CO2: Differentiate between microprocessor and microcontroller.

CO3: Use knowledge of architecture of 8085 and 8051 to write simple programs for arithmetic and logical operations

CO4: To write programs for memory interfacing, I/O devices and peripheral IC's to interface with 8085 and 8051

CO5: Understand and use the some of the latest microcontroller development boards

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M					
CO2		M		W			
CO3		S	M				
CO4		S	M				
CO5					M	M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I THE ROLE OF MICRO CONTROLLERS 6

Type and selection - Application example

UNIT II

MICRO – CONROLLER RESOURCES 9

Family members, bus widths program and data memory parallel ports, D/A and A/D converters, reset circuitry, watchdog timers, power - down consideration

UNIT III REAL TIME CONTROL 9

Interrupt Structures programmable timers, real – time clock, latency, interrupt, density and interval constraints.

UNIT IV

PROGRAMMING FRAMEWORK FOR 8051 AND PIC 16F877 9

CPU register – m Structure - Addressing mode - Instruction sets – Assembly languages – Assemblers

UNIT V

SOFTWARE BUILDING BLOCKS 12

Queues, tables and strings, program organization microcontroller expansion methods, I/O hardware alternatives, development tools, RTOS, Motorola (MC68HC11) and Intel microcontroller *8051)

L = 45

Text Books:

1. John, B. Peatman, 'Design with Microcontroller'. McGraw |Hill International., 1989
2. Michael Slater, 'Microprocessor – Based design : A Comprehensive Guide to Effective Hardware Design', Prentice Hall, 1989

References:

1. S. Yeralsan and A. Ahiuwalia, ' Programming and Interfacing the 8051 Microcontroller', Addison Wesley, 1995
2. Intel Manual on 16 bit – embedded control users, 191
3. Motorola manual on 8 and 16 bit microcontroller
4. Myke Predko, Programming and Customizing the 8051 microcontroller, Tata McGraw Hill , New Delhi.
5. Kenneth J. Ayala, The 8051 Microcontroller Architecture, programming and applications, Pentram International Publishers, Mumbai, 1996
6. Peter Spasoy, Microcontroller Technology: The 68HC11, Prentice Hall.

MEI008 FIBER OPTICS & LASER INSTRUMENTATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To expose the basic concepts of optical fibers and their industrial applications.
- To provide adequate knowledge about Industrial application of optical fibers.
- To provide basic concepts of lasers.
- To provide knowledge about Industrial application of lasers

- To provide knowledge about Industrial application of Holography and Medical applications of
- Lasers.

Course Outcomes after successful completion of this course,

The students should be able to

CO 1: To describe about fiber optics.

CO 2: Get adequate knowledge fiber optics instrumentation

CO 3: To describe optical fiber properties

CO 4: To understand laser properties.

CO 5: To get an adequate knowledge hologram and medical application,

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M				M	M
CO2	S	M				M	M
CO3	S	M				M	M
CO4	S	M				M	M
CO5	S	M				M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I
OPTICAL FIBERS AND THEIR PROPERTIES **9**

Principles of light propagation through a fiber – different 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 – different types of modulators – detectors – application in instrumentation – interferometric method of measurement of length – moiré fringes – measurement 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 lasers: 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 interferometric 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

45

TEXT BOOKS

1. John and Harry, Industrial lasers and their applications, McGraw-ill, 1974
2. **Senior J.M., Optical Fiber Communication Principles and Practice, Prentice Hall, 1985**

REFERENCES

1. John F Read, Industrial applications of lasers, Academic Press, 1978
2. MonteRoss, Laser applications, McGraw-Hill, 1968
3. Keiser G., Optical Fiber Communication, McGraw-Hill, 1991
4. Jasprit Singh, Semi conductor optoelectronics, McGraw-Hill, 1995

Ghatak A.K and Thiagarajar K, Optical electronics foundation book, TMH, New Delhi, 1991.

MEI009 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.

After successful completion of this course, the students will be able to

CO1: Use a modern computer programming environment (e.g. Matlab) as an interactive problem solving tool and to visualize programming projects

CO2: Apply and Analyze image processing techniques in both spatial and frequency (Fourier) domains

CO3: Design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation

CO4: Conduct independent study and analysis of feature extraction techniques

CO5: Understand the various Image Compression methods

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	W	W		S		
CO2	S	S	S	M	S		
CO3	S	S	S	M	S		
CO4	S	W		S	M		
CO5	M				W		W

Assessment method:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS 9

Elements of visual perception – Image sampling and quantization Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.

UNIT II

IMAGE ENHANCEMENT TECHNIQUES: 9

Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters ,Smoothing – Sharpening filters – Homomorphism filtering.

UNIT III

IMAGE RESTORATION: 9

Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo inverse – Singular value decomposition.

UNIT IV

IMAGE COMPRESSION 9

Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding-DPCM.

Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

UNIT V

IMAGE SEGMENTATION AND REPRESENTATION 9

Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors- Texture

TOTAL: 45

TEXT BOOKS

1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing - Pearson Education 2003.

REFERENCES

1. William K Pratt, Digital Image Processing John Willey (2001)
2. Image Processing Analysis and Machine Vision – Millman Sonka, Vaclav hlavac, Roger Boyle, Brooscolic, Thompson Learniy (1999).
3. A.K. Jain, PHI, New Delhi (1995)-Fundamentals of Digital Image Processing.
4. Chanda Dutta Magundar – Digital Image Processing and Applications, Prentice Hall of India, 2000

MEI010 **POWER ELECTRONICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching
- Characteristics.
- To understand the operation, characteristics and performance parameters of controlled
- rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching
- Regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to
- Understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

Course Outcomes After successful completion of this course, the students should be able to

CO1: Design and simulate converters and inverters according to the specifications.

CO2: Describe the behavior of semiconductor devices.

CO3: Explain the working of AC to DC, DC to DC, DC to AC converters.

CO4: Discuss the applications of power electronic systems.

CO5: Identify the type of power electronic converters to be used in various applications.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		S			S		
CO2	S						
CO3				S			
CO4							M
CO5				M			

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey

3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-1 POWER SEMICONDUCTOR DEVICES 9

Power diode-power transistor, SCR. Triac, GTO, MOSFET AND IGBT, Driver circuits, turns-on methods- commulation and various commutations circuits.

UNIT-2 PHASE CONTROLLED CONVERTERS 9

2pulse, 3pulse, 6pulse converters-inverter operation-comparison of symmertic and asymmetric semi converters-effect of some inductance and firing circuits-application of drive control-dual converters-HVDC transmission.

UNIT-3 DC TO DC CHOPPERS 9

Voltage, current & load cumulated choppers, step up chopper and firing circuits, one, two and four quadrant chopper application of DC driving control.

UNIT-4 INVERTERS 9

Series inverter-parallel inverter Mc-Murray inverter-McMurray-Bedford inverters, current source inverter, voltage control and waveform control-PWM inverters-UPS.

UNIT-5 AC CHOPPERS, CYCLOCONVERTERS AND VOLTAGE CONTROLLERS 9

Single phase AC choppers, multistage sequence control, step and step down cycloconverters. Three phase to single phase converters-triggering circuit based on microprocessors. Single phase AC voltage controller with R.RL.RLE Load.

References

1. Rashid M.H. power electronics circuits devices and application-prentice hall international 1995
2. Sen.P.C.power electronics-Tata Mc-Grew hill, New Delhi.
3. Sing, power electronics--Tata Mc-Grew hill, New Delhi.
4. Dubey G.k.Duradla.S.R.joshi.A and sinha.R.M.., Thyristorised power controller, wiley eastern limited, 1986.
5. Lander.W.power electronics, McGraw hill & co, Third edition, 1993.

MEI011 POWER PLANT INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an overview on power generation through various methods
- To educate on the important power plant measurements and devices
- To educate on basic Boiler control techniques
- To educate on advanced Boiler control techniques
- To educate on the turbine control techniques

Course Outcomes after successful completion of this course,The students should be able to

CO1: Outline the basics of power plant and power generation

CO2: Bring out the various measurements involved in power generation plants.

CO3: Understand the operation of traditional power plants and its Instruments

CO4: Impart knowledge about control in Boilers control loops.

CO5: Explain about boilers and turbines.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO2		S	M			M	M
CO3		S	M			M	M
CO4		S	M			M	M
CO5		S	M			M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-1

SAFETY STANDARDS **9**

Electrical safety standards-Requirements for Instruments in Hazardous localities-determination and classification of area in instrument systems-Group of materials.

UNIT-II

EXPLOSION FUNDAMENTALS **9**

Ignition energy and flame velocity-Lower and upper explosion limits-Precaution in testing-Opening contacts in inductive, capacitive and resistive circuits-Principle of hazardous reduction and approach to safety-Explosion proof housing-Reduction of hazard by purging-Intrinsic safety code and safe systems-Flame ancestors-kind of arresters safe level of circuit voltage-Canella standards.

UNIT-III

POWER PLANTS **9**

Plant layout as process descriptions-Structure of power plants-Nuclear and thermal power station-Hydroelectric-Non conventional energy sources

UNIT-IV

INSTRUMENTS AND CONTROL SYSTEMS IN POWER PLANTS 9

Boiler instruments and control-Turbine instruments and controls-Power house instruments and controls.

UNIT-V 9

INSTRUMENTS AND CONTROL SYSTEMS IN NUCLEAR POWER PLANTS

Control loop in nuclear plants-heat exchangers, moderators-speed control vibration control.

References:

1. Liptak.B.G., Instrumentation in processing industries 1st edition, Chitin book co. Philadelphia 1973.
2. Wakil E.I., Power Plant tecnology. Mc-graw Hill, 1984.
3. Magison E.G., Electrical Instrument in hazardous locations, ISA, USA 1980

MEI012 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

L	T	P	C
3	0	0	3

The student should be made to:

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and machine learning.

After successful completion of this course, the students should be able

CO1: Identify and describe soft computing techniques

CO2: Recognize the feasibility of applying a soft computing methodology for a particular Problem.

CO3: Apply NN to pattern recognition and regression problems.

CO4: Apply FL and reasoning to handle uncertainty and solve engineering problems.

CO5: Apply GA to optimization problems.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S						
CO2	S	M					
CO3	S	M					
CO4	S	M					
CO5	S	M					

ASSESMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE **9**

Overview of AI-general concepts-problem spaces and search-search techniques-BFS, DFS-Heuristic search techniques.

UNIT II KNOWLEDGE REPRESENTATION **9**

Knowledge – general concepts-predicate logic-representing simple fact-instance and ISA relationships-resolution-natural deduction.

UNIT III KNOWLEDGE EDGE ORGANISATION AND MANIPULATION **9**

Procedural Vs declaration knowledge-forward Vs backward reasoning- matching techniques-control knowledge/strategies-symbol reasoning under uncertainty-introduction to non-monotonic reasoning-logic for monotonic reasoning.

UNIT IV PERCEPTION – COMMUNICATION AND EXPERT SYSTEMS **9**

Natural language processing pattern recognition- visual image understanding expert system architecture.

UNIT V KNOWLEDGE ACQUISITION **9**

Knowledge acquisition-general concepts-learning-learning byu induction-explanation based learning.

Text Books:

1. Elaine Rich and Kelvin knight, Artificial Intelligence, Tata McGraw Hill, New Delhi, 1991.
2. Stuart Russell and Peter Nerving. Artificial Intelligence: A Modern approach. Prentice hal, 1995.

References:

1. Nilsson N.I. Principles of Artificial Intelligence, Springer Variage, Berlin, 1980.

Patterson, Introduction to Artificial Intelligence and Expert Systems. Prentice Hall of India, New Delhi, 1990.

MEI013 PERSONALCOMPUTER AND INSTRUMENTATION

L	T	P	C
3	0	0	3

Objectives

- To Get adequate knowledge Evolution of computers
- To describe processor

- To understand programming techniques.

Course Outcomes after successful completion of this course,

The students should be able to

CO 1: To describe about pipelines.
CO 2: Get adequate knowledge Evolution of computers
CO 3: To describe processor
CO 4: To understand programming techniques.
CO 5: To get an adequate knowledge memory organization and devices

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		M	M			M	M
CO2		M	M			M	M
CO3		M	M			M	M
CO4		M	M			M	M
CO5		M	M			M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Online Test	**4.**	Alumni
5.	End Semester Exam		

UNIT I

PC ARCHITECTURE BASICS **9**

Architecture of 8088/8086 processor- Memory mapping in PC- Memory organization – PPI, DMA and Interrupt Controllers – I/O interface – PC bus specifications – Architectural features of 8026,386,486 and Pentium processors – Memory protection – Extended and expanded Memory.

UNIT II

BASIC I/O IN PC **9**

Video display adapters – Monochrome, color graphics and video graphics adapters – Text and graphic modes – printer – keyboard and serial interface – floppy disk and hard disk controllers – format of floppy and hard disk.

UNIT III

DOS OPERATING SYSTEM **9**

Structure of MS DOS – BIOS – DOS Kernel – Command processor – File organization in MS DOS – Boot record – file allocation table and file directory – Boot Process Power – on-self-test and loading of MSDOS program segment prefix – DOS device drivers – mouse drivers – real time operating system.

UNIT IV

WINDOWS BASIC **9**

Windows presentation manager Filer application and managers control panel programming – window manager interface – Graphic device interface- System service interface- Naming conventions – windows calling conventions – real time operating system.

UNIT V **9**

TYPICAL PC BASED INSTRUMENTS

Outline and features of PC based instruments – Virtual of PC based instruments – Functions Generator, waveform and analyzer and digital storage oscilloscope – DAS card for PC – fault diagnosis and analysis **45**

References:

1. Hall D. V., Microprocessors and Interfacing, Tata McGraw Hill,1986.
2. Duncan R., Advanced MSDOS programming, Microsoft press, USA,1986
3. Norton P.Inside the PC, Prentice Hall of India Private Ltd., New Delhi,1996

MEI014 **DIGITAL INSTRUMENTATION**

L	T	P	C
3	0	0	3

Objectives

- To Get adequate knowledge Analog to digital converters
- To describe digital processor
- To understand Intelligent instruments

Course Outcomes after successful completion of this course, the students should be able to

CO 1: To describe about pipelines.
CO 2: To Get adequate knowledge Analog to digital converters
CO 3: To describe processor
CO 4: To understand programming techniques.
CO 5: To understand Intelligent instruments

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M				M	M
CO2	S	M				M	M
CO3	S	M				M	M
CO4	S	M				M	M
CO5	S	M				M	M

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Online Test	**4.**	Alumni
5.	End Semester Exam		

UNIT-I

D/A AND AID CONVERTERS **9**

D/A converters-Accuracy, resolution, setting time and other specification-A/D converters of different types performance specification-Interfacing with microprocessors, Data acquisition systems.

UNIT-II **9**

FREQUENCY & TIME MEASUREMENTS

Frequency counters-Frequency, Period, Frequency ratio & time interval modes of operation Errors.

UNIT-III **9**

TYPICAL DIGITAL INSTRUMENTS

Digital Voltmeters-Dual Slope and other types-source of errors-Automation in DVM multimeter-Digital Q meter –LCR meters & spectrum analysis Digital measurement of non-electrical variables like speed, temperature & displacement. Digital storage oscilloscope.

UNIT-IV **9**

INTELLIGENT INSTRUMENTATION

Microprocessor / PC based digital voltmeter and multimeter with self diagnostic features-Parallel bus standards-GPIB interface-RS232C & serial communication standards.

UNIT-V **9**

DISPLAY AND RECORDING DEVICES

Bar graph display LED,LCD and plasma display of segment & matrix type CRT monitors character generators-static and dynamic display Digital recorders & plotters.

45

References.

1. Sonde B.S, Data converters, Tata McGraw Hill, 1993.
2. Sonde Busman Introduction to system Design using ICS, Tata McGraw Hill, 1993.
3. Bouwens A.J., Digital Instrumentation, McGraw Hill, 1992.
4. Byers T.J.Electronics text equipment principle and applications, McGraw Hill, 1987.

RESEARCH METHODOLOGY

L	T	P	C
3	0	0	3

Objectives

- To Get adequate knowledge about research concepts
- To describe mathematical modeling and simulation
- To understand experimental modeling
- To get knowledge about the interpretation of result

Course Outcomes after successful completion of this course, the students should be able to

CO 1: To describe research concepts.
CO 2: To Get adequate knowledge about mathematical modeling
CO 3: To describe experimental modeling
CO 4: To understand analysis of results.
CO 5: To know about report writing

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M				M	M
CO2	S	M				M	M
CO3	S	M				M	M
CO4	S	M				M	M
CO5	S	M				M	M

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Online Test	**4.**	Alumni
5.	End Semester Exam		

1. RESEARCH CONCEPTS 9

Concepts, meaning, objectives, motivation, types of research, approaches, research (Descriptive research, Conceptual, Theoretical, Applied & Experimental).
Formulation of Research Task – Literature Review, Importance & Methods, Sources, quantification of Cause Effect Relations, Discussions, Field Study, Critical Analysis of Generated Facts, Hypothetical proposals for future development and testing, selection of Research task.

2. MATHEMATICAL MODELING AND SIMULATION 9

Concepts of modeling, Classification of Mathematical Models, Modeling with Ordinary differential Equations, Difference Equations, Partial Differential equations, Graphs, Simulation, Process of formulation of Model based on Simulation.

3 EXPERIMENTAL MODELING 9

Definition of Experimental Design, Examples, and Single factor Experiments, Guidelines for designing experiments. Process Optimization and Designed experiments, Methods for study of response surface, determining optimum combination of factors, Taguchi approach to parameter design.

4 ANALYSIS OF RESULTS 9

Parametric and Non-parametric, descriptive and Inferential data, types of data, collection of data (normal distribution, calculation of correlation coefficient), processing, analysis, error analysis, different methods, analysis of variance, significance of variance, analysis of covariance, multiple regression, testing linearity and non-linearity of model.

5 REPORT WRITING 9

Types of reports, layout of research report, interpretation of results, style manual, layout and format, style of writing, typing, references, tables, figures, conclusion, appendices.

TOTAL: 45

TEXT BOOKS

1. Wilkinson K. L, Bhandarkar P. L, „Formulation of Hypothesis", Himalaya Publication.
2. Schank Fr.,"Theories of Engineering Experiments", Tata Mc Graw Hill Publication.

REFERENCE BOOKS

1. Douglas Montgomery, "Design of Experiments", Statistical Consulting Services, 1990.
2. Douglas H. W. Allan, "Statistical Quality Control: An Introduction for Management", Reinhold Pub Corp, 1959.
3. Cochran and Cocks, „Experimental Design", John Willy & Sons.
4. John W. Besr and James V. Kahn, „Research in Education", PHI Publication.

5. Adler and Granovky, "Optimization of Engineering Experiments", Meer Publication. 6. S. S. Rao, „Optimization Theory and Application", Wiley Eastern Ltd., New Delhi, 1996.