KUMARAGURU COLLEGE OF TECHNOLOGY

(Autonomous Institution Affiliated to Anna University,Chennai)

COIMBATORE – 641049

CURRICULUM AND SYLLABUS
(REGULATIONS 2013)

3rd - 8th Semesters

B.E - Electronics and Instrumentation Engineering

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B.E. Electronics and Instrumentation Engineering
Curriculum – 2013

SEMESTER III						
Course code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
U13MA*T*301	B	Numerical Methods	3	1	0	4
U13EI*T*301	P	Electronic Circuit Design	3	1	0	4
U13EI*T*302	P	Sensors and Transducers	3	0	0	3
U13EI*T*303	P	Electrical and Electronic Measurements	3	0	0	3
U13EI*T*304	P	Electrical Machines and Control Devices	3	0	0	3
U13EI*T*305	P	Digital Fundamentals and circuits	3	1	0	4
PRACTICAL						
U13EI*P*301	P	Electronic Circuits Laboratory	0	0	3	1
U13EI*P*302	P	Transducer and Measurements Laboratory	0	0	3	1
U13EI*P*303	P	Electrical Machines and Control Laboratory	0	0	3	1
U13GH*P*301	G	Family Values	1	0	1	1
Total hours - 32				**Total Credits – 25**		

SEMESTER IV						
Course code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
U13MA*T*402	P	Signals and Systems	3	1	0	4
U13EI*T*401	P	Linear Integrated Circuits and Applications	3	0	0	3
U13EI*T*402	P	Control Systems	3	1	0	4
U13GS*T*001	E	Environmental Science and Engineering	3	0	0	3
U13CS*T*304	E	Object oriented programming with C++	3	0	0	3
U13ME*T*405	E	Applied Thermodynamics and Fluid Mechanics	3	0	0	3
PRACTICAL						
U13EI*P*401	P	Integrated Circuits laboratory	0	0	3	1
U13ME*P*405	E	Thermal Engineering and Fluid Mechanics Laboratory	0	0	3	1
U13GH*P*401	G	Professional Values	1	0	1	1
Total hours - 28			**Total Credits – 23**			

SEMESTER V						
Course code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
U13EI*T*501	P	Microprocessor and Microcontroller	3	1	0	4
U13EI*T*502	P	Industrial Instrumentation - I	3	0	0	3
U13EI*T*503	P	Process Control	3	1	0	4
U13EI*T*504	P	Communication Theory and Acquisition systems	3	0	0	3
U13EI*T*505	B	Digital Control System	3	1	0	4
U13EC*T*511	P	Digital Signal Processing	3	1	0	4
PRACTICAL						
U13EI*P*501	P	Microprocessor and Microcontroller Laboratory	0	0	3	1
U13EI*P*502	P	Data Acquisition and Simulation Laboratory	0	0	3	1
U13EN*P*501	G	Communication Skills Laboratory	0	0	3	1
U13GH*P*501	P	Social Values	1	0	1	1
Total hours - 33						**Total Credits – 26**

SEMESTER VI						
Course code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
U13EI*T*601	P	Bio Medical Instrumentation	3	0	0	3
U13EI*T*602	P	Industrial Instrumentation – II	3	1	0	4
U13EI*T*603	P	Advanced Industrial Controllers	3	1	0	4
U13EI*T*604	P	Process Dynamics and Control	3	0	0	3
U13EI*T*605	P	Embedded Systems	3	1	0	4
	P	Elective – I	3	0	0	3
PRACTICAL						
U13EI*P*601	P	Process control Laboratory	0	0	3	1
U13EI*P*602	P	Industrial Instrumentation Laboratory	0	0	3	1
U13EI*P*603	P	Mini – Project	0	0	0	1
U13GH*P*601	P	National Values	1	0	1	1
Total hours - 29					**Total Credits – 25**	

SEMESTER VII						
Course code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
U13EI*T*701	P	VLSI Design	3	1	0	4
U13EI*T*702	P	Analytical Instruments	3	1	0	4
U13EI*T*703	P	Power Plant Instrumentation	3	0	0	3
U13EI*T*704	P	Computer Networks and Distributed Control Systems	3	1	0	4
U13GS*T*008	E	Professional Ethics	3	0	0	3
	P	Elective – II	3	0	0	3
PRACTICAL						
U13EI*P*701	P	Embedded Laboratory	0	0	3	1
U13EI*P*702	P	Industrial Automation Laboratory	0	0	3	1
U13GH*P*701	P	Global Values	1	0	1	1
Total hours - 29					**Total Credits – 24**	

SEMESTER VIII						
Course code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
	P	Elective – III	3	0	0	3
	P	Elective - IV	3	0	0	3
	E	Elective - V	3	0	0	3
PRACTICAL						
U13EI*P*801	P	Project Work	0	0	18	6
Total hours - 27					**Total Credits – 15**	

LIST OF ELECTIVES						
Course code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
ELECTIVE I						
U13EI*T*E01	P	Mems and Nano technology	3	0	0	3
U13MA*T*605	E	Probability and Applied statistics	3	0	0	3
U13EI*T*E02	P	Advanced Control Systems	3	0	0	3
U13CS*T*503	E	JAVA Programming	3	0	0	3
ELECTIVE II						
U13EI*T*E03	P	Instrumentation in Iron and Steel Industries Industries	3	0	0	3
U13EI*T*E04	P	Automobile and Aircraft Instrumentation	3	0	0	3
U13EI*T*E05	P	Applied Soft Computing	3	0	0	3
U13EI*T*E06	P	Advanced Process control	3	0	0	3
ELECTIVE III						
U13EI*T*E07	P	Robotics and Automation	3	0	0	3
U13EI*T*E08	P	Industrial Chemical Processes	3	0	0	3
U13EI*T*E09	P	Digital Image Processing	3	0	0	3
U13EI*T*E10	E	Computer Architecture	3	0	0	3
ELECTIVE IV						
U13EI*T*E11	P	Power Electronics	3	0	0	3
U13EI*T*E12	P	Instrumentation in Petrochemical Industries	3	0	0	3
U13EI*T*E13	P	Fault Detection and Diagnosis	3	0	0	3
U13EC*T*603	P	ARM Architecture and Programming	3	0	0	3
ELECTIVE V						
U13GS*T*002	E	Total Quality Management	3	0	0	3
U13GS*T*004	E	Operational Research	3	0	0	3
U13GS*T*005	E	Engineering Economics and Financial Management	3	0	0	3
U13GS*T*006	E	Product Design and Development Management	3	0	0	3

SEMESTER III

U13MA*T*301	NUMERICAL METHODS	L	T	P	C
		3	1	0	4

Course Objectives

- To understand concepts of pseudocode and various errors.
- To solve algebraic, transcendental and system of linear equations by using various techniques.
- To understand the concepts of curve fitting, interpolation with equal and unequal intervals.
- To understand the concepts of numerical differentiation and numerical integral by various methods.
- To solve the ordinary differential equations with initial condition by numerical techniques.
- To solve the partial differential equations using numerical techniques.

Course Outcomes

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

- Solve a set of algebraic equations representing steady state models formed in engineering problems
- Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables
- Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
- Predict the system dynamic behaviour through solution of ODEs modeling the system
- Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.
- Have the necessary proficiency of using MATLAB for obtaining the above solutions.

Course Content

INTRODUCTION **5 Hours**

Simple mathematical modeling and engineering problem solving – Algorithm Design – Flow charting and pseudocode - Accuracy and precision – round off errors.

NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS **5Hours**

Solution of nonlinear equations: False position method – Fixed point iteration – Newton Raphson method for a single equation and a set of non- linear equations
Solution of linear system of equations by Gaussian elimination-Gauss Jordan method - Gauss

Seidel method.

CURVE FITTING AND INTERPOLATION 5Hours

Curve fitting – Method of least squares – Regression – Interpolation: Newton's forward and backward difference formulae – Divided differences – Newton's divided difference formula - Lagrange's interpolation – Inverse interpolation

NUMERICAL DIFFERENTIATION AND INTEGRATION 5Hours

Numerical differentiation by using Newton's forward, backward and divided differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Numerical double integration.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 10 Hours

Initial value problems - Single step methods: Taylor's series method – Truncation error – Euler and Improved Euler methods – Fourth order Runge – Kutta method – Multistep methods: Milne's predictor - corrector method.

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 15 Hours

PDEs and Engineering Practice – Laplace Equation derivation for steady heat conduction – Numerical solution of the above problem by finite difference schemes – Parabolic Equations from Fourier`s Law of Transient Heat Conduction and their solution through implicit schemes – Method of Lines – Wave propagation through hyperbolic equations and solution by explicit method. Use of MATLAB Programs to workout solutions for all the problems of interest in the above topics.

Theory:45Hr Tutorial: 15Hr Total Hours:60

REFERENCES

1. Steven C.Chapra and Raymond P. Canale, " Numerical Methods for Engineers with Programming and Software Applications", SixthEdition, WCB/McGraw-Hill, 1998.
2. John H. Mathews and Kurtis D. Fink, "Numerical Methods using Matlab", Fourth Edition, Prentice Hall of India, 2004.
3. Gerald C. F. and Wheatley P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
4. Sastry S.S, "Introductory Methods of Numerical Analysis", Third Edition, Prentice – Hall of India Pvt Ltd, New Delhi, 2003.
5. Kandasamy P., Thilagavathy K. and Gunavathy K., "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2007.

U13EI*T*301	ELECTRONIC CIRCUIT DESIGN	L	T	P	C
		3	1	0	4

Course Objectives

- To familiarize the student with the working, design and analysis of basic amplifier circuits.
- To analyze transistor amplifier using mid-band small signal models.
- To design and analyze wave shaping circuits, rectifiers and power supply circuits
- To design and simulate basic electronic circuits in MULTISIM or Pspice.

Course Outcomes

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

- Ability to use modern engineering tools and techniques in the practice of electronics engineering
- Understand the working of various types of amplifiers, oscillators, wave shaping and power supply circuits
- Design and Analyze the various types of amplifiers, oscillators, wave shaping and power supply circuits for any practical situation
- Ability to identify, formulate, and solve problems in the practice of electronics engineering using appropriate theoretical and experimental methods

Course Content

SMALL-SIGNAL AMPLIFIER and MID BAND ANALYSIS. 15 Hours

Bias stability, Need for biasing, Fixed and self biasing of BJT & FET – General shape of frequency response of amplifiers. Definition of cut off frequencies and bandwidth. Low frequency response of BJT amplifiers and FET . High frequency equivalent circuit of FETs. High frequency analysis of FET amplifiers - Miller effect capacitance - Gain bandwidth product, Transistor ratings. Design and Simulation of small signal amplifiers using Pspice or Multisim

LARGE SIGNAL,DIFFERENTIAL AND TUNED AMPLIFIERS 12Hours

Class A, class B, class C transformer coupled class A, B & AB amplifiers – Push-pull amplifier, bootstrap amplifier, Cascade and Darlington connections.

Differential amplifiers – Common mode and differential mode analysis - DC and AC analysis - Characteristics of tuned amplifiers – Single & double tuned amplifier

Design and Simulation of tuned amplifiers using Pspice or Multisim.

FEEDBACK AMPLIFIER AND OSCILLATORS 12 Hours

Characteristics of negative feedback amplifiers – Voltage / current, series/ shunt feedback – Theory of sinusoidal oscillators – Phase shift and Wien bridge oscillators – Colpitts, Hartley and crystal oscillators- oscillator applications.

Design and Simulation of oscillators using Pspice or Multisim.

WAVESHAPING CIRCUITS AND PULSE CIRCUITS 9Hours

RC wave shaping circuits – Diode clampers and clippers – Multivibrators – Schmitt triggers- Time base circuits

Design and Simulation of wave shaping circuits and pulse circuits using Pspice or Multisim.

RECTIFIERS AND POWER SUPPLY CIRCUITS 12 Hours

Half wave & full wave rectifier analysis - Inductor filter – Capacitor filter - Transistorized Series voltage regulator – Switched mode power supply Design and Simulation of power supply circuits

Theory:45Hr Tutorial: 15 Hr Total Hours:60 Hr

REFERENCES

1. R Robert. L. Boylestad & Lo Nashelsky, 'Electronic Devices & Circuit Theory', 8th edition, Pearson Education, Third Indian Reprint, 2002 / PHI.
2. Jacob Millman & Christos.C.Halkias, 'Integrated Electronics: Analog and Digital Circuits and System', Tata McGraw Hill, 2008.
3. David A. Bell, 'Electronic Devices & Circuits', Prentice Hall of India/ Pearson Education, IV Edition, Eighth printing, 2003.
4. Donald L.Schilling and Charles Belove, 'Electronic Circuits', Tata McGraw Hill, 3rd Edition, 2003.
5. Er.N.B.L.Mathur, "Electronic Devices and Circuits"Anmol Pulications

U13EI*T*302	SENSORS AND TRANSDUCERS	L	T	P	C
		3	0	0	3

Course Objectives

- To discuss about units, standards, error analysis and characteristics of measurement systems.
- To understand the static and dynamic characteristics of transducers.
- To describe the principle of operation, construction and characteristics of resistance, inductance and capacitance & other transducers.
- To demonstrate the various types of basic transducers.

Course Outcomes

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

- Classify and describe resistive, inductive and capacitive transducers which are used for measuring various parameters like displacement, temperature, humidity etc.
- Define units and standards, their conversions, characteristics and error analysis of measurement systems.
- To identify the various transducers used for various application.

Course Content

SCIENCE OF MEASUREMENTS AND INSTRUMENTATION 9Hours

Functional Elements of Measurement Systems- General I/O Configuration. Definition, principles of sensing and transduction, Classification of transducers, Units and standards – unit conversions - Classification of errors - Error analysis - Statistical methods - Odds and uncertainty - Introduction to Calibration methods.

CHARACTERISTICS OF MEASUREMENT SYSTEMS 9 Hours

Static characteristics - Dynamic characteristics - Mathematical model of transducer - Zero, I and II order transducers. Response to impulse, step, ramp and sinusoidal inputs. Simulation using MATLAB.

RESISTIVE TRANSDUCERS 9 Hours

Principle of operation, construction details, characteristics and application of resistance potentiometer, strain gauge and its signal conditioning circuits, RTD, LDR, thermistor, hot-wire anemometer and humidity sensor. Demonstration of RTD, Strain gauge, LDR

INDUCTIVE AND CAPACITIVE TRANSDUCERS 9Hours

Induction potentiometer - Variable reluctance transducers - EI pick up - LVDT - Variable reluctance tachometer, Proximity transducers - Capacitive transducer and types - Capacitor

microphone –capacitive thickness Transducers, capacitive strain transducers.

OTHER TRANSDUCERS 9 Hours

Piezoelectric transducer, magnetostrictive transducer - Digital transducers - Fiber optic transducer - Hall Effect transducer - Photo electric transducer- I/P &P/I transducer. Introduction to Smart sensors and MEMS. Points to be considered for selecting a transducer.

Theory:45Hr Tutorial: Hr Total Hours:45

REFERENCES

1. E.A. Doebelin, 'Measurement Systems – Applications and Design', Tata Mc Graw Hill, New York, 2012
2. John P. Bentley, 'Principles of Measurement Systems', 4th Edition,Pearson Education, 2005.
3. S. Ranganathan, 'Transducer Engineering', Allied Publishers Pvt. Ltd.,2003.
4. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India, 2011.
5. D.Patranabis, 'Sensors and Transducers', Prentice Hall of India, 2004.

U13EI*T*303	ELECTRICAL AND ELECTRONIC MEASUREMENTS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the working principles of the electrical and electronic meters
- To know and understand the concept behind the measurement of resistance capacitance and inductance

Course Outcomes

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

- Describe the working of various electrical and electronic meters
- Describe the working of digital meters currently in use
- Distinguish between the analog and digital meters
- Relate and apply the appropriate measuring techniques to real time applications

Course Content

ELECTRICAL METERS 9Hours

Galvanometers- Moving iron- permanent magnet moving coil instruments-Hall effect-clamp meters-Measurement of DC, AC voltage and current- Dynamometer type Wattmeter- Energy meters

MEASUREMENT OF RESISTANCE 9Hours

Measurement of low, medium and high resistance – automatic bridge method - Kelvin Double Bridge- Wheatstone Bridge –Megger – Direct deflection methods – loss of charge method – earth resistance measurement

Design of Wheatstone bridge for resistive transducers -Thermistor and strain gauge

MEASUREMENT OF CAPACITANCE AND INDUCTANCE 9Hours

Maxwell Bridge – Wein's bridge – Hay's bridge – Schering bridge – Anderson bridge – Campbell bridge to measure mutual inductance – Errors in A.C. bridge - types and their compensation. Digital capacitance meter -Digital LCR meter.

Demonstration of Digital LCR meter.

ELECTRONIC METERS 9Hours

D.C and A.C voltmeters, multimeter, power meter, Q-meter

Digital voltmeter – Digital multimeter –Microprocessor based digital multimeter.

Industrial Calibration of Multimeter, scope meter.

ELECTRONIC MEASUREMENTS 9Hours

Digital method of measuring frequency, period, phase difference, pulse width, time interval, total count , Function generator, Cathode Ray Oscilloscope, Digital storage oscilloscope- x-y chart, strip chart recorders, magnetic tape recorders, Logic Analyzers, Data Loggers
Demonstration of CRO and DSO.

Theory:45Hr **Tutorial: 15 Hr** **Total Hours:60**

REFERENCES

1. A.K.Sawhney,' Electrical and Electronic Measurements and Instrumentation', Dhanpath Rai & Co(P)Ltd,2004
2. J.B.Gupta, 'A Course in Electronic and Electrical Measurements and Instrumentation', S.K. Kataria & Sons, Delhi, 2003
3. Martia U. Reissland, 'Electrical Measurements', New Age International (P) Ltd., 2001
4. Albert D. Helfrick & William D. Cooper, 'Modern Electronics Instrumentation & Measurement Techniques', Prentice Hall of India,2002
5. D.A. Bell, 'Electronic Instrumentation and Measurements', Prentice Hall of India,2002
6. A.J.Bouwens, 'Digital Instrumentation', Tata Mcgraw Hill, 1997
7. Clyde F.Coombs, 'Electronic Instrument Handbook', McGraw Hill Professional,third Edition, 1999

U13EI*T*304	ELECTRICAL MACHINES AND CONTROL DEVICES	L	T	P	C
		3	0	0	3

Course Objectives

- To expose the students to the concepts of DC machines, single phase transformer and their applications.
- To impart the theoretical knowledge of structures, operating principle and applications of switches and relays.
- Introductory knowledge on Industrial control device.

Course Outcomes

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

- Ability to design and conduct performance experiments, as well as to identify, formulate and solve machine related problems.
- Analyze and describe aspects of the construction, principle of operation, applications and methods of speed control
- Describe the construction, application and operation of single phase and three phase transformers
- Understand the basic concepts and working of switches and relays.
- Identify suitable motors for industrial applications.

Course Content

DC MACHINES **9 Hours**

Magnetic system, Armature windings, Methods of excitation, Equivalent circuit and General equations. Performance of generators and motors, Permanent magnet motors and Practical Applications

Demonstration of construction and working of DC Machines

AC MACHINES **10Hours**

Induction Motor: Alternating current machine windings, Construction of A.C. machines, 3-phase induction motors - Equivalent circuits and performance characteristics, Single phase induction motors, Linear induction motors.

Synchronous Machines: Three-phase synchronous machine, equivalent circuit, principle of operation, operation on an infinite bus, synchronous condenser. Practical Applications of AC motors.

Demonstration of construction and working of AC Machines

TRANSFORMERS **8 Hours**

Ideal Transformer, Losses, Equivalent Circuit, Construction and Design, Variable frequency operation. Current Transformer, Potential Transformer. Transformers for poly phase systems. Building a Transformer

SWITCHES AND RELAYS **10 Hours**

Switches: Construction, symbolic representation, working, application of Reed switch, Toggle switches, Push buttons, Selector switches, DIP switches, Rotary switches, Thumbwheel switches, Drum switch, Limit switches-contact, non contact-type, switch specifications.
Relays: Construction, working, specifications, selection criteria and applications of Electro-mechanical relay, Reed relay, hermatically sealed relay, Solid state relays, interposing relays and overload relays. Demonstration of Switches and Relays

INDUSTRIAL CONTROL DEVICES **8Hours**

Principle and applications: Stepper motor - Reluctance motor- Switched Reluctance Motor - Hysteresis motor - Universal motor - AC series motor- Brushless DC motor - A.C & D.C Servomotor – Synchros.Selection of DC and AC machines for various applications.
Visit to a local industry

Theory:45Hr **Tutorial: Hr** **Total Hours:45**

REFERENCES

1. J. B. Gupta, "Theory & Performance of Electrical Machines", S. K. Kataria & Sons, 2009
2. M. D. Desai, Control System Components, Prentice Hall of India, 2013.
3. A.E.Fitzgeald, Charles Kingsley, Stepen.D.Umans, "Electrical Machinery", Tata McGraw hill publishing Company Ltd. 2003.
4. V.K Mehta and Rohit Mehta "Principle of Electrical Engineering" S Chand & Company, 2008
5. Tony R. Kuphaldt, "Lessons In Electric Circuits, Volume II – AC", Sixth Edition, last update July 25, 2007

U13EI*T*305	DIGITAL FUNDAMENTALS AND CIRCUITS	L	T	P	C
		3	1	0	4

Course Objectives

- To manipulate across various number system.
- To compute binary arithmetic operations.
- To design combinational and sequential circuits using gates.
- To synthesize combinational and sequential circuits using multiplexers and PLDs.

Course Outcomes

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

- Interpret numbers in different radix systems
- Apply various techniques to design a digital system.

Course Content

NUMERATION AND LOGIC 10 Hours

Numbers and symbols, Systems of numeration, Decimal versus binary numeration, Octal and hexadecimal numeration, Octal and hexadecimal to decimal conversion, Conversion from decimal numeration, Binary Arithmetic, BCD conversion.
Digital signals and gates, NOT gate, ”buffer” gate, Multiple-input gates, TTL NAND and AND gates, TTL NOR and OR gates, CMOS gate circuitry, Special-output gates, Gate universality, Constructing various gate, Logic signal voltage levels, DIP gate packaging - Switches and relays Simulation exercises using MULTISIM

BOOLEAN LAWS 15Hours

Introduction - Boolean arithmetic - Boolean algebraic identities - Boolean algebraic properties - Boolean rules for simplification - Circuit simplification examples - The Exclusive-OR function - DeMorgan’s Theorems - Converting truth tables into Boolean expressions - Venn diagrams and sets - Boolean Relationships on Venn Diagrams - Making a Venn diagram look like a Karnaugh map - Karnaugh maps, truth tables, and Boolean expressions - Logic simplification with Karnaugh maps - Larger 4-variable Karnaugh maps - minterm vs maxterm solution - (sum) and (product) notation, Don’t care cells in the Karnaugh map Larger 5 & 6-variable Karnaugh maps

COMBINATIONAL LOGIC CIRCUITS 10Hours

Half-Adder, Full-Adder, carry look ahead adder, BCD adder - Decoder, Encoder, Demultiplexers, Multiplexers, Using multiple combinational circuits, serial adder, parallel adder, parity checker, parity generator, Simulation of Combinational Logic Circuits using MULTISIM

SEQUENTIAL CIRCUITS 15 Hours

Digital logic with feedback, S-R latch, gated S-R latch, D latch, Edge-triggered latches: Flip-Flops, J-K flip-flop, Asynchronous flip-flop inputs, Monostable multivibrators, Binary count

sequence, Asynchronous counters -Synchronous counters - Counter modulus - Finite State Machines. Simulation of Sequential Logic Circuits using MULTISIM

REGISTERS AND MEMORY DEVICES **10 Hours**

Introduction, shift register-types, universal shift register, Ring counters, digital storage- digital memory concepts. Modern nonmechanical memory, Historical, nonmechanical memory technologies, Read-only memory, Memory with moving parts: Drives. PLDs.

Project – Seven Segment Display

Theory:45Hr **Tutorial: 15 Hr** **Total Hours:60**

REFERENCES

1. Tony.R.Kuphaldt "Digital lessons in Electric circuits" Volume IV – Digital, 4th edition,2007.
2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education, Inc, New Delhi, 2009
3. M. Morris Mano, "Digital Design", 4th Edition , Pearson Education 2007
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 5 Edition., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
5. Donald D.Givone, "Digital Principles and Design", Tata Mc-Graw Hill Publishing company limited, New Delhi, 2003.
6. John .M Yarbrough, "Digital Logic Applications and Design", Thomson - Vikas Publishing House, New Delhi, 2002.

U13EI*P*301 ELECTRONIC CIRCUITS LABORATORY L T P C

0 0 3 1

Course Objectives

- To obtain the frequency response of BJT and FET.
- To understand the working of various oscillators
- To experimentally design and acquire knowledge about biasing.

Course Outcomes

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

- Ability to analyze and design simple differential amplifier and Oscillators circuits using BJT.
- Analyze and design Biasing Circuits.
- Ability to identify faults in electronic circuits.

LIST OF EXPERIMENTS

1. Design of BJT Amplifier using Voltage divider bias.
2. Design of FET Amplifier using Voltage divider bias.
3. Design of transistorised series and shunt regulator.
4. Design a multivibrator using BJT.
5. Design of push pull amplifier.
6. Design of Single phase half wave and full wave rectifiers using capacitive filter.
7. Design of Phase shift oscillators and Wien bridge oscillators
8. Frequency response of BJT amplifiers.
9. Differential amplifiers using BJT.
10. Design a clipper and clamper circuit using diodes.
11. Design a common emitter amplifier using BJT
12. Troubleshooting for a given electronic circuit.
13. Design of HEARING AID with PUSH PULL OUTPUT

Total Hours:45

U13EI*P*302	TRANSDUCER AND MEASUREMENTS	L	T	P	C
	LABORATORY	0	0	3	1

Course Objectives

- To experimentally verify the principle and characteristics of various transducers.
- To impart the students with an adequate knowledge and work experience of the different types of bridges.

Course Outcomes

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

- To demonstrate the performance characteristics of various transducers.
- To demonstrate the working of various measurement bridges.
- To design a measurement system for an application.

LIST OF EXPERIMENTS

1. Measurement of strain using strain gauge.
2. Measurement of displacement using potentiometer.
3. Measurement of force/load using load cell.
4. Level measurement using capacitive transducers.
5. Speed measurement using photoelectric tachometer.
6. Pressure measurement using piezoelectric transducers.
7. Study of hall effect transducer - current and voltage measurement using clamp meters.
8. Measurement of displacement using LVDT.
9. Characteristics of thermocouple, Thermistor and RTD – Temperature measurement and performance comparison.
10. Design of Wheatstone‘s bridge for resistive transducer.
11. Impedance measurement using Automatic balancing Bridge.
12. Characteristic of Schering and Anderson Bridge.
13. Project – Design and testing of a measurement system.

Total Hours: 45

U13EI*P*303	ELECTRICAL MACHINES AND CONTROL LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To experimentally identify and correct errors in electrical meters through calibration.
- To experimentally verify the principle of operation, performance characteristics and Speed control of DC Machines, AC Machines.
- To experimentally verify the principle of operation and performance characteristics of transformers.
- To experimentally verify the principle of operation, performance characteristics AC Motors and Transformers.

Course Outcomes

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

- Ability to analyze the performance characteristics of various machines
- Ability to understand and analyze Instrumentation systems and their applications to various industries

List of Experiments

1. Calibration of Wattmeter & Single- phase energy meter
2. Speed Control of DC Shunt Motor
3. Load Test on DC Shunt Motor
4. Load Test on DC Series Motor
5. Load Test on 1 Phase Induction Motor
6. Load Test on 3 Phase Induction Motor
7. Open Circuit and Short Circuit Tests on Single Phase Transformer
8. Load Test on Single Phase Transformer
9. Determination of transfer function of a DC servo motor.
10. Determination of transfer function of AC servo motor.
11. Design Project - building a simplified version of an AC permanent capacitor split-phase induction motor

Total Hours:45

U13GH*P*301	FAMILY VALUES	L	T	P	C
		1	0	1	1

Course Objectives

- To inculcate the basic need for family life and peace in it.
- To lead spiritual development through good family life.
- To respect womanhood and live disease free life.
- To live with sound health.
- To reach Intuition.

Course Outcomes

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

- Develop skills in maintaining harmony among the family members.
- Acquire skills in traditional yogasanas leading to sound health.
- Behaves as a family member and leading to a blissful family life.
- Learnt Food is Medicine.

Course Content

RESTRAINT IN FAMILY 4Hours

Definition - Greatness of life force & mind. Introduction - Kayakalpa yoga -aim - maintaining youthfulness – sex & spirituality – ten stage of mind – mental frequency-method of concentration – kayakalpa philosophy - physical body – sexual vital fluid – life force – bio-magnetism - mind –food transformation into seven minerals – postponing the ageing process – death – importance of kayakalpa training.

SPIRITUAL DEVELOPMENT THROUGH GOOD FAMILY LIFE 4Hours

Kayakalpa exercise – methods –aswinimudhra – ojus breathing – explanations – benefits – practices – Responsibility of men and women – introduction a good education – need of morality – spiritual development.Revision of previous physical exercises. Introduction – hints & caution – body massaging – accu-pressure –relaxation.

PEACE IN FAMILY. 4Hours

Family value – meaning – Introduction – values – benefits of blessings – effect of vibrations – make blessings a daily habit – greatness of friendship – individual & family peace – reason for misunderstanding in the family – no comment – no command – no demand – no ego – peace of mind.

GREATNESS OF WOMANHOOD & FOOD IS MEDICINE 4Hours

Good–cultured behavioral patterns – love and compassion - Greatness of womanhood – Food is medicine (healthy food habits)

SIMPLIFIED PHYSICAL EXERCISES 7Hours

Simplified physical exercises – Kaya Kalpa Yoga (Benefits related to the Patient, Tolerance, Sacrifice)

MEDITATION & YOGASANAS 7Hours

Thuriya meditation – introduction – practice – benefits. Asanas– ashtanga yoga – pathanjali maharishi –hints & cautions – posture - movement – involvement – standing asanas: thadasana – ekapathasana – chakrasana(side) – uthkatasana – trikonasana. Sittingasanas: thandasana – padmasana – vajrasana – suhasana – siddhasana – parvathasana – yogamudhra.Downward lying asanas: makkarasana – bhujangasana – salabhasana –navukasana– dhanurasana. Upward lying asanas: savasana - arthapavanamukthasana– pavanamukthasana – utthanapathasana – navasana& Surya namaskara.

Theory:30Hr Tutorial: Hr Total Hours:30

REFERENCES

1. Yoga for Modern Age ---- Vethathiri Maharishi
2. The Man making Messages ---- Swami Vivekananda
3. Manavalakalai Part- 1&2&3 ---- Vethathiri Maharishi
4. Value Education for Health & Happiness and Harmony. ---- Vethathiriyam

SEMESTER IV

U13MA*T*402	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

Course Objectives

- To identify continuous time systems and signals that interacts with them.
- To apply laws of physics to derive simple models for real-life dynamic systems.
- To obtain system behaviour through model based simulation.
- To represent periodic signals using Fourier series and understand the significance of frequency spectra.
- To understand Fourier Transformation of aperiodic signals and the resulting continuous spectra.
- To infer linear time invariant system behaviour through state space as well as frequency domain models.

Course Outcomes

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

- Apply laws of Physics to model simple real life systems to predict its dynamic behavior
- Use Fourier analysis to identify the frequency characteristics of signals of interest.
- Use time domain and frequency domain methods to understand the inherent behavior of LTI systems
- Take up advanced courses on system dynamics, digital signal processing and design of feedback control systems

Course Content

REPRESENTATION OF SIGNALS AND SYSTEMS 3 Hours

Introduction to systems, signals and their interaction. Continuous time and discrete time signals, periodic and aperiodic signals, energy and power signals. Representation of simple systems with examples. Linear and nonlinear systems, Systems with and without memory, Time varying and time- invariant systems.

DYNAMIC SYSTEM MODELLING & SIMULATION 12 Hours

Lumped element modeling - Laws of Physics applied to Simple Mechanical Systems and RLC Electrical circuits. System State - State variables and forms of state equations. Matrix representation of state equations for linear dynamic systems – Free response and forced response. Time response from general system models through numerical integration. Use of Continuous System Simulation Tools (MATLAB).

PERIODIC SIGNALS AND FOURIER SERIES 7 Hours

Obtaining trigonometric Fourier series – Exponential Fourier Series –Fourier Spectra –

Parseval's Theorem- Linearity and time-shifting properties of Fourier Series.

FOURIER TRANSFORMS FOR APERIODIC SIGNALS 10Hours

Fourier Transform(FT) pair and equations relating them – Magnitude and phase spectra from Fourier Transforms – Linearity, time scaling , time shifting, time differentiation and integration properties of FTs - Parseval's Energy Theorem – Existence condition for FT.

ANALYSIS OF LINEAR TIME INVARIANT (LTI) SYSTEMS USING TRANSFORMS 13Hours

Impulse Response of LTI system- Convolution integral – FT for convolved time signals - Transfer function of LTI system using Fourier Transform – System gain and phase responses in sinusoidal steady state – Bode plots – Applications in Communication and Control – Analog filters.

Theory:45Hr **Tutorial: 15 Hr** **Total Hours:60**

REFERENCES

1. Mrinal Mandal and Amrit Asif, `Continuous and Discrete Time Signals and Systems', Cambridge University Press, 2007
2. P.D. Cha, J.J. Rosenberg & C.L. Dym, `Fundamentals of Modeling and Analyzing Engineering Systems', Cambridge University Press, 2000
3. W.Y. Yang et. al., `Signals and Systems with MATLAB', Springer, 2009
4. A.V. Oppenheim & A.S. Willsky, `Signals & Systems', PHI Learning Pvt.Ltd.,2011
5. V. Krishnaveni & A. Rajeshwari, `Signals & Systems',Wiley – India, 2012.

U13EI*T*401	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives

- Analyze circuits using operational amplifiers including the limitations imposed by non-ideal electrical characteristics.
- Introduce the basics of integrated circuits technology, types of IC's and their applications
- Introduce linear and non-linear applications of op-amps
- To design and simulate basic op-Amp circuits in MULTISIM or Pspice

Course Outcomes

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

- To acquire knowledge in identifying implementation areas of op-amps for specific purpose.
- To design and construct circuit's depending upon applications.
- Ability to design electrical circuits, devices, and systems to meet application requirements.

Course Content

INTRODUCTION TO OPERATIONAL AMPLIFIER 9 Hours

IC classification, fundamental of monolithic IC technology, Realization of MOS, CMOS and BJT ICs – packaging-Operational amplifier internal circuit-differential amplifier, low frequency small signal analysis of differential amplifier, current mirror circuit, current repeaters, level translator and output stage. open loop operation of Op-Amp, feedback- positive feedback, negative feedback, divided feedback

CHARACTERISTICS OF OPAMP 9 Hours

Ideal OP-AMP characteristics, inverting amplifier, non inverting amplifier, voltage follower, differential amplifier, DC characteristics, AC characteristics, voltage series feedback and shunt feedback amplifiers, differential amplifier; Basic applications of op-amp – summation, differentiator and integrator.

Simulation of DC and transient analysis of inverting and non inverting amplifier using Pspice. simulation of practical differentiator and lossy integrator using Pspice.

APPLICATIONS OF OPAMP 9 Hours

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit.

Simulation of frequency response of Ist order HPF and LPF. Design and simulation of Schmitt

trigger using multisim.

APPLICATIONS OF OPAMP **9 Hours**

A/D converter - (Dual slope, successive approximation and flash types.), D/A converter (R-2R ladder and weighted resistor types), 555 Timer circuit – Functional block, characteristics & applications;

Design and simulation of Monostable and Astable multivibrator using multisim

SPECIAL ICs and APPLICATION ICs **9 Hours**

IC 566- voltage controlled oscillator circuit; 565-phase lock loop circuit functioning and applications, Analog multiplier ICs. IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler electronic ICs.

Design a 12 V DC power supply using LM317 and LM 723.

Theory:45Hr **Tutorial: Hr** **Total Hours:45 Hr**

REFERENCES

1. Ramakant A.Gayakwad, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI.
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', IV edition, New Age, 2003.
3. Joseph.J.Carr,'Linear integrated Circuits', Elsevier 1st edition, 1996
4. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs', Pearson Education, 6th edition, 2002 / PHI.

U13EI*T*402	CONTROL SYSTEMS	L	T	P	C
		3	1	0	4

Course Objectives

- To understand the different methods of system representation and obtain the transfer function model for various types of systems
- To impart necessary knowledge in the time domain response and steady state error analysis
- To give basic knowledge in obtaining the open loop and closed–loop frequency responses
- To understand the concept of stability and methods of stability analysis
- To study the various methods of designing compensators for a control system

Course Outcomes

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

- To identify the mathematical model and find the transfer function of any system using various techniques such as block diagram reduction, signal flow graph etc.
- To identify any type of control system with respect to system stability in time domain as well as frequency domain.
- To analyze whether the system is stable or not using various methods like Routh Hurwitz criterion, Root Locus, Bode plot, Nyquist plot.
- To design compensators for control systems.

Course Content

PROCESS MODELING 12 Hours

Open loop and closed loop systems with examples – Elements of control system –Process modeling and transfer function representation - block diagram reduction technique – Signal flow graph.
Comparison between open loop and closed loop system

TIME DOMAIN ANALYSIS 8 Hours

Standard test signals -Time domain specifications – Steady state errors and error constants – Generalized error series – Dominant poles of transfer functions – P,PD, PI and PID models of feedback control systems.
Response of PID controller for standard error inputs using MATLAB.

FREQUENCY DOMAIN ANALYSIS 14Hours

Frequency response of systems - Frequency domain specifications - – Bode plot- Polar plot– Constant M and N circles – Nichols chart - Nichols plot.
Advantages of frequency response, frequency response analysis using MATLAB.

STABILITY OF CONTROL SYSTEMS 14 Hours

Concepts of stability – Characteristic equation – Routh-Hurwitz criterion – Root-Locus technique - Nyquist stability criterion.
Relationship between system parameter and pole location, stability analysis using MATLAB.

COMPENSATOR DESIGN 12 Hours

Design Specifications – Lag, lead and lag-lead networks – Cascade compensator design using time domain and frequency domain analysis.
Compensation analysis using MATLAB.

Theory:45Hr Tutorial: 15 Hr Total Hours:60

REFERENCES

1. J. Nagrath and M. Gopal, Control System Engineering, New Age International Publisher, 2010
2. K. Ogatta, Modern Control Engineering, Pearson Education, New Delhi, 2010
3. Benjamin C. Kuo, Automatic Control Systems, Prentice-Hall of India Pvt. Ltd. 2012
4. M. Gopal, Control System Principles and Design, Tata McGraw-Hill, 2012
5. M. N. Bandyopadhyay, Control Engineering Theory and Practice, Prentice Hall of India, 2009.

U13GS*T*001	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve biodiversity.

Course Outcomes

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

- Play a important role in transferring a healthy environment for future generations
- Analyse the impact of engineering solutions in a global and societal context
- Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
- Ability to consider issues of environment and sustainable development in his personal and professional undertakings
- Highlight the importance of ecosystem and biodiversity
- Paraphrase the importance of conservation of resources

Course Content

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES — 10 Hours

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

ECOSYSTEMS AND BIODIVERSITY — 14 Hours

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and

decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

ENVIRONMENTAL POLLUTION **8 Hours**

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT **7 Hours**

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

HUMAN POPULATION AND THE ENVIRONMENT **6 Hours**

Population growth, variation among nations – Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.

Field Work

Visit to local area to document environmental assets- river / grassland / hill / mountain, visit to local polluted site- urban / rural / industrial / agricultural, study of common plants, insects, birds, study of simple ecosystems-pond, river, hill slopes etc.,

Theory:45Hr **Total Hours:45**

REFERENCES

1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co., 2013
2. Masters G.M., and Ela W.P., Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India., 2002
4. Trivedi R.K and Goel P.K., "Introduction to Air pollution" Techno-science Pubications. 2003
5. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media. 1996
6. Cunningham, W.P., Cooper, T.H.., & Gorhani E., Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001
7. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998
8. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwell science Publishing Co., 2003
9. Syed Shabudeen, P.S. Environmental chemistry, Inder Publishers, Coimbatore. 2013

U13CS*T*304	OBJECT ORIENTED PROGRAMMING WITH C++	L	T	P	C
		3	0	0	3

Course Objectives

- To understand object-oriented programming features.
- To study the implementation of various features of OOP in C++.
- To illustrates solution of different problems using C++

Course Outcomes

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

- Define principles of Object Oriented programming [K1]
- Outline the merits and demerits of object oriented programming over the structure programming [K2]
- Develop solutions to a given problems using class object concepts[K3]
- Make use of overloading and inheritance concepts to solve real world problems[K3]
- Develop programs for all file and template related concepts[K3]

Course Content

9 Hours

Object-Oriented Paradigm - Elements of Object Oriented Programming – Merits and Demerits of OO Methodology – C++ fundamentals – Data types, Operators and Expressions, Control flow, Arrays, Structure and Functions.

9 Hours

Classes and Objects – Passing objects as arguments – returning objects – Friend functions – Static data and member functions - Constructors –Parameterized constructor – Destructor- Copy contractor- Array of Objects – pointer to object members.

9 Hours

Polymorphism – Function overloading – Unary operator overloading – binary operator overloading – Data Conversion- Overloading with Friend Functions. Inheritance –Derived class – Abstract Classes - Types of Inheritance.

9 Hours

Virtual functions – Need- Definition - Pure Virtual Functions – Virtual Destructors Template – Class template, Function Template.

9 Hours

C++ streams – console streams – console stream classes - formatted and unformatted console I/O operations – Manipulators File streams classes - File modes - File pointers and Manipulations - File I/O – Exception handling.

Theory:45Hr **Total Hours:45**

REFERENCES

1. K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, "Mastering C++", TMH, 2009.
2. Ira Pohl, “Object oriented programming using C++”, Pearson Education Asia, 2004
3. Bjarne Stroustrup, “The C++ programming language”, Addison Wesley, fourth edition, 2013
4. John R.Hubbard, “Progranning with C++”, Schaums outline series, TMH, 2003
5. E.Balagurusamy “Object Oriented Programming with C++”, 5th Edition,TMH 2/e,2011.

U13ME*T*405	APPLIED THERMODYNAMICS AND FLUID MECHANICS	L	T	P	C
		3	0	0	3

Course Objectives

- To expose the fundamentals of thermodynamics and to be able to use it in accounting for the bulk behavior of the sample physical systems.
- To integrate the basic concepts into various thermal applications like IC engines, gas turbines, steam boiler, steam turbine, compressors, refrigeration and air conditioning.
- Expected to gain knowledge regarding the fundamentals of fluid flow and their applications

Course Outcomes

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

- Demonstrate understanding of basic concepts of thermodynamics, heat transfer and engines.
- Understand the working of turbines and air conditioning systems.
- Solve problems in fluid properties and understand the working principle of pumps.

Course Content

BASIC OF THERMODYNAMICS AND HEAT TRANSFER 9 Hours

Thermodynamic systems – Types, Properties, State - process - Cycle – Equilibrium – Work and heat transfer – First law of thermodynamics for non flow process (closed system) – First law applied to Flow process (open system) - SFEE (Steady flow energy equation) – Second law of thermodynamics – Heat engines – Refrigerators and heat pumps(Descriptive only). Modes of Heat transfer- One dimensional Conduction heat transfer – composite walls, Convection heat transfer – Free and Forced convection- Cooling of electronic components: Thermoelectric cooling – Chip cooling.

IC ENGINES, STEAM BOILERS AND TURBINES 9 Hours

Air standard cycles: Otto, diesel and dual cycles efficiency derivation – I C Engine classifications - Working principle of four stroke and two stroke engines - Working principle of Spark Ignition and Compression Ignition engines

Formation of steam – properties of steam –of boilers – Mounting and accessories. Steam power cycle (Rankine), Steam turbines: Impulse and reaction principle (Descriptive only)

COMPRESSORS, REFRIGERATION AND AIR CONDITIONING 9 Hours

Reciprocating compressors, intercooling – multi stage with intercooling, Construction and working principle of centrifugal and axial flow compressors.

Refrigeration – Vapour compression cycle – Working principle, P-H and T-S diagram

(Descriptive only) – Air-conditioning systems – Basic psychrometry – Simple psychrometric processes – Types of air-Conditioning systems.

FLUID PROPERTIES AND FLOW KINEMATICS 9 Hours

Fluid properties – Viscosity – Surface Tension – Capillarity – Fluid Pressure and Pressure Head – Types of Fluid Flow – Flow Lines – Continuity Equation. Euler's equations – Bernoulli's Equation and Applications – Venturi meter, orifice meter and pitot tube, Energy losses in the flow – Pipes in series and parallel – Major and Minor Losses.

FLUID MACHINES 9 Hours

Pumps - definition and classifications - Centrifugal pump - Working Principle - performance curves, Reciprocating pump- Working principle. Turbines: Definition and classifications - Pelton turbine - Francis turbine - Kaplan turbine - working principles.

Theory:45Hr Total Hours:45

TEXT BOOKS

1. R. K. Bansal, Fluid Mechanics & Hydraulic Machines – Lakshmi PublicationsPvt., Ltd. 2006
2. S. Domkundwar, C. P. Kotandaraman & A. V. Domkundwar, Thermal Engineering, Dhanpat Rai & Co, 2002
3. P. K. Nag, 'Engineering Thermodynamics Tata McGraw Hill, New Delhi, 2003.
4. R. S. Khumi & J. K. Gupta, Thermal Engineering, S Chand & Co Ltd. 2006.
5. K. L. Kumar, Engineerng Fluid Mechanics, S. Chand & Company Ltd., 2002.
6. Rogers and Mayhew, "Engineering Thermodynamics – Work and Heat Transfer', Pearson Education Pvt., Ltd. New Delhi 2006.
7. P. N. Modi & S. M. Seth, "Hydraulic & Fluid Mechanics including Hydraulic Machines, Standard Book 2006.
8. Eastop and McConkey, 'Applied Thermodynamics', Peasrson Education Pvt., Ltd, New Delhi, 2002
9. Rajput, B. K. Sankaar, Thermal Engineering, S. Chand & Co. Ltd., 2003.

U13EI*P*401 INTEGRATED CIRCUITS LABORATORY L T P C

0 0 3 1

Course Objectives

- Analyze and design various applications of Op-Amp
- Design and construct waveform generation circuits
- Design timer, analog and digital circuits using op amps.
- To design combinational and sequential logic circuits using digital IC's

Course Outcomes

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

- Ability to Design basic application circuits using op-amp.
- Understand and implement the working of basic digital circuits
- Design timer, multivibrators and voltage regulators

LIST OF EXPERIMENTS

1. Study of flip flop. (JK, RS, D)
2. Implementation of combinational circuit 1.
3. Implementation of combinational circuit 2.
4. Design and Implementation of counters.
5. Design and Implementation of shift registers.
6. Op-Amp characteristics.
7. Op-Amp Application 1.
8. Op-Amp Application 2.
9. Design of astable, monostable multivibrator
10. Design and testing of low pass and high pass filter.
11. Application of IC voltage regulator.
12. Application of PLL.
13. Design and construction of a vending machine/ telephone exchange board using digital circuits.
14. Design and construct a triggering circuit for monostable multivibrator for PWM
15. Design and Fabrication of a +5 V DC power supply.

Total Hours:45

U13ME*P*405	THERMAL ENGINEERING AND FLUID MECHANICS LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- Expected to gain knowledge regarding the working of IC engines and refrigerators.
- Expected to gain knowledge regarding the fundamentals of fluid flow and their applications to flow through pipes and hydraulic machines.

Course Outcomes

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

- Conduct tests on engine performance.
- Study petrol and diesel engine working principles and conduct performance test on refrigerator.
- Examine the pump characteristics and conduct test on turbines.

LIST OF EXPERIMENTS

THERMAL ENGINEERING LABORATORY

1. Valve timing and port timing diagrams for IC Engines.
2. Performance test on a Petrol Engine.
3. Performance test on a Diesel Engine.
4. Heat Balance test on an IC Engine.
5. Performance test on a Refrigerator (Determination of COP)
6. Determination of heat transfer Coefficient (Free and forced convection)

FLUID MECHANICS LABORATORY

1. Determination of the Coefficient of discharge of a given Orifice meter.
2. Determination of the Coefficient of discharge of a given Venturi meter.
3. Study on Characteristic curves of centrifugal pump
4. Study on Characteristic curves of Reciprocating pump.
5. Study on Performance characteristics of Pelton wheel.
6. Study on Performance characteristics of Francis turbine.

Total Hours:45

U13GH*P*401	PROFESSIONAL VALUES(Common to all branches of Engineering and Technology)	L	T	P	C
		1	0	1	1

Course Objectives

- To know the 5 Cs (Clarity, courage, confidence, commitment, compassion)
- To Know the 5 Es(Energy, Enthusiasm, Efficiency, Enterprise, Excellence)
- To Practice the IQ Questions and given to the result
- To Learn about Professional Ethics
- To know the examples for Self Control

Course Outcomes

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

- Acquire knowledge on the Clarity, courage, confidence, commitment, compassion for a good Professionalize
- Demonstrate Skills of IQ test
- Contribute to the better Management of Time
- Behave a good Professionalism from Quality Enhancement

COURSE CONTENT

PERSONALITY CONCEPTS - 5C'S & 5E'S 5 Hours

Personality-concepts, definition,-types of personality-personality development activities- how to develop a good personality factors affecting personality development tools of improve personality-steps to a dynamic personality-5 C's and 5 E's

TIME MANAGEMENT 5 Hours

Self-development – importance of self development – how to develop oneself – continuous learning – laser focus +persistence – working a plan – sound mind follows sound body – complete responsibility – practice – those who make it, made it – never give-up – meditation – ten commandments of self development – self control technique for teenagers.

LEADERSHIP TRAITS 5 Hours

Leadership traits – style – factors of leadership – principles of leadership - time management – importance of time management – benefits – top five time sucks of the average Human –time management for college students. Passion for excellence – what is passion? – Why passion? – Value of life – index of life – fuel for fulfillment – secret of physical & spiritual fitness – improves learning ability.

EMPOWERMENT OF MIND 5 Hours

IQ, - Factors affecting the intelligence quotient – IQ and the brain – sex – race – age – relationship between IQ & intelligence – how to develop good intelligence quotient power – exercise can improve IQ – food plan to increase IQ – meditation – reading – playing – try right with opposite hands – learn new things - the IQ tests. EQ – emotional Intelligence – list positive & negative emotions. SQ – spiritual quotients – definition – basic science of spiritual quotient – how to build SQ? – Relationship between IQ, EQ, SQ.

MEDITATION **3 Hours**

Panchendhriya meditation – Introduction – practice – benefits.

SIMPLIFIED PHYSICAL EXERCISE& YOGASANAS **7 Hours**

Asanas – revision of previous asanas–standing asanas: natarasana –virabhadrasana – pathangusthasana– ardhachandrasana–utthithatrikonasana–parsvakonasana.

Theory:30Hr **Total Hours:30**

REFERENCES

1. Personality & Self Development –ICFAI University
2. Leadership-Dr.A Chandra Mohan
3. Intelligence-Swami Vivekananda
4. Ways to make every second valuable- Robert W. Bly
5. Manavalkkalai Part-II-Vethathiri Maharishi
6. Professional Ethics& Human Values-D.R Kiran&S.Bhaskar
7. Extraordinary performance from ordinary people- Keith Ward& Cliff Bowman,
8. Mind-Vethathiri Maharishi.
9. Manavalkkalai Part-I-Vethathiri Maharishi,
10. Self Cotrol-Russell Kelfer

SEMESTER V

U13EI*T*501	MICROPROCESSOR AND MICROCONTROLLER	L	T	P	C
		3	1	0	4

Course Objectives

- To study the Architecture of 8085 and 8051.
- To study the addressing modes and instruction set of 8085 & 8051.
- To develop skill in program writing for 8051and 8085 and their applications.
- To develop skills in interfacing memory, I/O devices and peripheral ICs.

Course Outcomes

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

- Explain the architecture of 8085 microprocessor and 8051 microcontroller.
- Differentiate between microprocessor and microcontroller.
- Use knowledge of architecture of 8085 and 8051 to write simple programs for arithmetic and logical operations
- To write programs for memory interfacing, I/O devices and peripheral IC's to interface with 8085 and 8051

Course Content

8085 PROCESSOR 12 Hours

Functional block diagram - Signals – Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure

PROGRAMMING OF 8085 PROCESSOR 12Hours

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions stack

Simulation programs using the above concepts

PERIPHERAL INTERFACING 12 Hours

Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter – Interfacing with 8085 - A/D and D/A converter interfacing

MICRO CONTROLLER 8051 12 Hours

Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer –I/O ports – Serial communication

MICRO CONTROLLER PROGRAMMING & APPLICATIONS 12 Hours

Data Transfer, Manipulation, Control & I/O instructions – key board and display interface – Closed loop control of servo motor - stepper motor control-brief introduction to PIC microcontroller, arduino, beagle bone , raspberry pi modules
Simulation programs using arithmetic and logical operations

Theory:45 Hrs **Tutorial:15 Hrs** **Total Hours:60Hrs**

REFERENCES

1. S. Gaonkar, 'Microprocessor Architecture Programming and Application', Penran International publishing private limited, 5th edition.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education, 5th Indian reprint, 2003
3. N.K.Srinath, '8085 Microprocessor Programming and Interfacing', PHI Learning Pvt Ltd, 2010.
4. V.Udayashankara, M.S Mallikarjunaswamy, 'MicroController Hardware, Software and Applications', Tata McGraw Hill Education Pvt Ltd, 2009

U13EI*T*502	INDUSTRIAL INSTRUMENTATION-I	L	T	P	C
		3	0	0	3

Course Objectives

- To get an adequate knowledge about various techniques used for various parameters of measurement in Industries.
- To provide exposure to various measuring techniques for vibration, density.
- To acquire knowledge about the principles of humidity, moisture and viscosity measurements
- To learn the working of different types of temperature and pressure transducers
- To understand, analyze and design various measurement schemes that meet the desired specifications and requirements of real time processes

Course Outcomes

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

- Understand the construction and working principle of various type of transducers/sensor to measure physical quantities.
- Ability to analyze, formulate and select suitable sensor for the given applications.
- Understand technical terms and nomenclature used in industrial measurement and industrial process control
- Understand the principles of industrial processes, process measurement , and process control
- Demonstrate a working knowledge of safety practices used in the measurement and control of industrial processes
- Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes

Course Content

PRESSURE MEASUREMENT I 9 Hours

Manometers – Different types – Mechanical pressure measurements – Bourdon tube, bellows and Diaphragms – Electrical pressure elements – Piezo resistive sensor –Differential capacitance sensor- Resonator sensor – Force balance transmitter - Differential pressure transmitter and its applications. Design a pressure sensor to measure stream pressure

measurement in a boiler.

PRESSURE MEASUREMENT II **9 Hours**

Measurement of vacuum – McLeod gauge – Knudsen gauge – thermal conductivity gauges – Ionization gauge cold cathode and hot cathode types – Electrical pressure transmitter – testing and calibration of pressure gauges – dead weight tester. Demonstrate the working of various pressure gauges

TEMPERATURE MEASUREMENT I **9 Hours**

Definitions and standards- Primary and secondary fixed point–Calibration of thermometer, different types of filled in system thermometer-Sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics –Three lead and four lead RTDs – Temperature switches. Develop a procedure for thermometer compensation

TEMPERATURE MEASUREMENT II **9 Hours**

Thermocouples – Laws of thermocouple – Fabrication of industrial thermocouples – Signal conditioning of thermocouples output – Thermal block reference functions – Commercial circuits for cold junction compensation – Special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two colour radiation pyrometers. Design a signal conditioning circuit for thermocouple output range of 0v-10v

MISCELLANEOUS MEASUREMENT **9 Hours**

Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometer – Calibration of vibration pick-ups – Units of density, specific gravity used in industries – Baume scale, API scale – Types of densitometer – Viscosity terms & ITS types –Humidity measurement. Construct a seismic sensor for measurement of landslide.

Theory: 45 Hrs **Total Hours:45**

REFERENCES

1. D.P. Eckman, "Industrial Instrumentation" CBS Publishers & Distributors, 2006
2. Bela G. Liptak "Process measurement and Analysis" CRC Press, 27-Jun-2003 - Technology & Engineering
3. Gregory K. McMillan, Douglas Considine**, "**Process/Industrial Instruments and Controls Handbook" McGraw Hill Professional, 5th Edition, 2004
4. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 2011.
5. Ernest O. Doebelin, Measurement systems Application and Design, McGraw Hill Book Company, New York, 2007.

U13EI*T*503 **PROCESS CONTROL** **L T P C**

3 1 0 4

Course Objectives

- To understand the procedure for modelling different processes.
- To study about the procedures of different control strategies.
- To distinguish the different controller tuning methods.
- To understand the Operations of Different Control Loops.
- To study about the operations of final control element.

Course Outcomes

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

- Identify the basic components of a Process Control.
- Distinguish between the servo and regulatory operations & Self Regulation and Integrating process
- Compute the Mathematical Model for different process.
- Distinguish the characteristics of different types of Control Strategies.
- Analyze the behaviour of different control loops.
- Identify the basic components of a final control element and distinguish the different characteristics of control valve.

Course Content

INTRODUCTION TO PROCESS CONTROL 12 Hours

Need for Process Control – Mathematical Model of First order Level, Pressure and Temperature Processes —higher order process - Interacting and Non Interacting Systems – Degrees of freedom - Continuous and Batch Process – Self Regulation and Integrating process– Servo and Regulatory Operation

CONTROL ACTIONS AND CONTROLLERS 12 Hours

Basic Control actions – Characteristics of On Off, Single Speed Floating, Proportional, Integral and Derivative Control Modes – P+I, P+D, P+I+D Control Modes Pneumatic and electronic Controllers to realize various control actions.

OPTIMUM CONTROLLER SETTINGS 12 Hours

Evaluation Criteria – IAE, ISE, ITAE and ¼ Decay ratio – Determination of Optimum settings for mathematically described processes using time response and frequency response – Tuning – Process Reaction Curve Method – Ziegler Nicholas Method – Damped Oscillation Method.

MULTI LOOP CONTROL 12 Hours

Feed Forward Control – Ratio Control – Cascade Control – Inferential Control – Split Range Control – Introduction to Multivariable Control – Examples from Distillation Column and

Boiler Systems.

FINAL CONTROL ELEMENT 12 Hours

I/P Converter – Pneumatic and Electric Actuators – Control Valves – Characteristics of Control Valves – Construction – Valve Body – Control Valve Sizing – Cavitation and Flashing – Selection Criteria – Valve Positioner.

Theory:45 Hrs **Tutorial: 15 Hrs** **Total Hours:60 Hrs**

REFERENCES

1. Stephanopoulos G, "Chemical Process Control", Prentice Hall of India, New Delhi, 2000.
2. Coughanowr, D.R., "Process Systems Analysis and Control", McGraw – Hill International Edition, 2004.
3. Curtis D Johnson, "Process Control Instrumentation", Prentice Hall India, New Delhi, 2003.
4. Eckman D P, " Automatic Process Control", Wiley Eastern Ltd., New Delhi, 1993
5. Pollard A, "Process Control", Heinemann Educational Books, London, 1971
6. Harriott P, "Process Control", Tata McGraw-Hill Publishing Co., New Delhi, 1991.
7. Considine D M Process/Industrial Instruments and Control Handbook, Fifth Edition, McGraw Hill, New Delhi – ISBN -0-07-012582-1
8. Paul W Murril, "Fundamentals of Process Control Theory", Third Edition, ISA Press, New York.

U13EI*T*504	COMMUNICATION THEORY AND ACQUISITION SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To explain various modulation techniques.
- To introduce the concept of Data Acquisition.
- To learn the various communication buses used in Industrial Automation.

Course Outcomes

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

- Explain the concept of Analog modulation and demodulation techniques.
- Explain the various buses used in data acquisition system.
- Design of practical communication system at the block diagram level under Certain constraints and requirements.

Course Content

AM SYSTEM **10 Hours**

Introduction-Amplitude modulation Theory – Frequency Spectrum – Representation – Power relation –AM Generation – plate Modulated class C amplifier – Evolution and description of SSB – Balanced modulator – Advantages of SSB Transmission – AM transmitter – AM envelope detector –Superhetrodyne receiver

FM SYSTEM **8 Hours**

Frequency modulation – phase modulation –Armstrong method of FM generation – Radio Detector – FM Transmitter – FM broadcast receiver – comparison of wideband and narrow band FM

DIGITAL COMMUNICATION SYSTEM **9 Hours**

Advantages of digital data transmission – Sampling – pulse code modulation – channel coding – line coding – Digital Modulation schemes: ASK, FSK, QPSK –Digital Communication Receiver – Synchronisation

NOISE THEORY **9 Hours**

SNR, Noise in AM and FM receivers, Noise in FM reception, FM Threshold effect, Pre-emphasis and de-emphasis, Noise in PCM system, Destination SNR in PCM system with quantization and channel noise, output SNR in DM system

DATA ACQUISITION BUSES **9 Hours**

Serial Interface standard – RS 232,USB, I^2C, PCI,PXI,ISA,CAN

Theory: 45 Hrs **Total Hours:45 Hrs**

REFERENCES

1. Kennady G and Davis, "Electronic Communication System" Tata McGraw Hill Inc, New Delhi, 4th edition,
2. Wayne Tomasi,"Advanced Electronic Communication Systems" PearsonEducation,New Delhi,6th edition 2004
3. Theodore. S.Rappaport, "Wireless communications – Principles and Practices", Pearson Education India,2nd edition,2009
4. S.Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2000.
5. H.Taub & D.Schilling, "Principles of Communication System", 2nd Edition, Tata McGraw Hill, 1991.
6. N.Mathivanan, "PC-Based Instrumentation: Concepts and Practice"Prentice Hall of India limited,New Delhi,2007.
7. Rajkamal,S 'Embedded System – Architecture, Programming, Design', Tata McGraw Hill, 2008.

U13EI*T*505	DIGITAL CONTROL SYSTEM	L	T	P	C
		3	1	0	4

Course Objectives

- To understand the concepts of discrete time system, their representation, analysis methods
- To get familiarized with the design procedures for digital controllers and compensators

Course Outcomes

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

- Describe a discrete time system by difference equations
- Estimate the response of a discrete time system for any given input
- Analyze the stability of a given system with varying sampling time periods
- Apply the design procedures to obtain a digital controller meeting the desired specifications
- Describe some of the digital control systems in use

Course Content

SAMPLED DATA CONTROL SYSTEM 12 Hours

Z- transforms-inverse Z-transform sampled data control system – discrete time system representation using difference equations-response of linear discrete systems-solving difference equations, using z-transform – pulse transfer function-Zero Order Hold-steady state error analysis.

STABILITY ANALYSIS 15 Hours

Concept of poles and zeroes –relationship between Z-domain and S-domain- Bilinear transformation –Jury's stability test- stability analysis using root locus –Z domain Nyquist stability - Transient response specifications-frequency response specifications
Simulation using MATLAB

DIGITAL CONTROLLER DESIGN 12 Hours

Digital PID controller-Positional and velocity form-realization of digital controllers- Digital controller design using - root locus, Bode plots –Design of digital PI and PID controllers - realizability of digital controllers

INTRODUCTION TO ADVANCED CONTROL SCHEMES 12 Hours

Internal Model Control – predictive Control – Optimal Control –Adaptive Control.

APPLICATIONS 9 Hours

Implementation of control algorithms for microprocessor based position, temperature control system –Case study -Hard disk read/write head controller.

Theory: 45 Hrs **Tutorial: 15 Hrs** **Total Hours: 60Hrs**

REFERENCES

1. Ogata,K."Discrete time Control Systems",2nd Edition, Eastern Economy Edition,2005
2. Gopal,M.,"Digital Control and State Variable Methods", Tata McGraw Hill,2003
3. Kuo,B.C,"Digital Control Systems", 2nd Edition , The Oxford University Press,2005

U13EC*T*511	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	1	0	4

Course Objectives

- Understand and analyze the characteristics of discrete signals and systems
- Apply mathematical tools for signal / system analysis
- Design digital filters.
- Learn the architecture and features of P-DSPs

Course Outcomes

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

- Understand the characteristics of discrete-time signals and discrete systems (K1)
- Analyze signal / system properties using mathematical tools (K2)
- Apply and develop algorithms for digital systems (K3)
- Illustrate efficient computation of DFT (K3)
- Discuss advanced features and architecture of generic P-DSP (K2)

Course Content

DISCRETE TIME SIGNALS AND SYSTEMS 12 Hours

Representation of a CT signal by samples – Sampling theorem – Reconstruction of a signal from its samples – Aliasing – DT Signals – Impulse, Step, Pulse, Sine, Exponential – Properties of DT signals - Transformation of independent variable – Shifting, scaling, folding - Discrete Time LTI systems – Properties – Impulse response – Convolution sum – Properties of Convolution.

Z-TRANSFORM AND SYSTEM ANALYSIS 12 Hours

DTFT – Properties - Z transform – Forward Transform - Inverse Transform using Partial Fractions - Properties – Pole-Zero plot – Difference Equations - Transfer function - Analysis of Discrete Time systems using DTFT and Z Transform.

DISCRETE FOURIER TRANSFORM 12 Hours

Introduction to DFT– Properties of DFT – Efficient computation of DFT – FFT algorithms – Introduction to Radix-n algorithms - Radix-2 FFT – Decimation-in-Time and Decimation–in-Frequency algorithms – Butterfly diagram.

DESIGN OF DIGITAL FILTERS 12 Hours

FIR filter design: Linear phase characteristics - Windowing Technique –Rectangular, Hamming, Hanning, Blackmann windows – IIR filter design: Analog filter design - Butterworth and

Chebyshev approximations – Impulse invariance and Bilinear transformations - FIR and IIR filter structures – Direct form I and II - cascade and parallel forms – Finite Precision effects.

ADVANCED TOPICS AND PROGRAMMABLE DSP CHIPS 12 Hours

Concepts of multi-rate signal processing – Decimation and interpolation by integer factor – Sampling rate conversion – Introduction to DSP architecture - Von Neumann, Harvard, Modified Harvard architectures - MAC unit – Multiple ALUs Modified Bus structures and memory access schemes in P-DSP – Multiple access memory – Multi-ported memory – VLIW architecture - Pipelining – Special addressing modes

Theory: 45 Hrs **Tutorial:15Hrs** **Total Hours:60Hrs**

REFERENCES

1. Mrinal Mandel and Amir Asif, "Continuous and Discrete Time Signals and Systems", Cambridge International Student Edition, Cambridge University Press, 2007.
2. John G.Proakis and Dimitris G.Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", PHI, 3rd Edition. 2000.
3. B. Venkataramani, M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications", Tata McGraw Hill, New Delhi, 2003. (Unit V)
4. Johny R.Johnson, "Introduction to Digital Signal Processing", PHI, 2009.
5. Won Y. Yang et. Al., "Signals and Systems with MATLAB", Springer International Edition, 2009
6. Steven W. Smith, "The Scientists and Engineer's Guide to Digital Signal Processing", California Technical Publishing, 1997.
7. James H. McClellan, Ronald W. Schafer, Mark A. Yoder, "Signal Processing First", 2nd Edition.

U13EI*P*501	MICROPROCESSOR & MICROCONTROLLER LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To develop programming skills in 8085 microprocessor and 8051 microcontroller.
- To develop programming skills in peripheral interfacing.

Course Outcomes

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

- Understand the usage of various instruction formats of 8085 and 8051
- Develop and test the assembly language program for a given problem.
- Identify the type of peripherals to be interfaced to a processor/controller for a given design and write the instructions to execute the logic needed

Course Content

LIST OF EXPERIMENTS

8-bit Microprocessor

1. Arithmetic operations – Addition, subtraction, multiplication and division
2. Programming with Control instructions – Ascending, descending, maximum and minimum.
3. Hex / ASCII / BCD code conversions
4. Design of Traffic Light Controller with 8255 Interface
5. A/D Interface Experiments
6. Serial Communication using 8251 Interface

8-bit Microcontroller

7. Demonstration of basic instructions with 8051 Micro controller execution, including: Conditional jumps, looping
8. Stepper motor Interfacing with 8051 using port 1
9. Interface with D / A converter
10. Programming Exercise on RAM direct addressing
11. Programming Exercise on SFR Bit Addressing
12. Interface multiplexed display with 8051

Total Hours : 45 Hours

U13EI*P*502	DATA ACQUISITION AND SIMULATION LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To acquire knowledge about design of filters used in signal conditioning.
- To demonstrate methods of real time data acquisition.
- To analyze real time data for various applications.

Course Outcomes

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

- Analyze various filters for different applications.
- Formulate methods of real time data acquisition.
- Predict action to be taken based on data obtained.

Course Content

LIST OF EXPERIMENTS

1. Design and simulation of RLC filter circuits.
2. Acquisition and analysis of real time ECG signal.
3. Measurement and detection of strain relief using EMG signal.
4. Speed control of a DC motor using LabVIEW.
5.Tank level control using LABVIEW.
6. Data acquisition of a given sensor using NI DAQ card
7. ON/OFF Temperature control of a water bath using NI DAQ card
8. Development of simple database application and publishing it in the web.
9. Image processing using LabVIEW
10. Design of virtual oscilloscope
11. Data acquisition and storage using file handling tools.

Total Hours : 45 Hours

U13EN*P*501	COMMUNICATION SKILLS LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To impart communicative ability to exhibit the individual's subject knowledge
- To achieve the desirable communicative competence by the students to meet the expectation of corporate
- To show the need for a comprehensive link language to share subject expertise
- To offer adequate exposure to soft skills needed for the corporate.
- To sensitize towards corporate culture.

Course Outcomes

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

- Imparting the role of communicative ability as one of the softskills needed for placement
- Developing communicative ability and softskills needed for placement
- Making students Industry-Ready through inculcating team-playing capacity

Course Content

GRAMMAR IN COMMUNICATION 9 Hours

Grammar and Usage – Building Blocks, Homonyms, Subject and Verb Agreement, Error Correction - Grammar Application, Framing Questions – Question words, Verbal Questions, Tags, Giving Replies –Types of Sentences, Listening Comprehension –Listening and Ear training.

ASSERTIVE COMMUNICATION 9 Hours

Listening Comprehension in Cross–Cultural Ambience, Telephonic Conversations/Etiquette, Role Play Activities, Dramatizing Situations- Extempore – Idioms and Phrases.

CORPORATE COMMUNICATION 9 Hours

Video Sensitizing, Communicative Courtesy – Interactions – Situational Conversations, Time Management, Stress Management Techniques, Verbal Reasoning, Current Affairs – E Mail Communication / Etiquette

PUBLIC SPEAKING 9 Hours

Giving Seminars and Presentations, Nuances of Addressing a Gathering - one to one/ one to a few/ one to many, Communication Process, Visual Aids & their Preparation, Accent Neutralization, Analyzing the Audience, Nonverbal Communication.

INTERVIEW & GD TECHNIQUES 9 Hours

Importance of Body Language –Gestures & Postures and Proxemics, Extempore, Facing the Interview Panel, Interview FAQs, Psychometric Tests and Stress Interviews, Introduction to GD, Mock GD Practices.

Total Hours:45 Hrs

REFERENCES

1. Bhatnagar R.P. & Rahul Bhargava, "English for Competitive Examinations", Macmillian Publishers, India, 1989, ISBN: 9780333925591
2. Devadoss K. & Malathy P., "Career Skills for Engineers", National Book Publishers, Chennai, 2013
3. Aggarwal R.S., "A Modern Approach to Verbal & Non–Verbal Reasoning", S.Chand Publishers, India, 2012, ISBN : 8121905516

U13GH*P*501	SOCIAL VALUES	L	T	P	C
		1	0	1	1

Course Objectives

- To produce responsible citizens to family and society
- To uplift society by pure politics and need education
- To realize the value of unity, service
- To immunize the body
- To get Divine peace through inward travel

Course Outcomes

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

- Learn knowledge on the Duties and responsibilities
- Demonstrate skills required for the Disparity among human being
- Behave as a responsible Politics and Society & Education and Society
- Analyze Impact of Science in Society

Course Content

RESPONSIBLE CITIZENS TO FAMILY AND SOCIETY 5 Hours

Evolution of man - evolution of universe – creating theory – evolution theory – theory permanence theory – mithya – maya or illusion – evolution of living being –

POLITICS AND NEED EDUCATION 5 Hours

Human being & group – unity of man in society – relationship between individual – society.

DEVELOPMENT OF SCIENCE, EDUCATION & ECONOMICS 5 Hours

Duties and Responsibilities- Duty to self, family, society and world – politics & society – education & society – case study and live example – impact of science, economic & society.

DISPARITY AMONG HUMAN BEINGS 5 Hours

Disparity among human beings – seven values – bodily structure – character of personality – advancement of knowledge or intellectual clarity – fame of service – physical strength –health – financial status. sixteen factors heredity – food – historical age – place of living – education – work – government – art – effort – physical age – friendship – opportunity – research – practice – accepted sentiments of society – morality.

SERVICE AND SACRIFICE 3 Hours

Social welfare – need – pure & pure society**.**

YOGASANAS & MEDITATION 7 Hours

Pancha bhootha navagraha meditation – Introduction – practice – benefits.Sitting asanas:

mahamudhra – ustrasana– gomukhasana– matsyasana –ArdhaMatsyendrasana.Upward lying asanas: setubhandasana–viparitakaranai – sarvangasana – halasana. Downward lying asanas: arthasarvangasana – adhomukhasvanasana–padmamayura

Theory: 30 Hrs **Total Hours:30 Hrs**

REFERENCES

1. World peace plane ---- Vethathiri Maharishi
2. Prosperous India ---- Swami Vivekananda
3. Samudhaya chikkalukkana nala Aaivugal ---- Vethathiri Maharishi
4. World Community Life ---- Vethathiriyam

SEMESTER VI

U13EI*T*601	BIO-MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives

- To develop an adequate knowledge in electro- physiological measurements.
- To acquire knowledge in non electrical parameters
- To acquire knowledge in medical imaging, PMS, assisting and therapeutic equipments.

Course Outcomes

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

- To choose the appropriate instrument required for measurement of any non-electrical , physiological parameter
- To interpret the outcome of any instrument and analyse the stability of the quantity measured

Course Content

PHYSIOLOGY OF SYSTEMS AND ELECTRODES 9 Hours

Man Instrument system-Physiology systems of the body. Bioelectric potential – Resting and action potential – Biopotential electrodes – different types of electrodes – Equivalent circuits for electrodes-Biochemical Transducers

ELECTRO – PHYSIOLOGICAL MEASUREMENTS 9Hours

ECG Machine– Lead systems, Signal Conditioning, recording methods and Typical waveforms. EEG Machine– Lead systems, Signal Conditioning, recording methods and Typical waveforms. EMG Machine – Lead systems, Signal Conditioning, recording methods and Typical waveforms. Simulation of ECG and EMG signal using LABVIEW.

NON-ELECTRICAL PARAMETER MEASUREMENTS 9Hours

Measurement of blood pressure – Cardiac output – Cardiac rate – Heartsound – Respiratory rate –Blood PCO& PO_2 Measurement, pH of blood, plethysmography. Simulation of Blood pressure measurement using LABVIEW.

MEDICAL IMAGING AND PMS 9Hours

X-ray machine - Radio graphic and fluoroscopic techniques – Computer tomography– MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Electrical safety. Processing of bio images using LABVIEW

ASSISTING AND THERAPEUTIC EQUIPMENTS 9 Hours

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators –Diathermy –

Heart – Lung machine – Audio meters – Dialyzers.

Design a simple therapeutic device.

Theory:45Hr **Total Hours:45**

REFERENCES

1. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II Edition, Pearson Education, 2011 / PHI.
2. R.S.Khandpur, 'Handbook of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003, 2nd edition
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 2007.3rd edition.
4. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2001.
5. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumenta- tion', John Wiley & Sons, 1975.3rd edition.

U13EI*T*602 INDUSTRIAL INSTRUMENTATION-II L T P C

3 1 0 4

Course Objectives

- To study, understand and design of various types of flow meters.
- To understand the different types of level measurements adopted in industrial and various types of power plant environment.
- To understand, analyze and design various measurement schemes that meet the desired specifications and requirements of real time processes
- To identify, select and design a suitable measurement techniques for process industries(petroleum, oil and refinery, chemical, cement).
- To get an adequate knowledge about industrial safety environment.

Course Outcomes

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

- Understand the construction and working principle of various type of transducers/sensor to measure physical parameters.
- Ability to analyze, formulate and select suitable sensor for the given applications.
- Understand technical terms and nomenclature used in industrial measurement and industrial process control
- Understand the principles of industrial processes, process measurement , and process control
- Demonstrate a working knowledge of safety practices used in the measurement and control of industrial processes
- Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes

Course Content

LEVEL MEASUREMENT 12 Hours

Definition of level – visual indicators – float gauges - different types – level switches – level measurement using displacer and torque tube – bubbler tube – boiler drum level measurement – hydra step systems – electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors – Rader level – Laser level –magnetostrictive level – weight - measurement of level of solids – paddle wheel type - differential pressure method. Analyze the performance of various types of level sensor to measure liquid level in a boiler drum level measurement.

FLOW MEASUREMEMT I **12Hours**

Theory of fixed and variable head type flow meters – Orifice plate – types of Orifice plates, pressure tapping and CD variations – Venturi tube – flow nozzle – dall tube – piping arrangement for different fluids- pitot tube – proper installation – variable area flow meter – laminar flow meter. Demonstrate the working of DPT for pressure based flow meters.

FLOW MEASUREMEMT I **12Hours**

Positive displacement flow meters - constructional details and theory of reciprocating piston, oval gear and helix type flow meters – Inferential meter – turbine flow meter – nutating disc – rotameter – theory and installation – angular momentum mass flow meter – coriolis mass flow meters – thermal mass flow meters – volume flow meter and density measurement-dynamic weighing method. Demonstrate the working of Rotameter for various flow rates.

EMI FLOW MEASUREMENT III **12Hours**

Principle and constructional details of electromagnetic flow meter – different types of excitation schemes used – different types of ultrasonic flow meters – laser Doppler anemometer – vortex shedding flow meter – target flow meter – solid flow rate measurement – guidelines for selection of flow meter. Electromagnetic flow meter demonstration by animation video.

INDUSTRIAL SAFETY MEASUREMENT **12 Hours**

Introduction – electrical hazards – hazardous areas and classification – Non hazardous areas, enclosures – NEMA types – fuses and circuit breakers – protection methods: purging, explosion proofing and Intrinsic safety. Specification of instruments – preparation of project documentation – process flow sheet, Instrument index sheet – Instrument specification sheet – panel drawing and specifications. Electromagnetic Interference and earth loops.

Theory:45Hr **Tutorial: 15Hr** **Total Hours: 60**

REFERENCES

1. D.P. Eckman, "Industrial Instrumentation" CBS Publishers & Distributors, 2006
2. Bela G. Liptak "Process measurement and Analysis" CRC Press, 27-Jun-2003 - Technology & Engineering
3. Gregory K. McMillan, Douglas Considine**, "**Process/Industrial Instruments and Controls Handbook" McGraw Hill Professional, 5th Edition, 2004
4. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 2011.
5. D. Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi,2011
6. Ernest O. Doebelin, Measurement systems Application and Design, McGraw Hill Book Company, New York, 2007

U13EI*T*603	ADVANCED INDUSTRIAL CONTROLLERS	L	T	P	C
		3	1	0	4

Course Objectives

- To give an introductory knowledge about PLC and the programming languages
- To give knowledge about of application of PLC
- To give basic knowledge on architecture of SCADA.

Course Outcomes

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

- To describe the architecture of PLC
- To program on basic ladder logic diagram using timer and counters.
- To describe the study of SCADA system.

Course Content

INTRODUCTION TO PLC **12 Hours**

Definition and history of PLC , Overall PLC system, PLC Input and output modules , central processing unit , CPUs and Programmer/monitors, the processor , input modules (Interfaces), power supplies , PLC advantages and disadvantages , selection criteria for PLC, Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, output analog devices.

PROGRAMMING OF PLC **12Hours**

Methods of Programming. Programming equipments, construction of PLC ladder diagram, Basic components & their symbols in ladder diagram, Fundamental of ladder diagram, Boolean logic &relay logic, and analysis of rungs. Timers and counters, programming with timers and counters.Simulation of Ladder Logic Programs using PSIM

ADVANCED PLC FUNCTIONS **12Hours**

Analog PLC operation, PID control of continuous processes, simple closed loop systems, problems with simple closed loop system, PLC interface operation.

APPLICATION OF PLC **12 Hours**

Instructions in PLC , program control instruction ,math instruction, sequencer instruction , use of PC as PLC , application of PLC, case studies of bottle filling system. Simulation of Applications using PSIM. Comparison of features of different Industrial PLCs

SCADA SYSTEM **12 Hours**

Introduction and definition of SCADA, basic architecture of SCADA, human machine

interface, Master terminal unit, Remote terminal unit , SCADA data transfer through PLC, communication technologies, communication system components.

Theory:45Hr **Tutorial: 15Hr** **Total Hours:60**

REFERENCES

1. Petrezeulla, "Programmable Controllers", McGraw-Hill, 2004
2. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes, 1st Edition, 2004
3. Hughes, T., "Programmable Logic Controllers", ISA Press, 2000
4. John W. Webb, Ronald A.Ries, "programmable logic controllers: Principle and application " 5th Edition.
5. Ronald L.Kurtz, "securing SCADA System", Wiley publishing.

U13EI*T*604	PROCESS DYNAMICS AND CONTROL	L	T	P	C
		3	0	0	3

Course Objectives

- To get adequate knowledge about the dynamics and control of Heat Exchangers and Boilers
- To understand the different control schemes in boiler optimization
- To acquire knowledge about the stability and control of reactors
- To understand the operations of different process industries

Course Outcomes

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

- Distinguish various dynamics and control techniques to different processes.
- Analyze the stability for Chemical Reactors.
- Identify the principles and practices for system design and development to plant operations.

Course Content

DYNAMICS AND CONTROL OF HEAT EXCHANGERS 9 Hours

Basic control strategies, dynamics of the heat exchangers, response to changes in steam temperature, measurement lag and control schemes

DYNAMICS AND CONTROL OF BOILERS 9Hours

Boiler basic controls (safety interlocks, single element, two and three element level control, shrink, swell effect, inverse response, feed forward control of feed water, dynamic compensation, fuel–air ratio, stochiometric calculations, steam temperature and pressure control) Boiler dynamics, burner management system, boiler optimization

STABILITY AND CONTROL OF CHEMICAL REACTORS 9 Hours

Types of reactions and reactors (overview),factors governing the conduct of reaction, stability of reactors, time constant, effects of lag, flow control, temperature control, pH control, end point detection of continuous and batch reactors.

DYNAMIC BEHAVIOR AND CONTROL OF DISTILLATION COLUMN 9Hours

Mass and Energy balance, column feed control, column pressure control, control of Over head and bottom composition, distillate reflux flow control. Frequency response, lag in liquid and vapor flow, concentration lag, predicting the behavior of control system

OPERATIONS IN DIFFERENT 9Hours

Identification and justification of unit operations used in different industries like food, paper, sugar, cement, fertilizer, Petrochemical industry with help of process flow diagram.

Theory:45Hr **Total Hours:45**

REFERENCES

1. Peter Harriott, “Process Control”, Tata McGraw-Hill Education, 1972.
2. Krishna Kant, “Computer based Industrial Control” PHI, second edition,2010.
3. Bela G. Liptak , “Instrument Engineers' Handbook- Process Control (Volume 2)”, CRC Press, Third Edition,2000.
4. George Stephonopolous “Chemical Process Control- An Introduction to Theory and Practice” Prentice-Hall International,1984.
5. David Lindsley, “Boiler Control Systems” McGraw-Hill Ryerson Limited, 1991.
6. Dale E. Seborg, Duncan A. Mellichamp, Thomas F. Edgar ,”Process Dynamics and Control”John Wiley & Sons, 3rd edition, 2010.
7. Gregory K. McMillan, Douglas Considine ”Process/Industrial Instruments and Controls Handbook”, McGraw Hill Professional, 5th Edition,1999.

U13EI*T*605	EMBEDDED SYSTEMS	L	T	P	C
		3	1	0	4

Course Objectives

- To introduce students to the embedded systems, its hardware and software components.
- To acquire knowledge about devices and buses used in embedded networking.
- To develop skills in scheduling mechanism.
- To acquire knowledge about basic concepts of REAL Time Operating Systems.

Course Outcomes

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

- To acquire a basic knowledge about fundamentals of microcontrollers, programming and system control to perform a specific task.
- Design embedded system architectures for various applications.
- To build complex embedded system with the use of RTOS

Course Content

INTRODUCTION TO EMBEDDED SYSTEM 12 Hours

Introduction to Embedded Systems, Review of Microprocessors and Micro-controllers, Multiprocessor systems using General Purpose Processor. CISC and RISC Processor architectures. DSP processor. Design Process in Embedded System, Components of Embedded System & its Classification, Characteristic of embedded system. Introduction to embedded processor, Digital Signal Processor, Application Specific System processor, Design Process in Embedded System, Design metrics, Steps in design process. Challenges in Embedded System design, Design Examples. Advances in Embedded Systems

EMBEDDED C PROGRAMMING 12Hours

Communication with Microcontrollers : Basics of Communication, Overview of RS-232, I2C Bus, UART, USB,8051 connections to RS-232, 8051 serial communication programming, 8051 interrupts, Programming of timer interrupts, Programming of External hardware interrupts, Programming of the serial communication interrupts, Interrupt priority in the 8051

EMBEDDED C PROGRAMMING 12 Hours

Interfacing with 8051: Interfacing an LCD to the 8051, 8051 interfacing to ADC, Sensors, Interfacing a Stepper Motor, 8051 interfacing to the keyboard, Interfacing a DAC to the 8051, 8255 Interfacing with 8031/51, 8051/31 interfacing to external memory

RTOS BASED EMBEDDED SYSTEM DESIGN 12 Hours

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling

TASK COMMUNICATION **12Hours**

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Theory:45Hr **Tutorial: 15Hr** **Total Hours:60**

REFERENCES

1. Rajkamal,S 'Embedded System – Architecture, Programming, Design', Tata McGraw Hill, 2008.
2. David E. Simon, 'An Embedded Software Primer', Pearson Education, 2004.
3. Daniel W. Lewis 'Fundamentals of Embedded Software', Prentice Hall of India, 2004.
4. Frank Vahid, 'Embedded System Design – A Unified hardware & Software Introduction', John Wiley, 2002.
5. Sriram V. Iyer, Pankaj Gupte, 'Embedded Real Time Systems Programming', Tata McGraw Hill, 2004.
6. Steve Heath, 'Embedded System Design', II edition, Elsevier, 2003.

U13EI*P*601	PROCESS CONTROL LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To experimentally verify the principle and characteristics of first order, second order systems, PID controller and interacting and non-interacting systems.
- To design and implement tuning algorithms.
- To design and implement controllers for various processes.

Course Outcomes

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

- Infer the effect of different control modes on different processes.
- Evaluate the different controller parameters using different tuning process.
- Analyse the different complex control systems in process industries.

LIST OF EXPERIMENTS

1. Dynamic Characteristics of First Order System with and without transportation lag.
2.Dynamic Characteristics of Second Order System with and without transportation lag.
3.Dynamic characteristics of P+I+D controller
4.Dynamic characteristics of interacting and non-interacting systems.
5.Tuning of PID controller using open loop method (Cohen – Coon Method)
6.Tuning of PID controller using closed loop method (Zeigler – Nicholis Method)
7. Closed loop control of Level process
8. Closed loop control of Flow process
9. Closed loop control of Pressure process
10. Closed loop control of Temperature process
11. Closed loop control of system using Cascade Control/Ratio control /split range control.
12.Characteristics of different types of Control valves (Final Control Element)

Total Hours:45

U13EI*P*602	INDUSTRIAL INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To provide exposure expertise for handling field instruments
- To understand, analyze and design various measurement schemes that meets the desired specifications and requirements.
- To acquire knowledge about the principles of level and flow measurements.
- To learn the working of different types of and temperature transducers

Course Outcomes

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

- To get an adequate knowledge about selecting particular sensing elements for the measurement of physical parameters.
- Analyze the measured value for displaying or controlling the physical variables
- Design a signal conditioning circuit for interfacing sensor with controller
- Demonstrate a working knowledge of safety practices used in the measurement and control of real time processes
- Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes

LIST OF EXPERIMENTS

1. Measurement of flow rate using Orifice meter, Venturi meter and mass flow meters
2. Calibration of pressure gauge using Dead weight tester.
3. Interfacing of field instruments with controller.
4. Measurement of humidity and vacuum.
5. Level measurement using DPT (open tank).
6. Identifying the components of a sample using UV – Visible spectrophotometer.
7. pH measurement and conductivity measurement.
8. Design of cold Junction compensation circuit of Thermocouple and linearization.
9. Measurement of gas concentration using IR Analyzer.
10. Calibration of temperature sensor.
11. Density measurement using pycnometer.

Total Hours:45

U13EI*P*603	MINI PROJECT	L	T	P	C
		0	0	0	1

Course Objectives

- The objective of this project is to provide opportunity for the students to implemen their skills acquired in the previous semesters to practical problems.

Course Outcomes

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

- The students will carry out a project in one of the specializations of program under study with substantial multidisciplinary component

GUIDELINES

1. Selection of a topic or project title in consultation with a staff member.
2. Develop a project planning strategy.
3. If it is an industry – sponsored project, a concurrent letter from industry i required.
4. A maximum of 3 students per group will do the project.
5. The project may be done in one of the labs under the supervision of a guide or i the selected industry.
6. At the end of the project, a report will be written and a technical presentation alon with demonstration will be made by the students.
7. The report, project demonstration and technical presentation will be evaluated by th internal and external examiners.

Total Hours: Nil

U13GH*P*601	NATIONAL VALUES	L	T	P	C
		1	0	1	1

Course Objectives

- To produce responsible citizens.
- To uphold our culture and spiritual life.
- To realize the value of unity, service.
- To immunize the body.
- To get Divine peace through inward travel.

Course Outcomes

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

- Acquire knowledge on the Enlightened Citizenship.
- Demonstrate skills required for the Indian Culture and it's greatness.
- Behave as responsible Great spiritual Leaders.
- Analyze National Values identification and practice.

Course Content

RIGHTS AND RESPONSIBLE CITIZENSHIP 5Hours

Citizenship- its significance-Enlightened citizenship – what are the rights to citizenship
Emerging India-its glory today- Global perspective

GREATNESS OF INDIAN CULTURE 5 Hours

Outsiders view about India – about yoga – culture – joint family – morality – service - food– 77behavior – attitude – work.
Indian culture and it's greatness – dress coding - festivals – food is medicine – games – traditional medicines.

INDIA AND PEACE 5Hours

India and Peace – who are the person to participate world peace – India and Spirituality- Great spiritual leaders – Shankarar – Ramanujar – mathvar – budha – mahaveerar – vallalar – Ramakrishna paramahamsar –mathaamirthananthamaayi – ramanar – aravindhar – annai.

INDIA'S MESSAGE TO THE WORLD 5Hours

India's message to the world – thiruvalluvar – thirukural – manivasagar – tiruvasagam – aravindhar – B.K.S Iyengar – yoga asanas – Sir C.V.Raman – Physics –ramanujam – maths – rabinthranathtagore – literature – A.P.J Abdulkalam.

GLOBAL PEACE 3 Hours

It's role in global peace - – vethathiri maharishi – world peace –Thiruvalluvar – vallalar –

Service and sacrifice-Unity in diversity – case studies-live examples – National values identification and practice.

MEDITATION & YOGASANAS 7 Hours

Nine Centre Meditations – Introduction – practice – benefits. Yogasanas – II

Theory:30Hr **Total Hours:30**

REFERENCES

1. World peace plane---- Vethathiri Maharishi
2. Prosperous India ---- Swami Vivekananda
3. Samudhaya chikkalukkana nala Aaivugal ---- Vethathiri Maharishi
4. World Community Life ---- Vethathiri Maharishi

SEMESTER VII

U13EI*T*701	VLSI DESIGN	L	T	P	C
		3	1	0	4

Course Objectives

- To describe the NMOS and CMOS inverter gates and its fabrication process.
- To develop skills in designing Dynamic CMOS Logic and PLDs.
- To apply skills in Programming combinational and sequential circuits using VHDL.

Course Outcomes

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

- To describe the various fabrication technology used in developing logic gates.
- To design combinational and sequential circuits using various MOS logic.
- To illustrate the design of combinational and sequential logic using VHDL programming.

Course Content

CMOS LOGIC AND FABRICATION 12Hours

MOSFET-Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – Second order effects-threshold voltage equation.

NMOS & CMOS INVERTER AND GATES 12Hours

NMOS & CMOS inverter – Determinatin of pull up / pull down ratios, Alternate forms of pull up. Stick diagram – lamda based design rules – Super buffers – BiCMOS logic, pass transistor logic, & transmission gate logic.

SUB SYSTEM DESIGN & LAYOUT 12 Hours

Structured design of combinational circuits –Static CMOS logic, Dynamic CMOS logic and domino CMOS Logic - Tally circuits – (NAND-NAND logic, NOR-NOR logic and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.

PROGRAMMABLE LOGIC DEVICE & TESTBILITY OF VLSI 12Hours

NMOS PLA – Programmable Logic Devices - Finite State Machine PLA– Introduction to FPGA – Testing of VLSI circuits – Testing struck at faults –Boolean difference method.

VHDL PROGRAMMING 12 Hours

Introduction to VHDL – Types – Operators – Packages – Combinatioanal and Sequential

circuit – Sub-programs – Introduction to Test bench Simulation – Programs on counters, flipflops, FSM, Multiplexers / Demltiplexers. Simulation of combinational sequential circuits Modelsim.

Theory:45Hr **Tutorial: 15Hr** **Total Hours:60**

REFERENCES

1. D.A.Pucknell, K.Eshraghian, 'Basic VLSI Design', 3rd Edition, Prentice Hall of India, New Delhi, 2011.
2. Eugene D.Fabricius, 'Introduction to VLSI Design', Tata McGraw Hill, 1990.
3. N.H.Weste, 'Principles of CMOS VLSI Design', Pearson Eduction, India, 2002
4. Douglas Perry, 'VHDL Programming by example', Tata McGraw Hill,3rd Edition, 2003.
5. Zainalatsedin Navabi, 'VHDL Analysis and Modelling of Digital Systems',2nd Edition, Tata McGraw Hill, 1998.
6. Charles H.Roth, 'Fundamentals of Logic Design', Jaico Publishing House,1992

U13EI*T*702	ANALYTICAL INSTRUMENTS	L	T	P	C
		3	1	0	4

Course Objectives

- To introduce students to principles and theory of instrument analysis.
- To identify various separation procedures used in a process industry.
- To teach students the different methods of analysis for pollutant gases.
- Master quantitative problem solving based on instrumental analysis.

Course Outcomes

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

- Acquire knowledge about the interaction of electromagnetic radiations with matter and apply analytical techniques to accurately determine the elements present in the given sample
- Select Instrument for a particular analysis with idea of its merits, demerits and limitations
- Learn specific technique employed for monitoring different pollutants in air and water.
- Students will understand the applications and usage of chromatography in real time industrial environments, various techniques for medical imaging and analysis.

Course Content

COLORIMETRY AND SPECTROPHOTOMETRY 12 Hours

Spectral methods of analysis – Beer-Lambert law – Colorimeters – UV-Vis spectrophotometers – Single and double beam instruments – Sources and detectors –IR spectrophotometers – Types – FTIR spectrophotometers-Gas Filter correlation spectrometer(GFC)- Analysis using Attenuated total reflectance - Atomic absorption spectrophotometers– Sources and detectors—Flame emission photometers.

CHROMATOGRAPHY 12Hours

Different techniques – Gas chromatography-basic and with multiple columns – Detectors-Applications in environmental analysis, food industry – High-pressure liquid chromatographs – Applications [Construction of paper chromatography column for separation of ink and water]

INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS 12Hours

Types of gas analyzers – Oxygen-micro fuel cells, NO_2 and H_2S types, IR analyzers-Basic Luft detectors, Luft detectors with flow sensor, filter cells, Continuous emission monitoring system(CEMS), thermal conductivity analyzers. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation – Dust and smoke measurements.

pH METERS AND DISSOLVED COMPONENT ANALYZERS 12Hours

Principle of pH measurement-equivalent electrical circuit of pH probe, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer.

Construct a conductivity cell with copper electrodes to check conductivity of various samples.

RADIOCHEMICAL AND MAGNETIC RESONANCE TECHNIQUES 12Hours

Nuclear radiations – Detectors – GM counter – Proportional counter – Solid state detectors – Gamma cameras – X-ray spectroscopy – Detectors – Diffractometers – Absorption meters – Detectors. NMR – Basic principles – NMR spectrometer – Applications. Mass spectrometers – Different types – Applications.

Theory:45Hr Tutorial: 15Hr Total Hours:60

REFERENCES

1. H.H.Willard, L.L.Merritt, J.A.Dean, F.A.Settle, 'Instrumental methods of analysis', CBS publishing & distribution, 1995.
2. R.S. Khandpur, 'Handbook of Analytical Instruments', Tata McGraw Hill publishing Co. Ltd., 2003.
3. Robert D. Braun, 'Introduction to Instrumental Analysis', Pharma Book Syndicate, 2008
4. G.W.Ewing, 'Instrumental Methods of Analysis', McGraw Hill, 1992.
5. DA Skoog and D.M.West, 'Principles of Instrumental Analysis', Holt, Saunders Publishing, 1985
6. A Practical Guide to Graphite Furnace Atomic Absorption Spectrometry David J. Butcher**,** Joseph Sneddon
7. Tony.R.Kuphaldt-"Lessons in Industrial Instrumentation" version 1.22

U13EI*T*703 POWERPLANT INSTRUMENTATION L T P C

3 0 0 3

Course Objectives

- To provide an overview of different methods of power generation with a particular stress on thermal power generation.
- To bring out the various measurements involved in power generation plants.
- To provide knowledge about the different types of devices used for analysis.
- To impart knowledge about the different types of controls and control loops.

Course Outcomes

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

- Outline the basics of power plant and power generation
- Understand the operation of traditional power plants and its Instruments
- Explain about boilers and turbines.

Course Content

OVERVIEW OF POWER GENERATION 9Hours

Importance of instrumentation in power generation – Methods of power generation – Hydro, thermal, nuclear, solar and wind power – Block diagram – Details of boiler processes - P&I diagram of boiler – Cogeneration.

MEASUREMENTS IN POWER PLANTS 9Hours

Electrical measurements – Current, voltage, power, frequency, power factor etc. – Non electrical parameters – Flow of feed water, fuel, air and steam with correction factor for temperature – Steam pressure and steam temperature – Drum level measurement – Radiation detector – Smoke density measurement – Dust monitor.

ANALYSERS IN POWER PLANTS 9Hours

Flue gas oxygen analyser – Analysis of impurities in feed water and steam – Dissolved oxygen analyser – Chromatography – pH meter – Fuel analyser – Pollution monitoring instruments.

CONTROL LOOPS IN BOILER 9Hours

Combustion control – Air/fuel ratio control – Furnace draft control – Drum level control – Main steam and reheat steam temperature control – Super heater control – Air temperature – Deaerator control – Distributed control system in power plants – Interlocks in boiler

operation.

TURBINE – MONITORING AND CONTROL **9Hours**

Speed, vibration, shell temperature monitoring and control – Steam pressure control – Lubricant oil temperature control – Cooling system.

Theory:45Hr **Total Hours:45**

REFERENCES

1. Sam G.Dukelow, 'The Control of Boilers', Instrument Society of America, 1991.
2. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill, 2001.
3. S.M. Elonka and A.L. Kohal, 'Standard Boiler Operations', Tata McGraw Hill, New Delhi,1994.
4. R.K.Jain, 'Mechanical and Industrial Measurements', Khanna Publishers.
5. Krishnasamy & Ponnibala 'Power Plant Instrumentation', Delhi PHI, 2010.

U13EI*T*704	COMPUTER NETWORKS AND DISTRIBUTED CONTROL SYSTEM	L	T	P	C
		3	1	0	4

Course Objectives

- To give an introductory knowledge about networks used in data communication.
- To give knowledge about of HART and Fieldbus.
- To give basic knowledge on distributed control system.

Course Outcomes

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

- To describe the networks used in data communication.
- To describe the HART and field bus.
- To describe the systems used in distributed control system.
- To get an adequate knowledge about MODBUS and Wireless instrumentation.

Course Content

DATA NETWORK FUNDAMENTALS 12 Hours

Network hierarchy and switching – open system interconnection model of ISO – data link control protocol :- HDLC – media access protocol – command/response – token passing – CSMA/CD,TCP/IP,

FIELDBUS AND WIRELESS INSTRUMENTATION 12Hours

Introduction – general fieldbus architecture – basic requirement of field bus standard – Field bus topology – interoperability- interchangeability- introduction to OLE for process control,wireless instrumentation:-Radio systems, Wireless HART, PROFIBUS.

HART AND MODBUS 12Hours

Introduction :- Evolution of signal standard – HART communication protocol – communication modes – HART networks –HART commands – HART application. MODBUS- protocol structure-function codes and Troubleshooting. MODBUS TCP/IP

DISTRIBUTED CONTROL SYSTEM 12 Hours

Architectures – comparison – local control unit – process interfacing issues – communication facilities.

OPERATOR INTERFACES 12 Hours

Low level and high level interface – operator displays –engineering interfaces – low level and High level engineering interfaces – general purpose computer in DCS. Case Studies

Theory:45Hr **Tutorial: 15Hr** **Total Hours:60**

REFERENCES

1. Data Communication & Networking – Behrour A.Frouzan Tata Mc Graw Hill,2006.
2. Lucas, M.P., "Distributed Control System", Van Nastrand Reinhold Company, New York, 1986
3. Bowden, R., "HART Application Guide", HART Communication Foundation, 1999.
4. Berge, J., "Field Buses for Process Control: Engineering, Operation, and Maintenance", ISA Press, 2004.
5. Andrew s. Tanenbaum , "computer networks" , fifth edition.
6. Steve Mackay, "Practical industrial data networks", Elsevier edition.
7. Tony R.kuphaldt, "lessons in Industrial instrumentation", version 1.22
8. N. Mathivanan ,"PC Based Instrumentation :concepts and practice" Prentice hall of India private limited,2007.

U13GS*T*008	PROFESSIONAL ETHICS	L	T	P	C
		3	0	0	3

Course Objectives

- To create an awareness on Engineering Ethics and its use in ones profession
- To instill moral values, social values and loyalty
- To provide an insight into ones professional rights and a view of professional ethics in the global context.

Course Outcomes

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

- Understand the ethical theories and concepts
- Understanding an engineer's work in the context of its impact on society
- Understand and analyze the concepts of safety and risk
- Understand the professional responsibilities and rights of Engineers
- Understand the concepts of ethics in the global context

Course Content

ENGINEERING ETHICS AND THEORIES 9 Hours

Definition, Moral issues, Types of inquiry, Morality and issues of morality, Kohlberg and Gilligan's theories, consensus and controversy, Professional and professionalism, moral reasoning and ethical theories, virtues, professional responsibility, integrity, self respect, duty ethics, ethical rights, self interest, egos, moral obligations.

SOCIAL ETHICS AND ENGINEERING AS SOCIAL EXPERIMENTATION 9Hours

Engineering as social experimentation, codes of ethics, Legal aspects of social ethics, the challenger case study, Engineers duty to society and environment.

SAFETY 9Hours

Safety and risk – assessment of safety and risk – risk benefit analysis and reducing risk – the Three Mile Island and Chernobyl case studies. Bhopal gas tragedy.

RESPONSIBILITIES AND RIGHTS OF ENGINEERS 9Hours

Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – Intellectual Property Rights (IPR) – discrimination.

GLOBAL ISSUES AND ENGINEERS AS MANAGERS, 9 Hours

CONSULTANTS AND LEADERS

Multinational Corporations – Environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – Engineers as trend setters for global values.

Theory:45Hr **Total Hours:45**

REFERENCES

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering". (2005) McGraw-Hill, New York.
2. John R. Boatright, "Ethics and the Conduct of Business", (2003) Pearson Education, New Delhi.
3. Bhaskar S. "Professional Ethics and Human Values", (2005) Anuradha Agencies, Chennai.
4. Charles D. Fleddermann, "Engineering Ethics", 2004 (Indian Reprint) Pearson Education / Prentice Hall, New Jersey.
5. Charles E. Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and cases", 2000 (Indian Reprint now available) Wadsworth Thompson Learning, United States.

U13EI*P*701	EMBEDDED LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To develop efficient code for embedded system.
- To demonstrate how microprocessor interface with the peripherals
- To illustrate the use of VHDL to program digital IC ‘s

Course Outcomes

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

- Build the latest embedded system.
- Develop skills in embedded system programming.

LIST OF EXPERIMENTS

Embedded C Programming

1. Design and simulation of Bit manipulation with delay function.
2. Interfacing switch and buzzer to microcontroller(8051).
3. Interfacing LCD/Seven segment to Microcontroller(8051)
4. Design and simulation of message transmission and reception using RS232
5. Interfacing sensors to microcontroller
6. Applications of interrupts in microcontroller.
7. Simulate a Program to demonstrate I2C Interface Serial EEPROM

VHDL Programming

1. Design and simulate half adder,full adder, half subtractor and full subtractor.
2. Design and simulate 4:1 Multiplexer /1:4 DMux.
3. Design and simulate 4:2 Encoder/ 2:4 Decoder
4. Create FSM of a typical application and implement on an FPGA.

Total Contact Hours: 45

U13EI*P*702	INDUSTRIAL AUTOMATION LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To Design and implement the concept of controlling different continuous / discrete process using computers, DCS / PLC.
- To develop the program in PLC and its application.
- To design and develop a program in LabVIEW.

Course Outcomes

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

- Design and implement the controllers using PLC.
- Develop the program in PLC Software and implement in an application
- Design and implement an program in LabVIEW .
- Demonstrate the working knowledge distributed control system for a real time process.

LIST OF EXPERIMENTS

1. Basic instruction in PLC programming.
2. Implementation of simple combinational logic using PLC.
3. implementation of Basic Mathematical instruction using PLC
4. Implementation of Sequential operation using PLC.
5. Implementation of Motor forward and reverse control using PLC.
6. Programming with PLC – star to delta conversion.
7. Programming with PLC – water level control system.
8. Design of Alarm and Interlocks
9. Design and implementation of pressure process station using DCS.
10. Programming with lab view –Temperature measurement
11. Design and implementation of flow process station using DCS.
12. Study of SCADA.

Total Contact Hours: 45

U13GH*P*701	GLOBAL VALUES	L	T	P	C
		1	0	1	1

Course Objectives

- To realize global brotherhood and protect global.
- To know the youths participation in politics.
- To know importance of retain of our culture and Maintain
- To know impact of global terrorism.
- To know the current economic status among the youths.

Course Outcomes

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

- Behave as responsible human beings respecting the global values.
- Acquire knowledge on the complex patterns involved in maintaining world's peace and ecological balance.
- Demonstrate skills required for the emergency of mono-culture at the global level.
- To learn about Man is the cause and Man is the solution.

Course Content

GLOBAL BROTHERHOOD AND PROTECT GLOBE 5 Hours

Global values – understanding and identification – its importance - Racial discrimination and solution

MAN IS THE CAUSE AND MAN IS THE SOLUTION 5Hours

Ecological imbalance – global warming – rain fall – status – acid rain – plastic usage – control - Political upheavals – nowadays political status – basic rights to citizen – corruption – youths participate in politics –e.g: M.K.Stalin – Kanimozhi – ragul Gandhi.

GREATNESS OF CULTURE 5Hours

Social inequality and solution– live case discussions and debate – black money – poverty people - Cultural degradation– live case discussions and debate – difference between Indian culture & western culture – impact of western culture in India – how to retain our culture and solution.

EMERGENCE OF MONOCULTURE 4Hours

Emergence of monoculture – solution - Global terrorism – it's cause and effect – solution

MARGINALIZATION OF GLOBAL ECONOMIC 4Hours

Economic marginalization and solution – it's impact in the globe – globalization in market – its effect in local market – merits – demerits of globalization - Man is the cause and man is the solution.

MEDITATION & YOGASANAS 7Hours

Nithyananda Meditation & Divine Meditation – Introduction – practice – benefits.
Yogasanas - III

Total Hours: 30 Hrs

REFERENCES

1. World peace plane---- Vethathiri Maharishi
2. Prosperous India ---- Swami Vivekananda
3. Samudhaya chikkalukkana nala Aaivugal ---- Vethathiri Maharishi
4.World Community Life---- Vethathiri Maharishi

ELECTIVE I

U13EI*T*E01	MEMS AND NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce different materials used for MEMS.
- To provide an introduction to Nanotechnology
- To get knowledge about the control of robots for some specific applications.

Course Outcomes

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

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

Course Content

INTRODUCTION TO MEMS **9 Hours**

Introduction, emergence, devices and application, scaling issues, materials for MEMS, Thin film deposition, lithography and etching.

MICROMACHINING **9 Hours**

Bulk micro machining, surface micro machining and LIGA process.

ENGINEERING MECHANICS **9 Hours**

MEMS devices, Engineering Mechanics for Micro System Design, Micro Pressure Sensor, Micro accelerometer.

DESIGN &MODELING **9 Hours**

Electronic interfaces, design, simulation and layout of MEMS devices using CAD tools.

INTRODUCTION TO NANOTECHNOLOGY **9 Hours**

Introduction to Nanotechnology, Nano sensors, Molecular Nanotechnology, CNT Types, synthesis and applications.

Theory:45Hr **Total Hours:45**

REFERENCES

- Tai Ran Hsu, "MEMS & Microsystem Design and Manufacture", Tata McGraw Hill, New Delhi 2002.
- Marc Madou, "Fundamentals of Micro fabrication", CRC Press, 1999.
- Julian W. Gardner and Vijay K. Varadan, "Microsensors, MEMS, and Smart Devices", John Wiley & Sons Ltd, 2001.
- Michael Wilson, KamaliKannangara, Geoff Smith, Michelk Simon, "Nanotechnology: Basic Science and Emerging technologies".
- Bharat Bhushan, "Handbook of Nanotechnology", 1st Edition, Springer, 2004.

U13MA*T*605	PROBABILITY AND APPLIED STATISTICS	L	T	P	C
		3	0	0	3

Course Objectives

- Have a fundamental knowledge of statistical measures of central tendency and dispersion
- Have knowledge of basic probability concepts and random variables.
- Know about certain standard distributions.
- Test hypothesis regarding large samples and small samples
- Know about design of experiments and quality control

Course Outcomes

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

- Compute measures of central tendencies, dispersions and correlate the variables.
- Analyze random or unpredictable experiments and investigate important features of random experiments.
- Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
- Analyze sample data and interpret the same for population
- Sketch the control charts and outline the process capability.

Course Content

STATISTICAL MEASURES 5 Hours

Measures of central tendency: Mean, Median and Mode – Measures of variation: Range, Mean deviation, standard deviation and coefficient of variation.

CORRELATION AND REGRESSION 4 Hours

Karl Pearson's coefficient of correlation – Spearman's Rank Correlation – Regression lines.

PROBABILITY AND RANDOM VARIABLE 9 Hours

Axioms of probability - Conditional probability – Total probability – Baye's theorem - Random variable – Distribution function – properties – Probability mass function – Probability density function – moments and moment generating function – properties.

STANDARD DISTRIBUTIONS 9 Hours

Binomial, Poisson and Normal distributions – Moments, Moment Generating functions and properties for the above distributions - Fitting of Binomial, Poisson and Normal distributions.

TESTING OF HYPOTHESIS **9 Hours**

Testing of hypothesis for large samples (single mean, difference of means, single proportion, difference of proportions) – Small samples tests based on t and F distributions (single mean, difference of means, paired *t*- test and variance ratio test) – Chi-square test for independence of attributes and goodness of fit.

DESIGN OF EXPERIMENTS **4 Hours**

Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD).

STATISTICAL QUALITY CONTROL **5 Hours**

Concept of process control - Control charts for variables – $\overline{X}$, R – charts – Control charts for attributes – p, np, c – charts – Tolerance limits.

Theory:45Hr **Total Hours:45**

REFERENCES

1. Veerarajan T., "Probability and Statistics", Tata McGraw-Hill, New Delhi, 2007 & 2nd Reprint 2004.
2. Gupta S. P, "Statistical Methods", Sultan Chand & Sons Publishers, 2004.
3. Johnson R. A., "Miller & Freund's Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000.
4. Gupta S.C, and Kapur, J.N., "Fundamentals of Mathematical Statistics", Sultan Chand, Ninth Edition, New Delhi, 1996.
5. Walpole R. E., Myers S.L. & Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education Inc, 2002.

U13EI*T*E02	ADVANCED CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To study the state variable analysis
- To provide adequate knowledge in the phase plane analysis.
- To give a basic knowledge in describing function analysis.
- To analyze the stability of the systems using different techniques
- To study the design of optimal controller

Course Outcomes

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

- To develop mathematical model and understand the mathematical relationship between the sensitivity function
- Design and fine tune the PID controllers and understand the roles of P,I & D in feedback control.
- Develop state space model
- Design state feedback controller and state observer.

Course Content

INTRODUCTION **9 Hours**

Features of linear and non-linear systems –State variable representation – Solution of state equations – Conversion of state variable models to transfer functions – Eigen values – Eigen vectors – Concepts of controllability and observability - Common physical non-linearities – Methods of linearising nonlinear systems

PHASE PLANE ANALYSIS **9 Hours**

Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method

DESCRIBING FUNCTION ANALYSIS **9 Hours**

Basic concepts, derivation of describing functions for common non- linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

STABILITY ANALYSIS **9 Hours**

Introduction – Liapunov's stability concept – Liapunov's direct method – Lure's transformation – Aizerman's and Kalman's conjecture – Popov's criterion – Circle criterion.

CONTROLLER SYNTHESIS FOR NON-LINEAR SYSTEMS **9Hours**

Linear design and non-linear verification – Non-linear internal model control – Parameter optimization – Model predictive controller – Optimal controller – State feedback and observer

Theory:45Hr **Total Hours:45**

REFERENCES

1. I.J.Nagrath & M. Gopal, 'Control System Engineering', New Age International Publishers, 2003
2. E. Jean-Jacques, 'Slot line, Applied Non-linear Control', Pearson Education
3. Torkel Glad & Lennart Ljung, 'Control Theory – Multi Variable and Non-linear Methods', Taylor's & Francis Group, 2002.
4. S. Hasan Saeed, 'Automatic Control Systems', S.K. Kataria & Sons, 2002.
5. George J. Thaler, 'Automatic Control Systems', Jaico Publishing house, 1993.
6. Ronald R. Mohler, 'Non-linear Systems, Vol. – I, Dynamics & Control', Pearson Education, 1998
7. Hassan K. Kahalil, 'Non-linear Systems', Pearson Education, 2002.
8. Peter A. Cook, 'Non-linear Dynamical Systems', Pearson Education.

U13CS*T*503	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives

- To learn the Java programming language fundamentals
- To learn object oriented programming concepts
- To learn the essentials of the Java class library

Course Outcomes

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

- Identify the swing components needed for developing a application/programs. [K1].
- Explain the concepts of exception handling, life cycle of thread, Applet class to develop an application or program [K2].

- Build applications that include GUIs and event driven programming [K3].
- Build applications using various types of Inheritance and Interfaces [K3].
- Integrate Servlets, JSPs with EJB and Databases in J2EE application. [K4].

Course Content

INTRODUCTION TO JAVA **9 Hours**

The History and Evolution of Java - An Overview of Java-Data Types, Variables, and Arrays - Operators-Control Statements - Introducing Classes - A Closer Look at Methods and Classes.

OBJECT ORIENTED CONCEPTS, INTERFACES AND PACKAGES **9 Hours**

Inheritance - Packages and Interfaces - Exception Handling - Multithreaded Programming - Enumerations, Autoboxing, and Annotations (Metadata) - I/O, Applets - Generics.

UTILITY & I/O PACKAGES **9 Hours**

String Handling - Exploring java.lang-java.util - The Collections Framework- java.util - More Utility Classes - Input/Output:Exploring java.io - Exploring NIO - Networking.

GUI **9 Hours**

The Applet Class - Event Handling-Introducing the AWT: Working with Windows, Graphics, and Text-Using AWT Controls, Layout Managers, and Menus- Images.

J2EE INTRODUCTION **9 Hours**

The Concurrency Utilities - Regular Expressions and Other Packages - Java Beans - Introducing

Swing - Exploring Swing – Servlets - Financial Applets and Servlets - Creating a Download Manager in Java.

Theory:45Hr **Total Hours:45**

REFERENCES

1. Herbert Schildt, "Java the Complete Reference", Eighth edition Tata Mc Graw Hills, 2011.
2. E.Balaguruswamy,"Programming with Java", Second Edition, TMH, 2009.

ELECTIVE II

U13EI*T*E03	INSTRUMENTATION IN IRON AND STEEL INDUSTRIES	L	T	P	C
		3	0	0	3

Course Objectives

- To acquire knowledge about iron and steel making process and the instrumentation related to it.
- To impart knowledge about the control system in furnace.

Course Outcomes

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

- To describe the various processes involved in the manufacturing of Iron and Steel.
- To distinguish between different instruments used in the measurement of different process variable
- To recognize the different control system in Iron and steel making.
- To understand the basic concepts of digital control system and their application in Iron and Steel industries.

Course Content

IRON AND STEEL MAKING **9Hours**

Flow diagram and description of the processes: Raw materials preparation, iron making, blast furnaces, stoves, raw steel making, basic oxygen furnace, electric furnace.

CASTING OF STEEL **9 Hours**

Casting of steel: Primary rolling, cold rolling and finishing.

INSTRUMENTATION **9 Hours**

Instrumentation: Measurement of level, pressure, density, temperature, flow weight, thickness and shape, graphic displays and alarms.

CONTROL SYSTEM **9 Hours**

Control and systems: Blast furnace stove combustion control system, gas and water controls in BOF furnace . Sand casting Mold control

COMPUTER APPLICATIONS **9 Hours**

Computer applications: Model calculation and logging, rolling mill control, annealing process control Computer (center utilities dispatch computer.

Theory: 45 Hrs **Total Hours:45 Hrs**

REFERENCES

1. Tupkary R.H, Introduction to Modern Iron Making, Khanna Publishers, New Delhi,1986 - II Edition
2. Tupkary R.H., Introduction to Modern Steel Making, Khanna Publishers, New Delhi, 1989 – IV Edition.
3. Liptak B. G, Instrument Engineers Handbook, volume 2, Process Control, Third edition, CRC press, London, 1995
4. Considine D.M, Process / Industrial Instruments and Control Handbook, Fourth edition, McGraw Hill, Singapore, 1993 – ISBN-0-07-012445-0

U13EI*T*E04	AUTOMOBILE AND AIRCRAFT INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives

- To acquire knowledge about measuring devices in automobiles and about the various sensors and actuators used in automobile industry.
- To understand the instrumentation behind emission measurement.
- To acquire knowledge about aircraft instruments and aircraft computer systems.

Course Outcomes

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

- Describe the working of various instruments, sensors and actuators used in automobile systems.
- Illustrate the test procedures and instrumentation for emission standards.
- Discuss about different types instruments used in Aircrafts.

Course Content

MEASURING DEVICES IN AUTOMOBILES **9 Hours**

Selection of measuring instrument, requirements of measurement such as precision, accuracy, errors, sensitivity, readability and reliability – Devices to measure temperature and pressure of the working fluid, coolant, air and fuel flow into the engine – Indicating and integrating instruments – Vibrometer, Accelerometer, vibration and pressure pickups, vibration test methods and counters.

SENSORS AND ACTUATORS **9 Hours**

Introduction to basic sensor arrangement – types of sensors – Oxygen sensors, crank angle position sensors – Fuel metering / vehicle speed sensor and detonation sensor –Altitude sensor – Flow sensors – Throttle position sensors – Solenoids, stepper motors, relays – Electronic dash board systems – GPS.

INSTRUMENTATION FOR EMISSION MEASUREMENT **9 Hours**

Test procedures – NDIR analyzers – Flame ionization detectors – Chemiluminescent analyzers – Gas chromatograph – Smoke meters – Emission – Standards

FLIGHT INSTRUMENTATION AND GYROSCOPIC INSTRUMENTS **9 Hours**

Classification of aircraft instruments – Instrument displays, panels, cockpit layout –Altimeters – Airspeed indicators – Machmeters – Accelerometers – Gyroscopic theory –Directional gyro indictor – Artificial horizon – Turn and slip indicators

AIRCRAFT COMPUTER SYSTEMS 9 Hours

Terrestial magnetism – Aircraft magnetism- Direct reading magnetic components –Compass errors – Gyromagnetic compass – Performance margin indicators – Safe take off indicators - Aircraft take off monitoring systems – Autopilot and navigation systems.

Theory: 45 Hrs **Total Hours:45 Hrs**

REFERENCES

1. William.B.Riddens., "Understanding Automotive Electronics", 5th Edition, Butterworth, Heinemann Woburn, 2012.
2. Springer and Patterson, "Engine Emission", Plenum Press, 1990.
3. Pallett E.H.J, "Aircraft Instruments – Principles and Applications", Pearson education.
4. Nagahushan.S.Sudha.L.K, "Aircraft instrumentation and Systems", International publishing house Private limited,2010.
5. Paul Degobert, "Automobiles and pollution" – SAE International ISBN-1-56091-563-3, 1991.

U13EI*T*E05	APPLIED SOFT COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce students about soft computing concepts.
- To acquire adequate knowledge in neural network, fuzzy logic and GA.

Course Outcomes

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

- Identify and describe soft computing techniques
- Recognize the feasibility of applying a soft computing methodology for a particular problem.
- Apply NN to pattern recognition and regression problems.
- Apply FL and reasoning to handle uncertainty and solve engineering problems.
- Apply GA to optimization problems.

Course Content

INTRODUCTION TO NEURAL NETWORKS **9 Hours**

Artificial neuron – Model of neuron – Network architecture – Learning process – Single layer perceptron – Limitations – Multi layer perceptron – Back propagation algorithm –Simulation of Neural Networks in MATLAB

ANN - ARCHITECTURE AND APPLICATION **9 Hours**

Hopfield network, Kohnen's self organizing maps - adaptive resonance theory- Schemes of Neuro-control – Identification and control of dynamical systems – Neuro controller for inverted pendulum.

INTRODUCTION TO FUZZY LOGIC **9 Hours**

Fuzzy set theory – Fuzzy sets – Operation on Fuzzy sets – Fuzzy relations – Fuzzy membership functions – Defuzzification – Fuzzy rules.

FUZZY LOGIC CONTROL SYSTEM **9 Hours**

Fuzzy Logic controller – Knowledge base – Decision making logic – Design of Fuzzy logic controller – Adaptive fuzzy systems - Case study.FLC for inverted pendulum ,home heating systems. Introduction to neuro fuzzy systems. Demo of FLC using MATLAB.

NEURO FUZZY CONTROLLER AND GENETIC ALGORITHM **9 Hours**

Introduction to neurofuzzy controller-Gradient search – Non gradient search - Genetic Algorithms: operation,search algorithm - Evolutionary programming: operators search algorithm.

Theory: 45 Hrs **Total Hours:45 Hrs**

REFERENCES

1. Laurence Fausett, L., "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 2004
2. Ross, T.J., "Fuzzy Logic with Engineering Applications", John Wiley and Sons(Asia) Ltd., 2004.
3. David Goldberg, "Genetic Algorithm in Search, Optimization, and Machine Learning", Addison Wesley Publishing Company, Inc. 1989
4. Zurada, J.M., "Introduction to Artificial Neural Systems", Jaico Publishing House, Mumbai, 1997.

U13EI*T*E06	ADVANCED PROCESS CONTROL	L	T	P	C
		3	0	0	3

Course Objectives

- To explain advanced process control schemes used in Industries.
- To explain in detail about model identification and adaptive control schemes.

Course Outcomes

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

- Develop skills in mathematical modeling.
- Describe auto tuning, adaptive control and model predictive control techniques.
- Apply the knowledge gained in model identification and adaptive control to analyze case studies.

Course Content

MODEL IDENTIFICATION **9 Hours**

Techniques for SISO: Step response model- impulse response model –least square algorithm – recursive least square algorithm for both off line & on line - frequency response identification.

AUTO TUNING **9 Hours**

Motivation- basic description- describing function (relay, relay with hysteresis, relay with saturation) - model identification-tuning procedure.

ADAPTIVE CONTROL **9 Hours**

Gain scheduling – Model reference adaptive control-Self tuning regulator.

MODEL IDENTIFICATION AND ADAPTIVE CONTROL FOR TYPICAL CASE STUDIES **9 Hours**

Simulation studies using Matlab package- validation of model identification and adaptive control techniques in simple laboratory set-ups.

MODEL PREDICTIVE CONTROL **9 Hours**

Motivation- basic description-optimization problem formulation (objective function, model)- selection of prediction horizon and control horizon- algorithm investigation.

Theory: 45 Hrs **Total Hours:45**

REFERENCES

1. B. Wayne Bequette, "Process Control – Modeling, Design and Simulation", Prentice Hall of India,2006.
2. M.Chidambaram, "Applied Process Control", Allied Publishers,1998.
3. Karl.J.Astrom , "Adaptive Control", Pearson Education Asia,2001.

ELECTIVE III

U13EI*T*E07	ROBOTICS AND AUTOMATION	L	T	P	C
		3	0	0	3

Course Objectives

- To study the various parts of robots and fields of robotics.
- To learn the various kinematics and inverse kinematics of robots.
- To study the Euler, Lagrangian formulation of Robot dynamics.
- To know about the trajectory planning of robots.
- To get knowledge about the control of robots for some specific applications.

Course Outcomes

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

- Ability to understand the basic concepts behind the working of any robot.
- Ability to analyze the function of sensors in the robot.
- Skill to design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, manipulators androbot kinematics

Course Content

INTRODUCTION TO ROBOTICS **9 Hours**

History of Robots – Classifications – Various fields of Robotics – Actuators –Sensors – Manipulators – End effectors – Application areas – Robot programming languages –Robot Operating System.

ROBOT KINEMATICS **9 Hours**

Matrix representation – Homogeneous transformation–DH representation of standard robots– Inverse kinematics.

ROBOT DYNAMICS **9 Hours**

Velocity kinematics – Jacobian and inverse Jacobian – Lagrangian formulation–Eulers Lagrangian formulation–Robot equation of motion.

TRAJECTORYPLANNING **9 Hours**

Introduction – Path Vs trajectory – Joint-space Vs Cartesian – space descriptions – Basics of trajectory planning – Joint-space trajectory planning–Cartesian-space trajectories.

CONTROL ANDAPPLICATION OF ROBOTICS **9 Hours**

Linear control of robot manipulation – Second-order systems –trajectory following control– Modeling and control of single joint–Architecture of industrial robotic controllers–Robot applications.

Theory: 45 Hrs **Total Hours:45**

REFERENCES

1. SacedB.Niku,'Introduction to Robotics Analysis, Systems, Applications',Prentice Hall of India/Pearson Education,Asia,2001.
2. Craig, 'Introduction to Robotics Mechanics and Control', Second edition,Pearson Education,Asia,2004.
3. K.S.Fu&Co.,'Robotics Control,Sensing, VisionandIntelligence', McGraw Hill International Editions, Industrial EngineeringSeries,1991.
4. R.D.Klafter, T.A. Chimielewski and M.Negin, 'Robotic Engineering – Anintegrated Approach', Prentice Hall of India,NewDelhi,2010.
5. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey,'Industrial Robotics Technology Programming and Application',McGrawHill bookcompany,1986.

U13EI*T*E08	INDUSTRIAL CHEMICAL PROCESS	L	T	P	C
		3	0	0	3

Course Objectives

- To acquire knowledge in mechanical operations of liquid, solid and gases.
- To understand mass transfer and heat transfer processes.
- To analyze case studies from the knowledge gained in heat transfer and mass transfer processes.

Course Outcomes

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

- Understand the various unit operations
- To demonstrate knowledge in heat and mass transfer operations
- To apply knowledge of unit operations and heat and mass balance to various process industries

Course Content

MECHANICAL OPERATIONS **9 Hours**

Unit operations - transport of liquids - solids - gases - adjusting particle size of bulk solids – mixing processes – separation processes

MASS TRASFER OPERATIONS PROCESSES **9 Hours**

Combustion processes – heat exchangers– evaporators – crystallization - Drying – distillation – refrigeration process – chemical reactions – energy balance and material balance for the above processes

HEAT TRANSFER OPERATIONS **9 Hours**

Radiation – conduction – convection -Total Balance - Heat Balance - Heat Effects - combustion reactions - Energy balances in manufacturing processes - optimum utilization of Energy – Heat Transfer Operations in Chemical reactors – equipments

CASE STUDY – I **9 Hours**

Operations in the manufacture of paper and pulp – operations in steel industry.

CASE STUDY – II **9 Hours**

Operations in thermal power plant – operations in pharmaceutical industry- leather industry

Theory: 45 Hrs **Total Hours:45**

REFERENCES

1. Waddams, A.L., Chemicals from petroleum, Butler and Tanner Ltd., UK, 1968
2. Balchen, J.G. and Mumme, K.J., Process Control structures and applications, Van Nostrand Reinhold Co., New York, 1988
3. Liptak, B.G., Process measurement and analysis, Chilton Book Company, USA, 1995
4. Austin, G.T. and Shreve's, Chemical Process industries, McGraw-Hill International student edition, Singapore, 1985
5. Luyben W.C., Process Modelling, Simulation and Control for Chemical Engineers, McGraw-Hill International edition, USA, 1989

U13EI*T*E09	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the image processing fundamentals and its computation aspects.
- To learn about spatial domain processing.
- To understand how images are analysed to extract features of interest.
- To acquire knowledge about Image segmentation, registration and Compression.

Course Outcomes

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

- Ability to use a modern computer programming environment (e.g. IDL or Matlab) as an interactive problem solving tool and visualization system programming projects
- Ability to apply image processing techniques in both spatial and frequency (Fourier) domains
- Design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation.
- Conduct independent study and analysis of feature extraction techniques

Course Content

DIGITAL IMAGE FUNDAMENTALS 9 Hours

Elements of Digital Image Processing systems – Digital image representation - Elements of visual perception- Image sampling and quantization - Imaging geometry- Demonstration through MATLAB.

IMAGE TRANSFORMS AND PREPROCESSING 9 Hours

Discrete Image transforms - Properties. Point Processing methods – Contrast stretching - Gray level slicing- Histogram modification techniques-Spatial filtering- Demonstration through MATLAB.

ENHANCEMENT AND RESTORATION 9 Hours

Enhancement in the frequency domain- Image restoration – Degradation model – Unconstrained and Constrained restoration- Inverse filtering – Wiener filter - Restoration in spatial domain- Demonstration through MATLAB.

SEGMENTATION AND REGISTRATION 9 Hours

Segmentation - Detection of discontinuities - Edge linking - Boundary detection - Thresholding - Region oriented segmentation - Image registration - Translational misregistration detection - Statistical correlation function, two state methods Image fusion – Demonstration through MATLAB.

COMPRESSION **9 Hours**

Fundamentals of Image Compression -Lossy versus Lossless coding techniques, pixel coding, predictive techniques, transform coding, algorithm and case studies.

Theory: 45 Hrs **Total Hours:45**

REFERENCES

1. Pratt, W.K., "Digital Image Processing", 2nd Edition John Wiley Pub.1991.
2. Jain A.K., "Fundamentals of Digital Image Processing", Prentice Hall Englewood,1989.
3. Rosenfield, A., and Kak, A.C., "Digital Picture Processing", 2nd Edition, AcademicPress New York 1982.
4. Gonzalez R.C., & Woods R.E., "Digital Image processing", Addison Wesley, 1998
5. Rao, K.R., and Hwang, J.J., "Techniques and Standards for Image Video and Audio Coding", Preice Hall, N.J., 1996

U13EI*T*E10	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

Course Objectives

- To understand about data representation, register transfer and micro operations in computers.
- To acquire knowledge about the different types of control and the concept of pipelining.
- To study the hierarchical memory system including cache memories and virtual memory.

Course Outcomes

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

- Explain the concept of pipelining and vector processing.
- Explain memory organization in computers and various devices.

Course Content

DATA REPRESENTATION, MICRO-OPERATIONS ,ORGANIZATION AND DESIGN — 9 Hours

Data representation: Data types, complements, fixed–point representation, floating-point representation, other binary codes, error detection codes.

Register transfer and micro operations: Register transfer language, register transfer, bus and memory transfers, arithmetic micro-operations, logic micro-operations, shift micro-operations, arithmetic logic shift unit.

Basic computer organization and design: Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory reference instructions, input-output and interrupt. Complete computer description, design of basic computer, design of accumulator logic.

CONTROL AND CENTRAL PROCESSING UNIT — 9 Hours

Micro programmed control: Control memory, address sequencing, micro- program example, design of control unit.Central processing unit: General register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, reduced instruction set computer.

COMPUTER ARITHMETIC, PIPELINE AND VECTOR PROCESSING — 9 Hours

Computer arithmetic: Addition and subtraction, multiplication algorithms, division algorithms, floating-point arithmetic operations, decimal arithmetic unit, decimal arithmetic

operations.Pipeline and vector processing: Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, RISC pipeline, vector processing array processors.

INPUT-OUTPUT ORGANIZATION **9 Hours**

Input-output organization: Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access, input-output processor, serial communication.

MEMORY ORGANIZATION **9 Hours**

Memory organization: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memorymanagement hardware.

Theory: 45 Hrs **Total Hours:45**

REFERENCES

1. Morris Mano, 'Computer System Architecture', 3rd Edition, Pearson Education, 2002 / PHI.
2. Vincent P.Heuring and Harry F.Jordan, 'Computer Systems Design and Architecture', Pearson Education Asia Publications, 2002.
3. John P.Hayes, 'Computer Architecture and Organization', Tata McGraw Hill, 1988.
4. Andrew S.Tanenbaum, 'Structured Computer Organization', 4th Edition, Prentice Hall of India/Pearson Education, 2002.
5. William Stallings, 'Computer Organization and Architecture', 6th Edition, Prentice Hall of India/Pearson Education, 2003.

ELECTIVE IV

U13EI*T*E11	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

Course Objectives

- To acquire knowledge about power semi-conductor devices.
- To explain the concepts of phase controlled converters, DC to DC converters, Inverters used in power electronic circuits.

Course Outcomes

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

- Design and simulate converters and inverters according to the specifications.
- Describe the behaviour of semiconductor devices.
- Explain the working of AC to DC, DC to DC, DC to AC converters .

Course Content

POWER SEMI-CONDUCTOR DEVICES 9Hours

Structure, operation and characteristics of SCR, TRIAC, power BJT, MOSFET and IGBT. Driver and snubber circuits for MOSFET - Turn-on and turn-off characteristics and switching losses.

PHASE-CONTROLLED CONVERTERS 9Hours

2-pulse; 3-pulse; and 6-pulse converters – Inverter operation of fully controlled converter - Effect of source inductance on single phase full wave converter - Distortion and displacement factor – Ripple factor. Simulation of phase controlled rectifiers in Multisim.

DC TO DC CONVERTERS 9 Hours

Step-down and step-up choppers - Time ratio control and current limit control - Switching mode regulators: Buck, boost, buck-boost and cuk converter - Resonant switching based SMPS. Simulation of switch mode regulators in Multisim.

INVERTERS 9Hours

Single phase and three phase (both 120^0 mode and 180^0 mode) inverters - PWM techniques: Sinusoidal PWM, modified sinusoidal PWM and multiple PWM - Voltage

and harmonic control. Series resonant inverters and current source inverters.

APPLICATIONS **9Hours**

Uninterrupted power supply topologies – Flexible AC transmission systems – Shunt and series static VAR compensator – Unified power flow controller- HVDC Transmission.

Theory:45Hr **Total Hours:45**

REFERENCES

1. Muhammad H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Prentice Hall of India/Pearson Education, Third edition, 2004.
2. Bimbhra. P.S. "Power Electronics", Khanna Publishers, 2004.
3. Ned Mohan, Tore.M.Undeland, William.P.Robbins, 'Power Electronics: Converters, applications and design', John Wiley and sons, third edition, 2003.
4. Cyril.W.Lander, 'Power Electronics', McGraw Hill International, Third edition, 2001.
5. Bimal K. Bose, 'Modern Power Electronics and AC Drives', Pearson Education, 2003.
6. Mr. Jaganathan, 'Introduction to Power Electronics', Prentice Hall of India2004

U13EI*T*E12	INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES	L	T	P	C
		3	0	0	3

Course Objectives

- To describe various equipments like distillation column, Reactor, Heat exchangers, Evaporators involved in the Petrochemical Industries.
- To relate to the different petroleum products and the chemicals obtained from the Industry.

Course Outcomes

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

- To describe the basics of petrochemical industries.
- To summarize the working of chemical Reactors, Control Heat Exchangers and Evaporators.
- To describe the Control of pumps, Effluent and Water Treatment Control.

Course Content

PETROLEUM PROCESSING **9Hours**

Petroleum exploration – Recovery techniques – Oil – Gas separation - Processing wet gases – Refining of crude oil.

OPERATIONS IN PETROLEUM INDUSTRY **9 Hours**

Thermal cracking – Catalytic cracking – Catalytic reforming – Polymerisation – Alkylation – Isomerization – Production of ethylene, acetylene and propylene from petroleum.

CHEMICALS FROM PETROLEUM PRODUCTS **9 Hours**

Chemicals from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products.

MEASUREMENTS IN PETROCHEMICAL INDUSTRY **9Hours**

Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Intrinsic safety of Instruments.

CONTROL LOOPS IN PETROCHEMICAL INDUSTRY **9Hours**

Process control in 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.

Theory:45Hr **Total Hours:45**

REFERENCES

1. A.L. Waddams, 'Chemicals from Petroleum', Butter and Janner Ltd., 1968.
2. J.G. Balchan. and K.I. Mumme, 'Process Control Structures and Applications', Van Nostrand Reinhold Company, New York, 1988.
3. Austin G.T. Shreeves, 'Chemical Process Industries', McGraw Hill International Student edition, Singapore, 1985.
4. B.G Liptak, 'Instrumentation in Process Industries', Chilton Book Company,1994.

U13EI*T*E13	FAULT DETECTION AND DIAGNOSIS	L	T	P	C
		3	0	0	3

Course Objectives

- To describe the role of fault detection and isolation in instrumentation.
- To design residuals for FDD

Course Outcomes

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

- To describe the various approaches to FDD.
- To interpret where the fault has occurred based on the residuals.
- To model the residuals based on given system specification

Course Content

INTRODUCTION TO FAULT DETECTION AND DIAGNOSIS 9Hours

Scope of FDD:- Types of faults and different tasks of Fault Diagnosis and Implementation - Different approaches to FDD: Model free and Model based approaches. Classification of Fault and Disturbances- Different issues involved in FDD- Typical applications.

ANALYTICAL REDUNDANCY CONCEPTS 9 Hours

Introduction- Mathematical representation of Fault and Disturbances: Additive and Multiplicative types – Residual Generation: Detection, Isolation, Computational and stability properties – Design of Residual generator – Residual specification and Implementation.

DESIGN OF STRUCTURED RESIDUALS 9Hours

Introduction- Residual structure of single fault Isolation: Structural and Canonical structures- Residual structure of Multiple fault Isolation: Diagonal and Full Row canonical concepts – Introduction to parity equation implementation and alternative representation.

DESIGN OF DIRECTIONAL STRUCTURED RESIDUALS 9Hours

Introduction – Directional Specifications: Directional specification with and without disturbances – Parity Equation Implementation – Linearly dependent column.

ADVANCED LEVEL ISSUES AND DESIGN INVOLVED IN FDD 9Hours

Introduction of Residual generation of parametric fault – Robustness Issues –Statistical Testing of Residual generators – Application of Neural and Fuzzy logic schemes in FDD – Case study.

Theory:45Hr Total Hours:45

REFERENCES

1. Janos J. Gertler “Fault Detection and Diagnosis in Engineering systems” – 2nd Edition, Macel Dekker, 1998
2. Sachin. C. Patwardhan, “Fault Detection and Diagnosis in Industrial Process” – Lecture Notes, IIT Bombay, February 2005.
3. Rami S. Mangoubi, “Robust Estimation and Failure detection”. Springer-Verlag-London 1998.

U13EC*T*603	ARM ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives

- The architecture and various instruction set supported by ARM processor.
- Programming concepts of ARM processor
- The memory hierarchy
- ARM processor and CPU cores.

Course Outcomes

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

- Discuss ARM architecture (K2)
- Identify special features of ARM instruction set (K2)
- Illustrate simple algorithm for data handling and processing based on ARM instruction set (K3)
- Explain memory and I/O management with ARM processor (K2)
- Review different ARM CPU cores (K2)

Course Content

ARM ARCHITECTURE **9 Hours**

Advanced RISC Machine – Architecture Inheritance – ARM Programming Model – ARM Development Tools – 3 and 5 stages Pipeline ARM Organization – ARM Instruction Execution and Implementation – ARM Co-Processor Interface.

ASSEMBLY LANGUAGE PROGRAMMING **9Hours**

ARM Instruction Types – Data Transfer, Data Processing and Control Flow Instructions – ARM Instruction Set – Co-Processor Instructions – Data Processing Instruction – Data Transfer Instruction – Control Flow Instructions.

THE THUMB INSTRUCTION SET **9 Hours**

Thumb bit in the CPSR – Thumb programmer's model – Thumb branch instructions – Thumb software interrupt instruction – Thumb data processing instructions – Thumb single register data transfer instructions - Thumb multiple register data transfer instructions – Thumb breakpoint instructions – Thumb implementation – Thumb applications

MEMORY HIERARCHY **9Hours**

Memory size and speed – On-chip memory – Caches – Cache design – an example – Memory management – Examples and Exercises. Abstraction in software design – Date type – Floating point data type and architecture – Expressions – Conditional statement – Loops – Functions and

procedures – Use of memory.

ARM PROCESSOR AND CPU CORES **9Hours**

ARM cores- ARM Architecture-ARM7TDMI,ARM8,ARM9TDMI,ARM10TDMI,ARM710T– ARM 810 – ARM920T and ARM940T – ARM1020E – Case Study

Theory:45Hr **Total Hours:45**

REFERENCES

1. Steve Furber, "ARM System on Chip Architecture" Addison- Wesley Professional Second Edition, Aug 2000.
2. Andrew N.Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", Morgan Kaufmann Publishers, Elsevier, 2004.
3. Ricardo Reis "Design of System on a Chip: Devices and Components" Springer FirstEdition, July 2004.
4. Jason Andrews "Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology)" Newnes, BK and CD-ROM (Aug 2004).
5. P. Rashinkar, Paterson and L.Singh, "System on a Chip Verification – Methodologies and Techniques", Kluwer Academic Publishers, 2001.
6. David Seal "ARM Architecture reference Manual", Addison-Wesley Professional;2nd Edition,2001
7. Alan Clement, "The Principle of computer Hardware", 3rd Edition,Oxford University Press.

ELECTIVE V

U13GS*T*002	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- Acquire knowledge on TQM concepts
- Acquire knowledge on quality systems
- Develop skills to use TQM tools for domain specific applications

Course Outcomes

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

- Understand quality concepts and philosophies of TQM
- Apply TQM principles and concepts of continuous improvement
- Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality
- Understand the TQM tools as a means to improve quality
- Remember and understand the quality systems and procedures adopted

Course Content

INTRODUCTION 9 Hours

Definition of Quality, Dimensions of Quality, Quality costs, Top Management Commitment, Quality Council, Quality Statements, Barriers to TQM Implementation, Contributions of Deming, Juran and Crosby, Team Balancing.

TQM PRINCIPLES 9 Hours

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement,5S, Kaizen, Just-In-Time and TPS.

STATISTICAL PROCESS CONTROL 9 Hours

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

TQM TOOLS 9 Hours

Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA.

QUALITY SYSTEMS 9 Hours

Need for ISO 9000 and Other Quality Systems, ISO 9001:2008 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 14001:2004

Theory:45Hr **Total Hours:45**

REFERENCES

1. Dale H.Besterfiled, "Total Quality Management", Pearson Education
2. James R.Evans & William M.Lidsay, "The Management and Control of Quality", South-Western (Thomson Learning), 2008
3. Feigenbaum.A.V. "Total Quality Management", McGraw Hill
4. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford
5. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 2007.
6. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers

U13GS*T*004	OPERATIONAL RESEARCH	L	T	P	C
		3	0	0	3

Course Objectives

- Apply knowledge of OR techniques to domain specific industrial situations to optimize the quality of decisions
- Conduct investigations by the use of OR techniques

Course Outcomes

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

- Apply linear programming model and assignment model to domain specific situations
- Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results.
- Apply the concepts of PERT and CPM for decision making and optimally managing projects
- Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions
- Analyze the inventory and queuing theories and apply them in domain specific situations.

Course Content

LINEAR MODEL **9 Hours**

The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simple

TRANSPORTATION AND ASSIGNMENT MODELS **9 Hours**

Transportation model – Initial solution by North West corner method – least cost method – VAM. Optimality test – MODI method and stepping stone method. Assignment model – formulation – balanced and unbalanced assignment problems

PROJECT MANAGEMENT BY PERT & CPM **9 Hours**

Basic terminologies – Constructing a project network – Scheduling computations – PERTCPM –Resource smoothening , Resource leveling, PERTcost

REPLACEMENT AND SEQUENCING MODELS: **9 Hours**

Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies) Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs

on machines Traveling salesman problem

INVENTORY AND QUEUING THEORY 9 Hours

Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management .
Queuing system and its structure Kendall's notation – Common queuing models - M/M/1: FCFS/∞/∞ - M/M/1: FCFS/n/∞ - M/M/C: FCFS/∞/∞ - M/M/1: FCFS/n/m .

Theory:45Hr **Total Hours:45**

REFERENCES

1. Taha H.A., "Operation Research", Pearson Education.
2. Hira and Gupta "Introduction to Operations Research", S.Chand and Co.2002.
3. Hira and Gupta "Problems in Operations Research", S.Chand and Co.2008.
4. Wagner, "Operations Research", Prentice Hall of India, 2000.
5. S.Bhaskar, "Operations Research", Anuradha Agencies, Second Edition, 2004.

U13GS*T*005	ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- Acquire knowledge of economics to facilitate the process of economic decision making.
- Acquire knowledge on basic financial management aspects.
- Develop the skills to analyze financial statements

Course Outcomes

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

- Evaluate the economic theories, cost concepts and pricing policies
- Understand the market structures and integration concepts
- Understand the measures of national income, the functions of banks and concepts of globalization
- Apply the concepts of financial management for project appraisal
- Understand accounting systems and analyze financial statements using ratio Analysis.

Course Content

ECONOMICS, COST AND PRICING CONCEPTS: 9 Hours

Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual cost and opportunity cost – Incremental cost and sunk cost – Fixed and variable cost – Marginal costing – Total cost – Elements of cost – Cost curves – Breakeven point and breakeven chart – Limitations of break even chart – Interpretation of break even chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods

CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES: 9 Hours

Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration

NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT: 9 Hours

National income concepts – GNP – NNP – Methods of measuring national income – Inflation Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization–Privatization–Globalization

CONCEPTS OF FINANCIAL MANAGEMENT: 9 Hours

Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital

ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS: 9 Hours

Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance Financial statements – Ratio analysis – Types of ratios – Significance – Limitations.

Theory:45Hr Total Hours:45

REFERENCES

1. Prasanna Chandra, " Financial Management (Theory & Practice) TMH
2. Weston & Brigham, " Essentials of Managerial Finance"
3. Pandey, I. M., "Financial Management"
4. Fundamentals of Financial Management- James C. Van Horne.
5. Financial Management & Policy -*J*ames C. Van Horne
6. Management Accounting & Financial Management- M. Y. Khan & P. K. Jain
7. Management Accounting Principles & Practice -P. Saravanavel

U13GS*T*006	PRODUCT DESIGN AND DEVELOPMENT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- Acquire knowledge on the various stages of a product development process
- Develop skills for using the various tools and techniques for developing products
- Acquire knowledge on project management techniques

Course Outcomes

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

- Understand the process to plan and develop products
- Understand the process of collecting information and developing product specifications
- Understand the concept generation, selection and testing processes
- Understand the concepts of product architecture, industrial design and design for manufacture
- Understand the basics of prototyping, economic analysis and project planning and execution processes

Course Content

INTRODUCTION - DEVELOPMENT PROCESSES AND ORGANIZATIONS - PRODUCT PLANNING: **9 Hours**

Characteristics of successful product development to Design and develop products, duration and cost of product development, the challenges of product development. A generic development process, concept development: the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization. The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process

IDENTIFYING CUSTOMER NEEDS-PRODUCT SPECIFICATIONS **9 Hours**

Gathering raw data from customers, interpreting raw data in terms of customer needs, organizing the needs into a hierarchy, establishing the relative importance of the needs and reflecting on the results and the process. Specifications, establish specifications, establishing target specifications setting the final specifications

CONCEPT GENERATION - CONCEPT SELECTION - CONCEPT **9 Hours**

TESTING

The activity of concept generation clarifies the problem search externally, search internally, explore systematically, reflect on the results and the process Overview of methodology, concept screening, concept scoring, caveats. Purpose of concept test, choosing a survey population and a survey format, communicate the concept, measuring customer response, interpreting the result, reflecting on the results and the process

PRODUCT ARCHITECTURE - INDUSTRIAL DESIGN - DESIGN FOR MANUFACTURING 9 Hours

Meaning of product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues. Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, is assessing the quality of industrial design. Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

PROTOTYPING-PRODUCT DEVELOPMENT ECONOMICS - MANAGING PROJECTS: 9 Hours

Prototyping basics, principles of prototyping, technologies, planning for prototypes. Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

Understanding and representing task, baseline project planning, accelerating projects, project execution, post mortem project evaluation.

Theory:45Hr **Total Hours:45**

REFERENCES

1. Product Design and Development: Karl. T. Ulrich, Steven D Eppinger,. Irwin McGrawHill.
2. Product Design and Manufacturing: A C Chitale and R C Gupta, PHI
3. New Product Development: Timjones. Butterworth Heinmann,, Oxford. UCI.
4. Product Design for Manufacture and Assembly: Geoffery Boothroyd, Peter Dewhurst and Winston Knight.

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

VISION

- To produce Instrumentation Engineers and researchers specialized in Control and Electronics Engineering who will strive to find new avenues for the advancement of mankind.

MISSION

- To create high standard curriculum to keep up with the pace of growing technology.
- To offer state of the art inquisitorial practical oriented training.
- To set up research laboratories.