BE INSTRUMENTATION AND CONTROL ENGINEERING

SEMESTER - 1

19U101 CALCULUS AND ITS APPLICATIONS

3 1 0 4

DIFFERENTIAL CALCULUS: Functions of two variables, limit, continuity, partial derivatives, differentiability, total differential, extreme values and saddle points, constrained maxima and minima, Lagrange multipliers with single constraint, Taylor’s formula for two variables. (9 + 3)

MULTIPLE INTEGRALS I: Basic concepts, double integrals over rectangles, double integrals as volumes, Fubini’s theorem, double integrals over general regions, area by double integration, reversing the order of integration. (9 + 3)

MULTIPLE INTEGRALS II: Double integrals in polar form, triple integrals in rectangular coordinates, spherical and cylindrical coordinates. (9 + 3)

SECOND ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS: Homogeneous linear ODEs of second order, linearity principle, general solution, homogeneous linear ODEs with constant coefficients, Euler–Cauchy equations, solution by variation of parameters, modeling of electric circuits. (9 + 3)

VECTOR CALCULUS: Gradient of a scalar field, directional derivative, divergence of a vector field, curl of a vector field. Integration in vector field—line integrals, Green’s, Gauss divergence and Stokes’s theorems. (9 + 3)

Total L: 45 + T: 15 = 60

TEXT BOOKS:
1. Joel Hass, Christopher Heil, Maurice D. Weir “Thomas’ Calculus”, Pearson Education., New Delhi, 2018
2. Erwin Kreyszig “Advanced Engineering Mathematics”, Wiley India Pvt Ltd., New Delhi, 2015

REFERENCES:

19U102 INTRODUCTION TO ELECTROMAGNETIC THEORY

3 0 0 3


MAGNETISM: Magnetic force and field, Charged particles in magnetic fields, Magnetic force on a current, Hall effect. Biot-Savart's law, Magnetic force between conductors. Magnetic dipoles, Gauss’s law of magnetism, Torque on a magnetic dipole. Ampere’s law, Magnetic field due to straight conductors, circular loop — Magnetic flux density(B), Magnetic potential. (9)

ELECTROMAGNETIC INDUCTION: Induced currents, Faraday's law, Induction and Energy, motional emf and Lenz’s law, Electromagnetic braking and its applications. Eddy currents, closed and open circuits in magnetic field. Inductance: mutual and self inductance. Magnetic energy, Induced electric fields: conservative and non conservative electric fields. (9)


Total L: 45
TEXT BOOKS:
2. David J Griffiths "Introduction to Electrodynamics", Pearson., 2015

REFERENCES:
1. D Halliday and R Resnick "Fundamentals of Physics", John Wiley and Sons., 2015
4. Raymond A. Serway, John W. Jewett "Physics for Scientist and Engineers", Cenagage Learning., 2010

19U103 CHEMISTRY OF ELECTRONIC MATERIALS


Total L: 45

TEXT BOOKS:

REFERENCES:

19U104 PROBLEM SOLVING AND C PROGRAMMING


OPERATORS AND EXPRESSIONS: Arithmetic operators - Unary operators - Relational operators - logical operators - Assignment operators - Conditional operators - comma operator - sizeof operator -precedence and associativity - Library
functions. Control statements: simple if, if..else, nested if .. else ,elseif ladder , switch case -while -do while -for-Nested loops -break—continue—goto statements. 

ARRAYS: Defining an array - Processing an array - Multi dimensional arrays -strings. 

FUNCTIONS: Function prototype - Defining a function — function call - Passing arguments to a function --nested function — recursive function- Storage classes - auto - static - extern and register variables 

STRUCTURES: Definitions - Processing a structure — Array and structures — Nested structures - Structures and functions. Pointers: Definition - Pointer Arithmetic — types of pointer - const pointer, pointer to a constant, void pointer, null pointer 

TEXT BOOKS: 
2. Ajay Mittal "Programming in C - A Practical approach", Pearson., New Delhi, 2010 

REFERENCES: 

19G105 ENGLISH LANGUAGE PROFICIENCY 

LEARNING LANGUAGE THROUGH STANDARD LITERARY AND GENERAL TEXTS: Integrated Tasks focusing on Language Skills - Training based on Text based Vocabulary, tone, register and Syntax features 

GRAMMAR IN CONTEXT: Word Order - Subject Verb Concord - Style features - Tenses, Conditionals, Prepositions, Active and Passive Voice, Modals, Cloze and Spotting Errors exercise 

GUIDELINES FOR WRITTEN COMMUNICATION: Principles of Clear Writing - Paragraph Writing - Essay Writing- Emphasis Techniques - Summarizing and Paraphrasing - Analytical Writing 

FOCUS ON SPOKEN ENGLISH: Task — based activities with graded levels of difficulty and with focus on language functions - Level 1: Self — expression — Greetings in Conversation, Hobbies, Special interests, Daily routine - Level 2: General Awareness — Expression of Concepts, Opinions, Social Issues, Description of a process / picture/chart, news presentation / review - Level 3: Advanced Skills — Making Short Speeches and Participating in Role Plays 

LISTENING ACTIVITY: Task based Activities using Language Lab 

19U106 ELECTRIC CIRCUITS 

BASIC DEFINITIONS AND LAWS : Overview of electrical circuits: currents, voltages, power and energy - Circuit elements: active and passive elements - Independent and dependent sources - Resistive circuits: Ohm's law and Kirchoff's laws - Series resistors and voltage division - Parallel resistors and current division - Series voltage source and parallel current source - Y→∆ transformations 


AC CIRCUIT ANALYSIS: Sinusoidal voltages and currents - Phasor representation - RMS value - Form factor - Energy storage elements: Capacitors and inductors - Phasor relationship for R, L and C - Impedance and admittance - Inductively coupled
circuits: Mutual inductance - Dot convention - Coefficient of coupling - Resonance in parallel and series circuits - Bandwidth and Q factor

COMPLETE RESPONSE ANALYSIS:

THREE PHASE CIRCUITS:
Three phase voltages and currents - Y connected source and load - ∆ connected source and load - Y to ∆ circuit - Balanced three phase circuits - Power and power factor in three phase - Two-Wattmeter method of power measurement

TEXT BOOKS:

REFERENCES:

19U110 ENGINEERING GRAPHICS

INTRODUCTION:
1. Introduction to Engineering Drawing
2. BIS
3. Principles of dimensioning
4. Lettering Practice

ORTHOGRAPHIC PROJECTION:
1. Principles of orthographic projection—projection of points, straight lines, planes and solids.
2. Orthographic projection of simple engineering components – missing view exercises.
3. Drawing orthographic projections of computer components.

PICTORIAL PROJECTIONS:
1. Principles of pictorial views, isometric view of simple engineering components.
2. Isometric views from given two or three views.

SECTION OF SOLIDS:
1. Section of regular solids, Need for Sectional views.
2. Sectional views of simple engineering components.
3. Drawing sectional views of assemblies like electric motor, mobile phone.

DEVELOPMENT OF SURFACES:
1. Development of lateral surfaces of regular solids and truncated solids.
2. Preparing parts like tray, funnel, CPU housing using cardboard material.

TEXT BOOKS:

REFERENCES:
19U111 PROBLEM SOLVING AND C PROGRAMMING LABORATORY

1. Working with RAPTOR Tool – Flowchart Interpreter
2. Operators
3. Decision making Statements
4. Loops : while , do..while, for
5. One dimensional array
6. Two dimensional array
7. Strings
8. Functions
9. Recursive functions
10. Structures
11. Structures and arrays
12. Nested Structures
13. Pointers

Total P: 30

REFERENCES:
2. Ajay Mittal "Programming in C - A Practical approach", Pearson., New Delhi, 2010

19IP15 INDUCTION PROGRAMME

As per AICTE guidelines

SEMESTER - 2

19U201 COMPLEX VARIABLES AND TRANSFORMS

COMPLEX DIFFERENTIATION: Complex differentiation - analytic function, Cauchy Riemann equations, harmonic functions, linear fractional transformations. (9 + 3)

COMPLEX INTEGRATION: Cauchy’s integral theorem, Cauchy's integral formula, Laurent series, singularities and zeros, residue integration method (Residue integration of complex integrals only). (9 + 3)

LAPLACE TRANSFORMS: Laplace transform, inverse transform, linearity, s-shifting, transforms of derivatives and integrals, unit step function, t - shifting, Dirac’s delta function, periodic functions, method of solving differential equations by using Laplace transform technique. (9 + 3)

FOURIER SERIES: Fourier series- convergence and sum of Fourier series, functions of any period 2L, even and odd functions, half range expansions. (9 + 3)

FOURIER TRANSFORMS: Fourier transform, Fourier cosine and sine transforms - Discrete Fourier transform —Fast Fourier transform—DITalgorithm. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

REFERENCES:
19U202 MATERIALS SCIENCE

2002


TEXT BOOKS:

REFERENCES:

19U203 INDUSTRIAL ELECTROCHEMISTRY

2002

ELECTROCHEMISTRY: Conductance of strong and weak electrolytes, mobility of ions - transport number, applications of conductance measurement. Electrode potential — standard and reference electrodes, Nernst equation, emf series — applications. Galvanic and concentration cells. Applications of emf measurements — glass electrode - pH measurement, potentiometric redox titrations. (6)


METAL FINISHING IN ELECTRONIC INDUSTRY: Electroplating — plating parameters- polarization and overvoltage, current and energy efficiency. Electroplating of Cu, Ni, and Cr. Electroless deposition of Ni and Cu. Production of plated through hole PCBs, electroforming - fabrication of CD stampers, electrochemical etching of Cu from PCBs , Electrophoretic painting, Electrochemical etching of semiconductors. (6)

ELECTROCHEMICAL POWER SOURCES: Batteries- types, characteristics. Fabrication and working of lechlanche cell, primary lithium cell, lead- acid battery, Ni-metal hydride and lithium ion batteries. Supercapacitors. Fuel cells - Classification, working principle, components, applications of proton exchange membrane, direct methanol and solid oxide fuel cells. Hydrogen as a fuel-production and storage. (6)

SENSORS: Components of electrochemical sensors, electrochemical transducers-potentiometric, amperometric and conductometric methods – ion-selective electrodes — solid-state electrode, liquid ion-exchange membrane electrodes. Gas sensors—CO2,O2and NH3 sensing. Sensors for health care—glucose and urea. (6)

TEXT BOOKS:
REFERENCES:

19U204 ELECTRONIC DEVICES AND CIRCUITS

3003


TRANSISTORS: Basic BJT operation - Characteristics and Parameter - Transistor as a switch, as an amplifier - Phototransistor - Transistor biasing circuits - DC Operating point - Voltage divider bias and other bias methods - Hybrid equivalent circuit of a transistor - General Black Box theory - JFET Characteristics, Parameters and Biasing - MOSFET Characteristics, Parameters and Biasing - MOSFET based digital switching - Characteristics and applications of Uni Junction Transistor


OSCILLATORS: Elements of feedback oscillator - Conditions for oscillations - start up conditions - Oscillators with RC feedback circuits - Phase shift oscillator - Wein Bridge oscillator - Oscillators with LC feedback circuits - Colpitts oscillators - UJT relaxation oscillator - Crystal controlled oscillator

VOLTAGE REGULATORS: Voltage regulation - Selection of voltage regulator - Basic linear series regulator - short circuit or overload protection - Foldback current limiting - Linear shunt regulator - Introduction to switching regulators - Integrated circuit voltage regulators

Total L: 45

TEXT BOOKS:

REFERENCES:

19U210 CIRCUITS AND DEVICES LABORATORY

0042

LIST OF EXPERIMENTS:
1. Characteristics of PN Junction Diode (Silicon diode –forward bias only)
2. Half wave and Full wave diode rectifiers
3. Diode Clipper and Clamper Circuits
4. Characteristics of Zener diode and Zener diode voltage regulator
5. Characteristics of Bipolar Junction Transistor (BJT)
6. Characteristics of Junction Field Effect Transistor (JFET)
7. Characteristics of Uni Junction Transistor (UJT)
8. Realization of Differential amplifier using Bipolar Junction Transistors (BJT)
9. Single stage RC coupled Common Emitter amplifier
10. RC phase shift oscillator using BJT
11. Relaxation oscillators using UJT
12. Series and Shunt voltage regulators using BJT

Total P: 60
REFERENCES:

19U211 BASIC SCIENCES LABORATORY

0 0 4 2

PHYSICS LABORATORY (ANY EIGHT EXPERIMENTS):
1. Determination of magnetic field along the axis of a coil
2. Determination of Hysteresis loss of a ferromagnetic material
3. Determination of resistivity of metal and alloy using Carey Foster bridge
4. Determination of Temperature Coefficient of Resistance of metallic wire using post office box
5. Determination of capacitance using LCR bridge
6. Study of reverse bias characteristics of Germanium diode and determination of its band gap
7. Study of I-V characteristics of solar cell and determination of its efficiency
8. Thermistor: Measurement of temperature and band gap
9. Determination of dielectric constant and Curie Temperature of Barium Titanate
10. Hall effect set up - Determination of Hall Coefficient

(30)

CHEMISTRY (ANY EIGHT EXPERIMENTS):
1. Determination of hardness, TDS, pH and conductivity of a water sample.
2. Determination of molecular weight of polymers by Ostwald / Ubbelohde Viscometer.
3. Construction of phase diagram for eutectic system – for application in electronic cooling system.
4. Study of a galvanic cell.
5. Conductometric estimation of acid strength of a pickling bath.
6. Potentiometric estimation of ferrous ion in an effluent.
7. Anodizing of aluminium and determination of thickness of anodised film.
8. Preparation of chloride ion sensor by anodizing silver and calibration.
10. Examination of different forms of corrosion using Ferroxyl indicator and determination of corrosion rate by current measurement.

(30)

Total P: 60

REFERENCES:
1. Department of Chemistry "Basic Science Laboratory Manual", 2019
3. Department of Physics "Physics Practicals," , PSG College of Technology., Coimbatore, 2019

19U212 COMPUTATIONAL TECHNIQUES

0 0 2 1

LIST OF EXPERIMENTS:
1. Simple and complex numbers and their vector and polar forms
2. Elementary functions, their evaluations and series approximations
3. Polynomial interpolation schemes and curve fitting of data
4. Solutions of algebraic and transcendental equations
5. Matrix algebra and eigen values
6. Numerical differentiation and the finite difference methods
7. Approximate solutions of differential equations
8. Numerical integration
9. Arithmetic using graphical programming
10. Boolean operations using graphical programming

Total P: 30

REFERENCES:
2. Jovitha Jerome "Virtual Instrumentation using LabVIEW", PHI learning Pvt Ltd., New Delhi, 2010
4. Steven C Chapra "Applied Numerical Methods with MATLAB for Engineers and Scientists", McGraw-Hill., New Delhi,
19U213 INTERNSHIP

MODULE - I INSTRUMENTATION AND CONTROL
1. Study of Sensors
2. Functioning of Measurement Systems - Demonstration
3. Functioning of Control Systems - Demonstration

MODULE - II MECHANICAL
1. Fitting - Tools, operations, exercises Make — L joint, types of joints.
2. Carpentry - Tools, carpentry process, carpentry exercises types of joints.
3. Sheet metal work - Tools, operations, exercises Make a Rectangular Tray in Galvanized Iron sheet

MODULE - III SEMINAR PRESENTATION AND TECHNICAL REPORT WRITING
1. Technical Presentation
2. Writing Technical Laboratory Report

REFERENCES:

SEMESTER - 3

19U301 LINEAR ALGEBRA AND NUMERICAL ANALYSIS

VECTOR SPACE : General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension. (9 + 3)

SYSTEM OF LINEAR EQUATIONS, EIGENVALUES AND EIGENVECTORS : Errors - approximations and round-off errors — truncation errors, system of linear equations - Naive Gauss elimination method, Crout’s method, Gauss – Seidel method, eigenvalues and eigenvectors using power method. (9 + 3)

INTERPOLATION, DIFFERENTIATION AND INTEGRATION : Newton’s divided-difference interpolating polynomials, Lagrange interpolating polynomials, equally spaced data - Newton’s forward and backward interpolating polynomials, numerical differentiation — evenly spaced data, numerical integration - Newton-cotes formulae, trapezoidal rule, Simpson’s 1/3 rule. (9 + 3)


NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS : Finite difference: elliptic equations - the Laplace equation, Poisson equation — Liebmann method, parabolic equations — heat conduction equation — Crank Nicolson’s method, hyperbolic equations – vibrating string. (9 + 3)

Total L: 45 + T: 15 = 60

TEXT BOOKS:

REFERENCES:

19U302 ELECTRICAL MACHINES

DC MACHINES : Principles of energy conversion - Construction and principle of operation of DC generator - EMF equation - Characteristics of DC generators - Principle of operation of DC motor - Torque equation- Characteristics of DC motors — Starting of DC motors - Speed control of DC motors - Losses and efficiency calculations- Braking - Applications of DC machines. (9)
TRANSFORMERS: Construction and principle of operation of single phase transformer- EMF equation- Equivalent circuit - Testing of transformer — Efficiency and voltage regulation - All day efficiency - Operation of auto transformers - Three phase transformer connections - Applications of single phase and three phase transformer. (9)

SYNCHRONOUS MACHINES: Construction and principle of operation of three phase alternators - EMF equation - Determination of regulation - Theory of operation of synchronous motor - Methods of starting- Operating characteristics: Constant excitation with variable load and constant load with variable excitation – Synchronous condenser—Applications (9)

INDUCTION MOTORS: Construction and principle of operation of three phase induction motor - Classification of induction motor - Torque production — Torque-Slip characteristics - Maximum torque - Starting and speed control - Principle of operation of single phase induction motor - Types of single phase induction motors and their applications. (9)

SPECIAL MACHINES: Stepper motor — Switched reluctance motor - Universal motor - Brushless DC motor - Permanent magnet synchronous motor - Servomotor - Linear induction motor. (9)

TOTAL L: 45

TEXT BOOKS:

REFERENCES:

19U303 DIGITAL ELECTRONICS

NUMBER SYSTEMS AND BOOLEAN FUNCTIONS: Review of Number Systems, number complements, Binary arithmetic, Binary codes: weighted and non-weighted codes, alphanumeric codes, Error detection and correction codes, Switching functions, Canonical forms, Incompletely specified functions, Simplification of logic functions through Boolean Algebra, K — maps and Quine-McCluskey method, Implementation of logic functions using basic logic gates and universal gates. (9 + 3)

COMBINATIONAL LOGIC DESIGN: Design of Arithmetic circuits-Adders / subtractors, Carry look-ahead adder, signed number addition and subtraction, BCD adders, IC adders, Magnitude comparator, Decoders, Encoders, Multiplexers and Demultiplexers. Implementation of combinational logic function using multiplexers and demultiplexers. (9 + 3)


PROGRAMMABLE LOGIC DEVICES: Semicustom design - Introduction to Programmable Logic Devices — Read Only Memory, Programmable Array Logic, Programmable Logic Array, Field Programmable Logic Array, Field Programmable Logic Sequencer, Architecture of Programmable Logic Devices , Implementation of logic functions. (9 + 3)

DIGITAL LOGIC FAMILIES: Characteristics of digital ICs — Voltage and current ratings, Noise margin, Propagation delay, Power dissipation, Fan-in, Fan-out. TTL logic family — Totem pole, Open collector and tristate outputs. MOS transistor switches —NMOS Inverter / Logic gates, CMOS Inverter / logic gates, ECL logic families, Comparison of performance of various logic families, Interfacing TTL and CMOS devices.. (9 + 3)

TOTAL L: 45 +T: 15 = 60

TEXT BOOKS:

REFERENCES:
19U304 LINEAR ICS AND APPLICATIONS

OPERATIONAL AMPLIFIER CHARACTERISTICS: Functional Block Diagram - Symbol - Characteristics of an ideal operational amplifier - Circuit schematic of 741 op-amp - Open loop gain - CMRR - DC characteristics - Frequency response characteristics - stability - limitations - frequency compensation - slew rate

LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS: Inverting and Non-inverting amplifiers - Voltage follower - Summing amplifier - Differential amplifier - Instrumentation amplifier: Design and applications - Integrator and Differentiator - Voltage to Current and Current to Voltage converters - Active filters - Design of Butterworth filters - low pass, high pass, wide band pass, Band stop and notch filter

NON-LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS: Comparator - Regenerative comparator - Zero crossing detector - Window detector - Sample and Hold circuit - Precision diode - Half and Full wave rectifiers - Active peak detector - Clipper and Clamper - Logarithmic and Exponential amplifiers - Square and Triangular waveform generators

VOLTAGE REGULATORS AND SPECIAL FUNCTION ICS: Block diagram of 723 general purpose voltage regulator - Circuit configurations, Fixed and adjustable three terminal regulators - 555 Timer - Functional block diagram and description - Monostable and Astable operation, Applications - Voltage Controlled Oscillator - PLL: Functional Block diagram - Principle of operation - Applications

D/A AND A/D CONVERTERS: Digital to Analog Converters - Binary weighted and R-2R Ladder types - Analog to digital converters - Continuous, Counter ramp - Successive approximation, Single slope - Dual slope and Parallel types - Sigma-Delta type ADC - Performance characteristics

TEXT BOOKS:

REFERENCES:

19U305 THERMODYNAMICS AND FLUID MECHANICS

BASIC CONCEPTS OF THERMODYNAMICS: System, property, state and equilibrium, process and cycle, work, heat and other forms of energy, Zeroth law and application, first law - statement, applications to closed and open systems, statements - Heat engine, refrigerator and heat pump, reversibility and irreversibility, Carnot cycle and Carnot theorem, second law, entropy - Thermo Dynamic Cycles: Air standard cycles - Otto cycle, Diesel cycle, Dualcycle, Brayton cycle. Rankine cycle


FLOW THROUGH CIRCULAR PIPES: Pipes in series and parallel. Reynolds number, Darcy-Weisbach equation, minor losses - Sudden expansion, sudden contraction and losses in pipe fittings

HYDRAULIC TURBINES AND PUMPS: Impulse type, Pelton wheel, reaction type, Francis, Kaplan and Propeller — Principle of operation, performance of turbines, draft tube. Hydraulic pumps: Classification - Reciprocating and centrifugal pumps - Performance studies, fluid coupling and torque converter

COMPRESSORS: Classification, reciprocating and centrifugal compressors, applications, characteristics, surging and stalling

TEXT BOOKS:

REFERENCES:

19O306 ECONOMICS FOR ENGINEERS


TEXT BOOKS:

REFERENCES:

19U310 ELECTRICAL MACHINES LABORATORY

LIST OF EXPERIMENTS :
1. No-load and Load Characteristics of DC Shunt Generator
2. Load Characteristics of Compound Motor
3. Load Characteristics of DC Series Motor
4. Open Circuit and Short Circuit Tests on Single phase Transformer
5. Load Test on Single phase Transformer
6. Load Test on Three phase Alternator
7. Load Test on Three phase Induction Motor
8. Load Test on Single phase Induction Motor
9. Electrical Braking of DC shunt motor
10. Speed control of DC shunt motor

REFERENCES:

19U311 LINEAR AND DIGITAL ICS LABORATORY

ANALOG ICS BASED EXPERIMENTS :
1. Implementation of linear applications of operational amplifier
2. Implementation of Non linear applications of operational amplifier
3. Design and implementation of active filters
4. Implementation of voltage regulators
5. Realization of astable multivibrator using 555 timer

DIGITAL ICS BASED EXPERIMENTS:
1. Realization of universal gates using basic logic gates
2. Design and implementation of combinatorial circuits
3. Design and implementation of flip flops using logic gates
4. Design and implementation of counters and registers
5. Design of synchronous sequential circuits

REFERENCES:

19K312 ENVIRONMENTAL SCIENCE

INTRODUCTION TO ENVIRONMENT:
Environment - Definition, scope and importance. Types and composition of atmosphere — particles, ions and radicals. Ozone layer - significance, formation and depletion. Ecosystems- Structure and functions, components, energy flow, food chains, food web, Biodiversity- levels, values and threats — India as a mega-diversity nation — hotspots of biodiversity — endangered and endemic species of India — conservation of biodiversity.

ENERGY RESOURCES:
Introduction — National and International status- exploitation - sustainable strategies- Fossil fuels- classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas; solar energy - introduction, harnessing strategies. Wind energy - availability, wind power plants, wind energy conversion systems, site characteristics, and types of wind turbines. Supporting renewable energy resources - tidal —geothermal -hydroelectric.

ENVIRONMENTAL POLLUTION:
Definition — Sources, causes, impacts 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 (h) RF hazards - Role of an individual in prevention of pollution. DISASTER MANAGEMENT: Floods, earthquake, cyclone and landslides — Case studies, consequences and rescue measures

WASTE MANAGEMENT:

SOCIAL ISSUES AND THE ENVIRONMENT:

TEXT BOOKS:

REFERENCES:

SEMESTER - 4

19U401 PROBABILITY AND RANDOM PROCESSES

PROBABILITY:
Probability axioms, some consequences of the axioms, conditional probability, law of total probability, Baye’s theorem, independence, sequential experiments and tree diagrams, reliability problems.

RANDOM VARIABLES:
Discrete random variables — probability mass function, binomial, Poisson and geometric random variables, cumulative distribution function, expectations. Continuous random variables — probability density function,
uniform, exponential, Gaussian random variables, expectations. \( (9 + 3) \)

**PAIRS OF RANDOM VARIABLES**: Joint cumulative distribution function, joint probability mass function, marginal probability mass function, joint probability density function, marginal probability density function, expected values, independent random variables, covariance. \( (9 + 3) \)

**STOCHASTIC PROCESSES**: Types of stochastic processes — Poisson process, Brownian motion process, expected value and correlation, stationary processes, wide sense stationary stochastic process, cross-correlation \( (9 + 3) \)

**RANDOM SIGNAL PROCESSING**: Linear filtering of a continuous-time stochastic process, linear filtering of a random sequence, power spectral density of a random sequence. \( (9 + 3) \)

**TEXT BOOKS**:

**REFERENCES**:  

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**19U402 TRANSDUCER ENGINEERING**

**SCIENCE OF MEASUREMENT**: Units and Standards — General concept and terminology of measurement systems— General input-output configuration - transducer classification — Static and Dynamic characteristics— Calibration techniques (analog and digital) — Statistical analysis of measurement data \( (9) \)

**RESISTANCE TRANSDUCERS**: Principles of operation, construction details, characteristics of resistance transducers, resistance potentiometers, metal and semiconductor strain gauges. Signal conditioning circuits. Applications of strain gauge for measurement of load and torque \( (9) \)

**INDUCTIVE TRANSDUCERS**: Induction potentiometer, variable reluctance transducers, LVDT, eddy current transducers, synchros and resolvers, magneto-strictive transducers, electromagnetic sensors — associated signal conditioning circuits for above transducers- Proximity sensor \( (9) \)

**OTHER SENSORS**: Piezo-electric transducer, Piezo resistive sensor, capacitive transducer, Hall effect transducer, tachogenerator, stroboscope, photoelectric transducers, thermocouples, gyroscope, seismic instruments and accelerometers, digital displacement transducers, fibre optic sensor, IC sensor, LIDAR \( (9) \)

**MICRO AND SMART SENSORS**: MEMS sensors and actuators, principle and application. Smart sensors: Introduction construction, advantages and application, flexible sensors, Gas sensors \( (9) \)

**TEXT BOOKS**:  

**REFERENCES**:  
19U403 ELECTRICAL AND ELECTRONIC MEASUREMENTS

3 0 0 3

ELECTRO MECHANICAL INSTRUMENTS: Classification of instruments, Operating forces and Control systems for electromechanical indicating instruments, D’Arsonval galvanometer- Permanent Magnet Moving Coil instrument, Moving iron instruments, Electrodynamometer type instruments - Construction, Torque equation, Errors, Extension of instrument ranges, Use of Shunts, Multipliers and Instrument transformers. (9)

MEASUREMENT OF POWER AND ENERGY: Electrodynamometer wattmeter, Torque expression, errors, Measurement of power using instrument transformers, Measurement of power in single and three phase circuits, Single phase induction type energy meter, Digital energy meter, Single phase Electrodynamometer Power Factor meter. (9)

MEASUREMENT OF RESISTANCE: Classification of resistances, Measurement of resistances: Ammeter Voltmeter method, Substitution method, Wheatstone bridge, Kelvin’s double bridge method, Meggar, Potentiometers. (9)

IMPEDANCE MEASUREMENTS: General equation for bridge balance — Maxwell’s bridge —Wien’s bridge —Hay’s bridge — Schering bridge—Anderson bridge—Campbell bridge to measure mutual inductance. (9)


Total L: 45

TEXT BOOKS:

REFERENCES:

19U404 CONTROL SYSTEMS I

3 1 0 4

INTRODUCTION TO CONTROL SYSTEMS: History of control systems - Types of control systems: Open loop and closed loop - Mathematical modeling: Linearization, modeling of mechanical systems, electrical systems, liquid level systems, and thermal systems - Electrical analogy of physical systems - Reduction of multiple subsystems: block diagram, signal flow graphs. (9+3)


INTRODUCTION TO INDUSTRIAL CONTROLLERS: Proportional, Integral and Derivative modes of control – PI, PD, PID controllers – Tuning rules for PID controllers - Modification of PID control schemes - Robust control systems and system sensitivity – Design of robust PID controlled system. (9+3)

TEXT BOOKS:

REFERENCES:

19U405 PRINCIPLES OF COMMUNICATION SYSTEMS

2 0 0 2

AMPLITUDE MODULATION : Electromagnetic Waves, Principles of Amplitude Modulation, AM Generation, AM Transmitter, AM Receiver, AM Detection. (6)

ANGLE MODULATION : Frequency Modulation, Direct and Indirect Method of FM Generation, FM Transmitter, FM Receiver, FM Detection, Phase Modulation. (6)


Total L: 30

TEXT BOOKS:

REFERENCES:

19U406 DATA STRUCTURES AND ALGORITHMS

3 0 0 3


Total L: 45

39
TEXT BOOKS:

REFERENCES:

19U410 TRANSDUCER LABORATORY

LIST OF EXPERIMENTS:
1. Measurement of strain using strain gauges
2. Measurement of linear displacement using LVDT
3. Characteristics of Hall effect sensor
4. Characteristics of temperature sensors
5. Measurement of vibration
6. Measurement of pressure
7. Measurement of distance using proximity sensors
8. Experimental study of loading effect of potentiometer
9. Implementation of opto-coupler using photoelectric transducers
10. Characteristics of capacitive measurement systems
11. Study of angular displacement measurement using digital transducer
12. Study of sound intensity measurement

Total P: 60

REFERENCES:

19U411 SYSTEMS AND MEASUREMENT LABORATORY

LIST OF EXPERIMENTS:
1. Measurement of resistance using Wheatstone bridge and Kelvin's Double bridge
2. Measurement of capacitance and inductance using Schering Bridge and Anderson Bridge
3. Extension of instrument ranges
5. Calibration of voltmeter and ammeter
6. Time response of first order systems for test inputs
7. Time response of second order system for test inputs
8. Frequency response analysis of systems
9. Study of effect of adding poles and zeros
10. Design of compensation networks

Total P: 60

REFERENCES:

19O412 INDIAN CONSTITUTION

INTRODUCTION: Evolution of Indian Constitution; Significance of Constitution; Composition; Preamble and its Philosophy. (4)
RIGHTS, DUTIES AND DIRECTIVE PRINCIPLES: Fundamental Rights- Writs and Duties, Directive Principles of State Policy (6)

COMPOSITION OF PARLIAMENT AND FEDERALISM: Union Government, President and Vice President, Houses of the Parliament and their functions; Composition of State Legislature; Powers, Functions and Position of Governor, Function of Chief Ministers, Council of Ministers; The Indian Federal System, Administrative Relationship between Union and States. (8)

BILLS AND CONSTITUTION AMENDMENT PROCEDURE: Types of Bills, Stages of passing of Bill into an Act, Veto Power, Constitution Amendment Procedure, Various Amendments made and their significance for India. (6)

JUDICIARY: Supreme Court and High Court; Functions and powers, Judicial Review. (6)

TEXT BOOKS:

REFERENCES:

19Q413 SOFT SKILLS DEVELOPMENT

SOFT SKILLS DEVELOPMENT:
1. Body Language and Professionalism
2. Interpersonal skills
3. Goal setting
4. Impression Management
5. Team Building
6. Time Management
7. Stress Management
8. Convincing Skills
9. Motivation
10. Change Management
11. Communication Confidence
12. Group discussion basics
13. Personal Interview basics
14. Resume writing

REFERENCES:

SEMESTER - 5

19U501 INDUSTRIAL INSTRUMENTATION I

PRESSURE MEASUREMENT: Terminologies - Units - Manometer types - Elastic elements: Bourdon tube-Bellows- Diaphragm. Electrical Methods: Elastic elements with LVDT and strain gauges-Capacitive type pressure gauge - Piezo resistive pressure sensors- IP converter- Low pressure measurement: McLeod gauge-Thermal conductivity gauges-Ionization gauge-Cold cathode and hot cathode types - Testing and calibration of pressure gauges: Dead weight tester (9)

LEVEL MEASUREMENT: Units - Sight glass - Dip stick - Float type - Level measurement in open and closed head tanks - Bubbler method- Tuning fork and displacer methods -Differential pressure method- Mounting Issues - Purge system - Electrical methods of level measurement using resistance, capacitance, radar, nuclear radiation and ultrasonic sensors - Level switches
- Calibration of level sensors

**TEMPERATURE MEASUREMENT**: Units - Filled-in systems: Different types - Sources of errors and their compensation - Bimetallic thermometer - Electrical methods of temperature measurement: RTD - Types of RTDs - 3 wire and 4 wire RTDs - Thermistor - Linearization - Diode type sensors - Integrated circuit sensors - Temperature switches and thermostats - Thermal Imaging - Calibrators - Calibration of temperature sensors

**THERMOCOUPLES AND RADIATION PYROMETERS**: Thermocouple - Laws and types of thermocouple - Fabrication of industrial thermocouples - Signal conditioning - Cold junction compensation - Thermocouple burnout detection - Special techniques for measuring high temperature using thermocouples - Thermopile - Installation - Radiation fundamentals - Radiation methods of temperature measurement: Radiation pyrometers - Total radiation pyrometers - Optical radiation pyrometers - Ultrasonic thermometers - Fiber optic temperature measurement

**MEASUREMENT OF VISCOSITY, HUMIDITY, DENSITY AND MOISTURE**: Units - Viscosity - Terminologies - Saybolt viscometer - Torsion Viscometer - Rotameter type viscometer - Humidity terms - Dry and wet bulb psychrometers - Hotwire electrode type hygrometer-Dew cell - Electrolysis type hygrometer - Capacitive humidity sensor - Density measurement using weight, buoyancy, hydrostatic head and radiation methods - Moisture measurement - Electrical methods - Overview of weight measurement techniques

**TEXT BOOKS:**

**REFERENCES:**

**19U502 CONTROL SYSTEMS II**


**ANALYSIS IN STATE SPACE**: Characteristic equation, Eigen values and Eigen vectors - Matrix exponential - Solution of state equation – State transition matrix - Concepts of controllability and Observability - Controllability tests – Observability tests – Invariance property - Effect of Pole Zero cancellation on controllability and Observability – Equivalence between transfer function and state variable representations.


**INTRODUCTION TO DIGITAL CONTROL SYSTEMS**: Basic elements of discrete data control system – Advantages of discrete data control system – State equations of discrete data systems – Relationship between state equations and transfer functions - Relationship between state equations and higher order difference equations – Digital controllers: Physical realizability considerations, Realization of digital controller by digital programming, Digital PID controllers – Pole placement design with state feedback (SISO).


**TEXT BOOKS:**
REFERENCES:

19U503 MICROPROCESSORS AND MICROCONTROLLERS

MICROPROCESSOR: Architecture of 8-bit microprocessor, bus configurations, Instruction classifications — Instruction, data format and storage — Overview of 8085 Instruction set — Programming exercise — Instruction execution time.

MEMORY AND I/O INTERFACING: Interface requirements — Address space partitioning — Buffering of Buses — Memory control signals — Typical EPROM, RAM Interfacing. I/O interfacing: Memory mapped I/O scheme — I/O ports - Programmable peripheral interface.


ON-CHIP PERIPHERALS AND INTERFACING: Input / Output Ports structure - Counter and Timers, Serial Data Input / Output - Interrupts, LCD, LED and Keyboard Interfacing, ADC, DAC and Sensor interfacing, interfacing to external memory.

APPLICATIONS AND PROGRAMMING IN C: Stepper and DC motor interfacing, 8051 programming in C: Data types, I/O programming, Logic operation, Accessing code ROM space.

TEXT BOOKS:

REFERENCES:

19U504 DIGITAL SIGNAL PROCESSING

DISCRETE TIME SIGNALS AND SYSTEMS: Motivation — Sampling and Quantization of signal - Different representations of DT sequence — Operations on DT sequence - LTI system - properties — Linear and convolution - correlation.

TRANSFORMS: Discrete Fourier Transform — Properties — Fast Fourier Transform - Decimation in Frequency FFT algorithm- Frequency response of LTI system.

FIR FILTERS: Characteristics, symmetry, linear phase and types — Design of FIR filter using windowing technique Frequency sampling technique- introduction to optimal FIR filter design- Realization of FIR filter.


TWO DIMENSIONAL SIGNALS AND SYSTEMS: 2D unit impulse, unit step sequence - separable sequence - properties of 2-D systems: linearity, time invariance, causality and stability - 2-D convolution-2-D Z transform - Region of Convergence-2-D Discrete Fourier Transform - properties.
19U505 COMPUTER NETWORKS

3 0 0 3

INTRODUCTION TO DATA COMMUNICATION: Characteristics and Components of Data Communication, Data representation, Data flow, Network topology, Protocols and Standards, Data and signals- analog and digital signals, Transmission Impairment, Network performance, Transmission media-guided media and unguided media. (9)


NETWORK AND TRANSPORT LAYERS: Introduction to TCP/IP Protocol suite, Logical Addressing—IPv4 and IPv6 addresses, Internet protocol—Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Process to process delivery, UDP, TCP. (9)

LOCAL AREA NETWORKS: Objectives and advantages of PC LANs, Medium access control techniques - CSMA, CSMA/CD, Token passing, Connecting devices - Passive hubs, Repeaters, Active hubs, Bridges, Layer 2 switches, Routers, Layer 3 switches, Gateway. (9)

INTERFACE: Communication protocols- EIA232, EIA485 serial interface standard, Industrial Ethernet, Local Interconnect Network, Controller Area Network, Flexray. (9)

Total L: 45

TEXT BOOKS:

REFERENCES:

19U510 CONTROL SYSTEMS LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:
1. Realization of electronic P, PI, PD and PID controllers
2. Determination of Transfer function of DC Servo motor
3. Determination of Transfer function of AC Servo motor
4. Frequency response based PID controller design
5. Time response based PID controller design
6. Design of compensation networks
7. Design of state feedback controller
8. Design of state observer
9. Design of observer based controller
10. Design of simple robust controller

Total P: 30
REFERENCES:

19U511 MICROPROCESSOR AND DSP LABORATORY

LIST OF EXPERIMENTS:

MICROPROCESSOR BASED EXPERIMENTS:
1. Binary addition and subtraction
2. BCD addition and subtraction
3. Multiplication and division
4. Table processing
5. Interfacing with peripherals (15)

SIGNAL PROCESSING BASED EXPERIMENTS:
1. Generation of signals and operation on signals
2. Sampling and Quantization of signals
3. Transform domain analysis of signals and systems
4. Design of FIR filter
5. Design of IIR filter (15)

Total P: 30

REFERENCES:

19Q513 BUSINESS AND MANAGERIAL COMMUNICATIONS

BUSINESS AND MANAGERIAL COMMUNICATIONS:
1. Advanced Group discussion
2. Advanced Resume writing
3. Mock Group discussion
4. Advanced Personal Interview
5. Mock Personal Interview
6. Cracking special Interviews
7. Essential Grammar for Placements
8. Vocabulary for Placements
9. Email writing
10. Paragraph writing
11. Essay writing

Total P: 30

REFERENCES:

SEMESTER - 6

19U601 INDUSTRIAL INSTRUMENTATION II


ELECTRICAL TYPE FLOW METER: Principle and constructional details of electromagnetic flow meter - Different types of excitation schemes used - Different types of ultrasonic flow meters - Laser Doppler anemometer systems - Vortex shedding flow meter - Target flow meter - Open channel flow measurement - Solid flow rate measurement - Guidelines for selection of flow meter.

ELECTROMAGNETIC COUPLING: Introduction, interference coupling mechanism, basics of circuit layout and grounding, concepts of interfaces, filtering and shielding - Safety: 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.


REFERENCES:

TEXT BOOKS:


BASIC CONTROL ACTIONS AND CONTROLLERS: Characteristics of on-off, proportional, single-speed floating, integral and derivative control modes - P+I, P+D and P+I+D control modes - Integral windup and prevention - Auto / Manual transfer: Bumpless transfer - Electronic controllers to realize various control actions - Response of controllers for test inputs - Effects of P, I and D actions on closed loop response - Selection of controller modes for control of level, pressure, flow and temperature process.

FINAL CONTROL ELEMENT: Current to pressure converter - Pneumatic and electric actuators - Valve positioner - Pneumatic control valve: parts and classification - Characteristics of control valves: Inherent and Installed characteristics - Commercial valve bodies - Control valve sizing - Cavitation and flashing - Control valve types: flow control valve, pressure control valve and directional control valve - Valve selection actuators.


MULTILOOP & MULTIVARIABLE CONTROL: Feed forward control - Ratio control - Cascade control - Time delay compensation - Inferential control - Split range control - Selective Control - Introduction to Adaptive Control - Multi Input Multi Output Processes: Process interactions and control loop interactions - Pairing of controlled and manipulated variables - Case studies: Binary distillation column control, boiler drum level control and chemical reactor control.

19U602 PROCESS CONTROL

3 1 0 4

Total L: 45 + T: 15 = 60
19U603 EMBEDDED SYSTEM DESIGN

3 0 0 3


RTOS FOR EMBEDDED SYSTEMS: Interrupt driven systems-Need for Real-time Operating System-RTOS Concepts Tasks, Context switching, Interrupt latency, Memory management, Scheduling, Task synchronization- Introduction to RTOS APIs- Power optimization strategies for processes-Basic design using RTOS- Response time calculation-Comparison of commercial RTOSs. (9)

EMBEDDED-BASED CONTROL SYSTEM: Introduction to digital control systems — Open-Loop and Closed-Loop control system — General control systems and PID controllers — Software coding of a PID controller — PID Tuning — Practical issues related to computer-control implementations. (9)

TEXT BOOKS:

REFERENCES:

Total L: 45

19U604 POWER ELECTRONICS AND DRIVES

3 0 0 3

REVIEW OF POWER ELECTRONIC DEVICES: Power diodes and transistors. Thyristors, GTO, IGBT, other devices in thyristor family. Thyristor protection circuits — Thyristor triggering circuits — series and parallel operation of thyristors, commutation techniques. (9)


DC AND AC DRIVES: Basic characteristics of DC motor - Control of DC motor - Regenerative and dynamic braking Closed loop control scheme - Speed torque characteristic of induction motor - stator voltage control — Sensor less vector control – Flux vector control- Static rotor resistance control - Slip power recovery scheme - Self control of synchronous motor. (9)

APPLICATIONS: Switched mode power supplies, Uninterrupted power supplies, High Voltage DC transmission — control of HVDC converters, Solid state relays, Static circuit breakers. Introduction to FACTS controllers. (9)

TEXT BOOKS:

REFERENCES:

19U610 PROCESS CONTROL LABORATORY

LIST OF EXPERIMENTS:
1. First principle modeling and validation of Interacting and non-interacting systems
2. Experimental study of ON-OFF and proportional controller responses on temperature loop
3. Experimental study of controller response and analysis on flow loop.
4. Experimental study of controller response and analysis on level loop
5. Experimental study of controller response and analysis on pressure loop.
6. On line controller tuning using open loop and closed loop methods.
7. Comparisons of inherent and installed characteristics of control Valves.
8. Implementation of cascade control system.
9. Design and implementation of Feed forward-feedback Controller and inferential control schemes
10. Design and Implementation of PID controller for MIMO process

REFERENCES:

19U611 EMBEDDED SYSTEM LABORATORY

LIST OF EXPERIMENTS:
1. GPIO Programming.
2. I/O interfacing.
3. Polling and interrupt service mechanism using Timer/ Counter Peripheral.
5. Implementation of Pulse Width Modulation.
7. Microcontroller based TRIAC control for AC loads.
8. Microcontroller based PID implementation for real time system.
9. Microcontroller based fixed point implementation.
10. Microcontroller based power consumption analysis.

REFERENCES:
1. ATMEL, "ATMEL Datasheet", .
19Q613 QUANTITATIVE AND REASONING SKILLS

QUANTITATIVE AND REASONING SKILLS:
1. Number System, Time and Work
2. Percentages, Simple and Compound Interests
3. Time, Speed and Distance
4. Permutation, Combination and Probability
5. Ratio and Proportion
6. Profit, Loss and Partnership
7. Logarithms, Progressions, Geometry and Quadratic Equations
8. Coding and Decoding
9. Series, Analogy and Odd Man Out
10. Visual Reasoning
11. Data Arrangements
12. Blood Relations
13. Clocks, Calendars and Direction Sense
14. Cubes, Logical Connectives and Syllogisms
15. Venn Diagrams, Interpretations and solving

Total P: 30

REFERENCES:

19U620 INNOVATION PRACTICES

Students will
- Learn about current practices in product/process development
- Identify key issues, priorities, and tasks
- Perform literature survey, including Patents
- Perform feasibility analysis
- Develop prototypes and test or re-use recent innovations systematically and submit a report

Total P: 60

SEMESTER - 7

19U701 LOGIC AND DISTRIBUTED CONTROL SYSTEM

COMPUTER BASED PROCESS CONTROL: Data loggers - Data Acquisition Systems (DAS) - Functional block diagram of computer control systems - sampling considerations - Supervisory Control and Data Acquisition Systems (SCADA): Hardware and software, Remote terminal units, Master station, communication architectures. (8)

PROGRAMMABLE LOGIC CONTROLLER (PLC): Introduction - architecture of PLC - working principle - memory types - Input/Output modules - sink and source I/O cards - programming methods - programming device - Basic Programming Instructions: User and bit Instructions, Instruction addressing, branch instructions, internal relay instructions - Ladder diagram for Boolean Gates - Concept of Latching and Unlatching - Timer instruction - Counter instruction (9)

ADVANCED FUNCTIONS IN PLC: Program Control Instructions: Master Control Reset, Jump, SKIP and Subroutines - Data Manipulation Instructions: Data transfer, Data Compare - Math instructions: Addition, Subtraction, Multiplication, Division - Sequencer instructions - PID functions - Design of alarm and interlocks - Networking of PLC - PLC installation, maintenance and troubleshooting. (10)

DISTRIBUTED CONTROL SYSTEMS (DCS) AND COMMUNICATION FACILITIES: DCS - Various Architectures and Comparison - Local control unit (LCU) - Process interfacing issues - Operator Interfaces - Engineering Interfaces - Redundancy concept - Interoperability and Interchangeability - Communication facilities: HART Protocol, Wireless HART, Foundation Fieldbus and Profinbus - Case Study of any one DCS (10)

ADVANCED TOPICS IN AUTOMATION: Introduction to Networked Control systems - Plant wide control – Industrial Internet of things (IIoT) - Cloud based Automation - Introduction to OLE for Process Control (OPC) - Safety PLC (8)
TEXT BOOKS:

REFERENCES:

19U702 ANALYTICAL INSTRUMENTATION


NMR AND X-RAY SPECTROSCOPY: Nuclear magnetic Resonance (NMR) spectroscopy - Basic principles - The NMR phenomenon - Magnetic moments - Number of signals - Chemical shift - Continuous wave NMR spectrometer - Pulsed Fourier Transform NMR spectrometer - NMR applications. X-ray absorption methods - X-ray fluorescence methods - X-ray diffraction. Radioactive measurement - Units of radioactivity - Application of radio nuclides in analysis - Radioactivity detectors. (9)

CHROMATOGRAPHY: Basic principles of chromatography - Types of Chromatography - Gas chromatography - Column details - Detectors for chromatography - Thermal conductivity detector - Flame ionization detector - Flame photometric detector - Electron capture detector - Effect of temperature programming - High pressure liquid chromatography (HPLC). Mass spectrometry - Instrumentation - Base peak - Molecular ion peak - metastable peak - Isotopic peaks - Applications. (9)


TEXT BOOKS:

REFERENCES:
LIST OF EXPERIMENTS:
1. Implementation of basic logic operations Using PLC
2. Implementation of timer operations using PLC
3. Implementation of counter operations using PLC
4. Study of Analog and Digital I/O interfacing in PLC
5. Implementation of actuator control using PLC
6. Implementation of sequential control using PLC sequencer function
7. Implementation of PLC programming for practical applications
8. Study of various function blocks in DCS
9. Implementation of control logic using DCS
10. On-line monitoring and control using DCS
11. Study of IoT based Automation using PLC

REFERENCES:

LIST OF EXPERIMENTS:
1. Study of zero elevation and zero suppression in differential pressure transmitter
2. Design of alarm circuit
3. Linearization of thermistor and cold junction compensation of thermocouple
4. Design of temperature transmitter
5. Calculation of discharge co-efficient of orifice plate, venturi and pitot tube
6. Implementation of GUI for a transducer output with options to moderate static characteristics
7. 7) Signal acquisition and creation of GUI for real-time display and data logging from a temperature sensor (RTD/Thermistor)
8. Signal Acquisition from thermocouple and creation of GUI with compensation
9. Implementation of virtual PID controller
10. Implementation of single loop and multi loop controllers using virtual instrument

REFERENCES:

19U720 PROJECT WORK I

- Identification of a real life problem in thrust areas.
- Developing a mathematical model for solving the identified problem.
- Finalisation of system requirements and specification.
- Proposing different solutions for the problem based on literature survey.
- Future trends in providing alternate solutions.
- Consolidated report preparation.

Total P: 60

SEMESTER – 8

19U820 PROJECT WORK II

The Project involves the following:

1) Preparing a project — brief proposal including
   - Problem Identification
   - A statement of system / process specifications proposed to be developed (Block Diagram / Concept tree)

Total P: 60
- List of possible solutions including alternatives and constraints
- Cost benefit analysis
- Time line of activities

II) A report highlighting the design finalization [based on functional requirements & standards (if any)]

III) A presentation including the following:
- Implementation Phase (Hardware / Software / both)
- Testing & Validation of the developed system
- Learning in the Project

IV) Consolidated report preparation

Total P:120

PROFESSIONAL ELECTIVES

19U001 BIOMEDICAL INSTRUMENTATION

3 0 0 3

BIOELECTRIC POTENTIALS AND ELECTRODES : Cells and their structures - Transport of ions through cell membrane - Biopotential - action and resting potential - propagation of action potential - Bioelectric potential - Biopotential electrodes – Types of electrodes: surface, needle and microelectrodes  (12)

CARDIOVASCULAR SYSTEM AND MEASUREMENTS : Heart and cardiovascular system — ECG — 12 lead system - principle of vector cardiography - blood pressure and its measurement — heart sound and its measurement - Defibrillator : principle and types - pacemakers: principle and types. (9)

NERVOUS SYSTEM AND MEASUREMENTS : Central and peripheral nervous system - parts of human brain- Action potential of brain - brain wave - EEG- 10-20 electrode system. (8)

RESPIRATORY SYTEM AND MEASUREMENTS : Physiology of respiratory system - Principle of pneumograph - Spirometer - ventilators: principle and types. (8)

MEDICAL IMAGING : X-ray imaging - Computed Tomography (CT) - Ultrasonic Scanner - Magnetic Resonance Imaging - Positron Emission Tomography (PET). (8)

Total L: 45

TEXT BOOKS:

REFERENCES:

19U002 FIBER OPTICS AND LASER INSTRUMENTATION

3 0 0 3

OPTICAL FIBERS AND THEIR PROPERTIES : Characteristics of optical radiation, luminescence - Fiber materials and their characteristics - Principles of light propagation through a fiber - Types of optical fibers - Properties - Transmission characteristics - Absorption losses - Scattering losses - Dispersion - Fibers splicing, connector and couplers - Optocouplers – Optrodes (9)

OPTICAL SOURCES AND DETECTORS : LED — LED power and efficiency - Structures, planar, dome, ELED, SLED, super luminescent LEDs, characteristics and applications - General characteristics of photodetectors - Photodiode - Junction photodiodes – Heterojunction diode and PIN diode - APD - Special detectors – Schottky barrier diode - Photo-transistor and photo-thyristor - Solar cells (9)

INDUSTRIAL APPLICATION OF OPTICAL FIBERS : Fiber optic sensors - Fiber optic instrumentation system - Application in instrumentation: interferometric method of measurement of length - Moiré fringes - Measurement of pressure, temperature, current, voltage, liquid level and strain - Fiber optic gyroscope - Cavity dumping - Polarization maintaining fibers (9)
LASER FUNDAMENTALS: Characteristics of lasers - Three level and four level lasers - Properties of laser - Laser modes - Resonator configuration — Q switching and mode locking — Cavity dumping - Types of lasers: gas lasers, solid lasers, liquid lasers, semiconductor lasers


TEXT BOOKS:

REFERENCES:

19U003 INSTRUMENTATION SYSTEM DESIGN

DESIGN OF SIGNAL CONDITIONING CIRCUITS: Design of V/I and I/V converters - Analog and Digital filter design Signal conditioning circuit for pH measurement - Temperature compensation circuit - software and hardware approaches - Thermistor linearization.

DESIGN OF TRANSMITTERS: RTD and thermocouple based temperature transmitter- Capacitance based level transmitter - Air purge system for level measurement - Smart transmitters.

DESIGN OF DATA ACQUISITION SYSTEM AND CONTROLLERS: Design of ON / OFF controller using linear integrated circuits-Electronic PID controller- Selection of ADC and DAC - Microcontroller based design: Measurement system and digital PID controller.

DESIGN OF ORIFICE AND ROTAMETER, CONTROL VALVE SIZING: Orifice Sizing - Liquid - gas and steam services - Rotameter design - Control valves - Valve body- Commercial valve bodies- Control valve sizing - Liquid - gas and steam services- Selection criteria.


REFERENCES:

19U004 POWER PLANT INSTRUMENTATION

MEASUREMENTS IN POWER PLANTS: Measurement of feed water flow, Fuel flow, Airflow and Steam flow with correction factor - Steam pressure and temperature measurement - Turbine speed and vibration measurement.  

ANALYZERS IN POWER PLANTS: Analysis of impurities in feed water and steam: Dissolved oxygen analyzer — Chromatography pH meter - Fuel analyser — Flue gas oxygen analyser - Pollution monitoring instruments – SOX and NOX measurements.

CONTROL LOOPS IN BOILER: Combustion control — Air/fuel ratio control — Furnace draft control – Main steam and reheat steam temperature control — Super heater control— Distributed control system in power plants — Interlocks in boiler operation.

NUCLEAR POWER PLANT INSTRUMENTATION: Different types of Nuclear power plant, Nuclear reactor control loops, Reactor dynamics, Control and Safety instrumentation, Reliability aspects.

TEXT BOOKS:

REFERENCES:

19U005 INSTRUMENTATION AND CONTROL IN PETRO CHEMICAL INDUSTRIES

PETROLEUM PROCESSING: Petroleum exploration - Recovery techniques - Refining of crude oil - Constituents of Crude Oil - Refining Capacity in India - Consumption of Petroleum products in India.

CONTROL OF DISTILLATION COLUMN: P and I diagram of petroleum refinery - Atmospheric Distillation of Crude oil – Vacuum Distillation process - Thermal Conversion process - Control of Distillation Column – Temperature Control - Feed Control - Reflux Control - Reboiler Control

CONTROL OF CHEMICAL REACTORS AND DRYERS: Temperature Control - Pressure Control - Control of Dryers - Batch Dryers - Atmospheric and Vacuum Dryers - Continuous Dryers.

CONTROL OF HEAT EXCHANGERS AND EVAPORATORS: Variables and Degrees of freedom - Liquid to Liquid Heat Exchangers - Steam Heaters - Condensers - Reboilers and Vaporizers - Cascade Control - Feed forward Control - Types of Evaporators


TEXT BOOKS:

REFERENCES:

19U006 OPTIMAL AND ADAPTIVE CONTROL SYSTEMS

OPTIMAL CONTROL: Statement of optimal control problem - Problem formulation and types of optimal control — Selection of performance measure, cost function and norms — Hamilton Jacobi Equation - Pontryagin’s minimum principle — State
inequality constraints — Necessary conditions for optimality — optimal control problems by Transfer function approach and State variable approach.


INTRODUCTION TO ADAPTIVE CONTROL: Development of adaptive control problem — The role of Index performance (IP) in adaptive systems — Development of IP measurement process model. Pole placement design - Self tuning controller — Minimum variance controller.


TEXT BOOKS:

REFERENCES:

19U007 SYSTEM IDENTIFICATION

INTRODUCTION TO IDENTIFICATION AND MODELS: System Identification Procedure - Identifiability - Signal to Noise ratio - Over fitting - Models: Definition of a model, Classification of models - Models for discrete time linear time invariant Systems - Models for time varying systems and nonlinear systems, Models for linear stationary processes


IDENTIFICATION OF PARAMETRIC TIME-SERIES MODELS: Nonparametric descriptions and parametric descriptions: - Estimation of AR models - Estimation of MA models - Estimation of ARMA models


STATISTICAL ELEMENTS OF MODEL BUILDING: Informative Data - Input design for identification – Data preprocessing - Model development

TEXT BOOKS:

REFERENCES:
19U008 INDUSTRIAL CHEMICAL PROCESSES


MASS TRANSFER CONCEPT OF STAGED PROCESSES: Distillation Drying Adsorption Humidification Crystallization. (9)

FLUID FLOW EQUIPMENT: Pipe fittings: Pumps, compressors and blowers — Chemical reactors: isothermal and non-isothermal operations — Concepts of reactor stability. (9)

CASE STUDIES OF OPERATION: Paper and pulp manufacturing — Thermal power plant — Iron and steel manufacturing — Petrochemical refinery. (9)

TEXT BOOKS:

REFERENCES:

19U009 APPLIED SOFT COMPUTING

NEURAL NETWORKS: Introduction - Differences between biological and artificial neural networks - architecture - activation functions - single layer perceptron - multilayer perceptron - back propagation algorithm - Hopfield's networks - Kohonen's self organizing maps. (9)

NEURAL NETWORKS FOR CONTROL: Pattern recognition - Control and Process Monitoring - Model identification - direct and indirect neuro control schemes - adaptive neuro controller - case study (9)


FUZZY LOGIC FOR CONTROL: Mamdani and Takagi-Sugeno model of fuzzy logic control - Stability analysis of fuzzy control systems- fuzzy pattern recognition - fuzzy controllers - control and estimation. (9)

GENETIC ALGORITHM: Biological background - encoding - fitness function - reproduction - inheritance operator - crossover - mutation operator - bitwise operator - convergence of genetic algorithm - applications and advances in genetic algorithm. (9)

TEXT BOOKS:

REFERENCES:
19U010 VLSI DESIGN


LOGIC DESIGN: Switch logic- Pass transistor and transmission gate. Other forms of CMOS logic: Dynamic CMOS logic - Clocked CMOS logic - Precharged domino CMOS logic - Combinational logic design examples. Clocked sequential circuits - Two phase clocking - Charge storage - Dynamic register element - nMOS and CMOS Dynamic shift register - JK flip flop.


TEXT BOOKS:

REFERENCES:

Total L: 45

19U011 OPERATING SYSTEMS

INTRODUCTION: Operating system objectives and functionalities - Types of Operating System - Structure of Operating system - Computer architecture support to operating systems: - Instruction execution, Interrupts, Memory hierarchy, - Cache memory, Direct Memory Access - Multiprocessor and Multicore organization – Time sharing - system programs and calls

MEMORY MANAGEMENT: Single contiguous allocation - Partitioned allocation - Paging - Virtual memory concepts - Swapping - Demand paging - Page replacement algorithms - Segmentation - Segmentation with paging.

PROCESS MANAGEMENT: Introduction to processes - Scheduling objectives - Scheduling Criteria - Types of scheduling algorithms - Performance comparison - Inter- process communications - Synchronization - Semaphores - Types of Semaphores - Deadlock: - Principles of Deadlock - Deadlock Prevention – Deadlock Avoidance - Deadlock Detection and Recovery

REAL-TIME OPERATING SYSTEMS: Characteristics of real-time operating systems - classification of real-time systems, - architectures of real-time systems, - micro-kernels, Memory management schemes - scheduling in RTOS - rate monotonic scheduling, - Inter-task communication, Shared data problem, - priority inversion - Selection of RTOS - Design and implementation of a multitasking application using RTOS

DEVICE INPUT OUTPUT AND FILE MANAGEMENT: Principles of I/O hardware and software - Device controllers - Device drivers - Interrupt driven device management - Interaction between operating system, - drivers and devices, File Systems - Files-Directories - File system implementation - Allocation methods - Security - Protection mechanisms.

Total L: 45
TEXT BOOKS:

REFERENCES:

19U012 ROBOTICS AND AUTOMATION

INTRODUCTION TO ROBOTIC SYSTEMS: Structure of a Robot, Classification of Robots: Cartesian, Cylindrical, Spherical, Articulated, SCARA - Accuracy, Resolution and Repeatability of Robots, Degrees of Freedom of Serial and Parallel Manipulators, Robot Application in Manufacturing: Material Transfers - Machine Loading and Unloading - Processing Operations - Assembly and Inspection. (9)

TRANSFORMATIONS AND KINEMATICS: Homogeneous Coordinates, Coordinate Reference Frames, Homogeneous Transformations for the Manipulator, D-H Representation, Forward and Inverse Problem of Manipulator Kinematics (9)


DYNAMICS AND CONTROL : Differential Motion of Manipulators, Trajectory Planning, Manipulator Dynamics, Jacobian in terms of D-H Matrices, Manipulator Control, Controller Architecture, Robot Programming. (9)

COMPUTER AIDED MANUFACTURING APPROACHES : Robot Interface, Networking and Bus Standards, Flexible Manufacturing Systems (FMS), Computer Integrated Manufacturing (CIM) - Role of Robots in FMS and CIM – Case Studies. (9)

Total L: 45

TEXT BOOKS:

REFERENCES:

19U013 PRODUCT DESIGN AND DEVELOPMENT


PATENTS AND INTELLECTUAL PROPERTY : Formulate a Strategy and Plan- Study Prior Inventions- Outline Claims- Write the Description of the Invention- Refine Claims- Pursue Application- Reflect on the Results and the Process (7)

PRODUCT DEVELOPMENT ECONOMICS: Elements of Economic Analysis- Build a Base –Case Financial Model- Perform Sensitivity Analysis- Use Sensitivity Analysis to Understand- Consider the influence of the Qualitative Factors on Project Success-Carrying out Qualitative Analysis. Managing Projects: Understanding and Representing Tasks- Baseline Project Planning- Project Execution-Postmortem-Project Evaluation (10)

Total L: 45
**19U014 MEASUREMENT DATA ANALYTICS**

***Total L: 45***

**INTRODUCTION:** Terms pertaining to quantity - Measurement and statistics - Instruments and standards Distribution function

**EVALUATION OF MEASUREMENT DATA:** Evaluation of validity of extreme values of measurement results - Evaluation of the means obtained from two sets of measurement results - Comparison of variances of two sets of measurement results - Measurements concerning travelling standards - F-test for internal and external consistency - Standard error of the overall mean - Analysis of variance - Tests for uniformity of variances

**ERROR PROPAGATION:** Propagating the error in a single-variable function - Propagating the error through a multi-variable function - Experimental strategy based on error analysis - Combined experiments - The weighted mean

**UNCERTAINTY IN CALIBRATION OF ELECTRICAL INSTRUMENTS:** Uncertainty in calibration of RF power sensor - Uncertainty in calibration of a Digital Instrument - Uncertainty calculation for correlated input quantities - Vector Measurands. Least-squares fitting with uncertainties in both variables - More complex error surfaces - Monte Carlo methods - Bootstrap methods

**ESTIMATION OF PARAMETERS:** Simple Linear Regression - Multiple Linear Regression - Interpretation of regression coefficients - Visualizations - Visual Data Analysis techniques - Interaction techniques - Systems and applications

**TEXT BOOKS:**

**REFERENCES:**

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**19U015 ADVANCED DIGITAL SIGNAL PROCESSING**

***Total L: 45***


**TIME-FREQUENCY ANALYSIS:** Fourier Transform — Limitation of Fourier Transform — Short Time Fourier Transform – Continuous Wavelet Transform – Discrete Wavelet Transform - Implementation of Discrete Wavelet Transform through Lifting Scheme and Filter bank — Applications of wavelet transform in instrumentation and image processing.

**RANDOM PROCESS:** Random variables — Ensemble average — Gaussian random variables — Stationary processes — Wide sense Stationarity — Ergodicity — Types of random process — Auto regressive (AR), Moving Average (MA) and Autoregressive Moving Average Processes (ARMA).

**POWER SPECTRUM ESTIMATION:** Nonparametric methods — The periodogram — Performance of the periodogram — The Modified Periodogram — Bartlett’s method — Welch Method — Blackman- Tukey method- Parametric methods - Performance comparisons

**ADAPTIVE FILTER:** Need for Adaptive filter - Wiener filter - limitations - Gradient Descent algorithm - LMS algorithm - variants of LMS algorithm - introduction to RLS algorithm - Applications of adaptive filter
TEXT BOOKS:

REFERENCES:

19U016 DIGITAL IMAGE PROCESSING

DIGITAL IMAGE FUNDAMENTALS:
- Pixel-Relationship between pixels - Gray level - resolution - image sampling and quantization - elements of image processing system. (9)

IMAGE TRANSFORM:
- Need for image transform - Fourier transform - Discrete Cosine Transform - KL transform - Singular Value Decomposition - Introduction to Wavelet transform. (9)

IMAGE ENHANCEMENT:
- Gray level transformation - histogram equalization - spatial domain filtering: smoothing, sharpening filters - frequency domain filters. (9)

IMAGE DENOISING:
- Types of noise in digital image - Methods to minimize impulse noise: Median filter and its variants - Spatial domain and frequency domain approach to minimize speckle noise - methods to minimize periodic noise. (9)

IMAGE SEGMENTATION AND COMPRESSION:
- Point, line and edge detection - Different edge detection operators - thresholding approach - region based segmentation - Watershed algorithm - Feature extraction techniques - Need for compression - Types of compression - Transform based compression - Compression Standards. (9)

TEXT BOOKS:

REFERENCES:

19U017 COMPUTER ARCHITECTURE

BASIC COMPUTER ORGANISATION:
- Classification of Architectures: CISC and RISC - Instructions - Timing and Control - Instruction Cycle - Fetch and Decode - Execution - Processor clock - Measuring computer system performance. (9)

CENTRAL PROCESSOR ORGANISATION:
- Introduction to CPU design - Hard wired control - Micro-programmed control - General register organization - Stack organization - Instruction formats - Addressing modes - Data transfer and manipulation - Program control - Address sequencer - Datapath structure. (9)

ARITHMETIC PROCESSING:
- Number system and representation - IEEE 754 representation - Addition, Subtraction, Multiplication and division Algorithms - Role of Flag register - Fixed point and Floating point Arithmetic operations - Design of Arithmetic units. (9)

MEMORY AND INPUT/OUTPUT ORGANISATION:
- Basic concepts - Memory Hierarchy - Main memory - Auxiliary memory - Associative memory - Cache and Virtual memory concepts - Performance considerations - Input - Output Interface - Modes of transfer: Asynchronous Datatransfer - Direct memory access. (9)

INTRODUCTION TO PARALLEL PROCESSING:
- Parallelism in uniprocessor systems - Pipeline execution - Instruction level parallelization - Parallel Computer architecture classifications - Data level parallelization - Graphical Processing Unit.
TEXT BOOKS:

REFERENCES:

19U018 NON LINEAR SYSTEMS THEORY

NONLINEAR SYSTEMS: State space representation of nonlinear systems - Autonomy - Basic characteristics of nonlinear systems - Bifurcation - Chaos - Limit cycles - Types of nonlinear elements

MATHEMATICAL BACKGROUND: Manifolds - Tangent and cotangent Spaces - Vector fields and flows - Lie bracket and Lie derivatives - Distributions and co distributions - Frobenius theorem

PHASE PLANE ANALYSIS: Concepts of phase plane analysis - Phase portraits - Construction of phase portrait - Isocline and delta methods - Singular points - Phase plane analysis of linear system and nonlinear system - Existence of limit cycles

DESCRIBING FUNCTION ANALYSIS: Describing function fundamentals - Computing describing functions for common nonlinearities in control systems - Describing functions analysis of nonlinear systems - Stability analysis

STABILITY ANALYSIS: Linearization method - Stability analysis based on Lyapunov’s direct method - Krasovski’s method - Variable gradient method

TEXT BOOKS:

REFERENCES:

19U019 FUNDAMENTALS OF PNEUMATICS AND HYDRAULICS

INTRODUCTION TO PNEUMATIC CONTROL: Characteristics of compressed air - Elements of pneumatic control system - Pneumatic Actuators: Linear and rotary types - End position cushioning, sealing

PNEUMATIC VALVES: Symbolic representation as per ISO 1219 and ISO 5599 - Direct and indirect actuation pneumatic cylinders - Use of memory valve - Flow control valves and speed control of cylinders supply air throttling and exhaust air throttling - Use of quick exhaust valve - Signal Processing Elements - Use of Logic gates — OR and AND gates - Pressure dependent controls: types - Time dependent controls: principle, construction

INTRODUCTION TO HYDRAULIC POWER: Elements of hydraulic system - Source of hydraulic power: Pumping theory - Classification of pumps - Gear pumps, vane pumps and piston pumps - Performance of pumps - Selection of pumps

HYDRAULIC ACTUATORS AND VALVES: Linear hydraulic actuators - Hydraulic motors: gear motors, vane motors, piston motors - Control valves: Directional control valves, Constructional features and working principle – Pressure control valves: Direct and
HYDRAULIC CIRCUIT DESIGN AND ANALYSIS: Control of single and double acting hydraulic cylinders - Speed control of hydraulic actuators - Regenerative circuit - Pump unloading circuit - Cylinder synchronizing circuits – Accumulators

REFERENCES:

TEXT BOOKS:

SAFETY INTEGRITY LEVEL:
SIL determination methods - ALARP - Risk matrix - Risk graph - LOPA - Examples for design of SIL.

INTEGRATION OF TECHNOLOGY:
Relay systems - Solid-state systems - Microprocessor based systems - PLC based systems - Safety PLCs - Safety system complexity - Communication with other systems.

REFERENCES:


TEXT BOOKS:

REFERENCES:

19U022 INDUSTRIAL INTERNET OF THINGS

INTRODUCTION TO INTERNET OF THINGS: Overview of Internet of Things - The Edge, Cloud and the Application Development - Anatomy of the Thing - Industrial Internet of Things (IIoT - Industry 4.0) - Quality Assurance - Predictive Maintenance - Real Time Diagnostics - Design and Development for IoT - Understanding System- Design for IoT - Design Model for IoT

SYSTEM DESIGN OF CONNECTED DEVICES: Embedded Devices, Embedded Hardware - Connected Sensors and Actuators, Controllers - Battery Life Conservation and designing with Energy Efficient Devices, SoCs - CC3200 Architecture - CC3200 Launchpad for Rapid Internet Connectivity with Cloud Service Providers

UNDERSTANDING INTERNET PROTOCOLS: Simplified OSI Model - Network Topologies, Standards - Types of Internet Networking—Ethernet, WiFi - Local Networking, Zigbee, Sub 1 GHz, RFID, NFC - Proprietary Protocols - SimplicTI - Networking Design - Push, Pull and Polling - Network APIs

SYSTEM DESIGN PERSPECTIVE FOR IOT: Products vs Services - Value Propositions for IoT - Services in IoT - Design views of Good Products - Understanding Context - IoT Specific Challenges and Opportunities

ADVANCED DESIGN CONCEPTS FOR IOT: Software UX Design Considerations - Machine Learning and Predictive Analysis - Interactions, Interusability and Interoperability considerations - Understanding Security in IoT Design - Design requirements of IoT - Security Issues and challenges - Privacy - Overview of Social Engineering

TEXT BOOKS:

REFERENCES:

19U023 NON-CONVENTIONAL ENERGY SYSTEMS

BACKGROUND OF ENERGY SCENARIO: Energy Demand Scenario in India - Energy resources in India and its sustainability - Different types of conventional Power Plant - Limitation of fossil fuels - Pollution aspects and impact of various power plants - Industrial and transport emissions
SOLAR PHOTO-VOLTAIC SYSTEM: Solar radiation and its measurement - Insolation and Temperature - Solar cells and characteristics, Solar PV module, PV system design and applications - Maximum Power Point Tracking algorithms - Stand-alone and grid connected systems (12)

WIND POWER GENERATION: Components of Wind Energy Conversion Systems - Classification of wind turbines - aerodynamic operation of wind turbine, extraction of wind turbine power, wind turbine power curve, horizontal axis wind turbine generator - modes of wind power generation - stand-alone and grid connected system (6)

FUEL CELL SYSTEM AND HYBRID ENERGY SYSTEMS: Principle of operation of fuel cell, technical parameters of fuel cell - Type of fuel cell - Advantages of fuel cell power plants, energy output, efficiency and emf of fuel cell - operating characteristics, applications - Hybrid energy systems: Need for hybrid systems, types, configuration and coordination, electrical interface - PV-Diesel, Wind-diesel, wind-PV, wind-PV- fuel cell (14)


TEXT BOOKS:

REFERENCES:

ONE-CREDIT COURSES

19UF01 DISTRIBUTED CONTROL SYSTEM IN INDUSTRIES

1 0 0 1

INTRODUCTION: Evolution of process control system - DCS CS3000 System Architecture Configuration: PFCS-,FCS Hardware LFCS, KFCS, FFCS, FFCS-L. (3)

HIS CONFIGURATION: Application Capacity - Network Details - Address Setting. (3)

CS3000 SYSTEM BUILDER CONFIGURATION: Project Creation-Project Attribution Utility - Downloading-Introduction to CS3000 FCS Simulation SW - User Login - IOM - Creation/ Signal Configuration. (3)


CREATION OF WINDOWS: Operation of Tuning Window - Control Group Window - Configuration of Trend Window - Graphics Window - Introduction to Switches/Interlocks. (3)

Total L: 15

TEXT BOOKS:

REFERENCES:

19UF02 ADVANCED INDUSTRIAL AUTOMATION SYSTEMS

1 0 0 1

PROGRAMMABLE AUTOMATION CONTROLLERS: Multidisciplined Controllers-System Model-Backplane Communications - Different Form Factors - Networking Options - Operating System - Task Program and Routine as per IEC 61131-3 - Controller
Data Features - Programming Software - Anatomy and Memory Structure - Operating System Priorities - Concept of Connections for Industrial Automation Systems - Understanding Controller Communication to the external World (4)

HANDS ON PRACTICE: Logix Controller programming Software with examples on Process Control and PID Tuning (3)


DEMONSTRATION: Hands on Practice on Device net/Control net/Ethernet/IP Networks. (3)

HMI SYSTEMS AND VISUALIZATION SOLUTIONS: Integrated Architecture and Factory Talk Manufacturing Information platform - One Architecture for Plant wide Control and Information - Role of Industrial Visualization - Visualization fit within an Automation Environment - View technology Cornerstones - View Technologies - Machine level and PC Based platforms (3)

REFERENCES:

19UF03 MARINE INSTRUMENTATION AND SYSTEMS

ELECTRICAL LAYOUT OF A SHIP: Main generators - Main switchboard - Paralleling of Generators - Synchronizing and load sharing - Generator protection - Emergency supply system - Emergency generator - Emergency batteries Shore supply electronic control of protective relays (2)

NAVIGATIONAL AIDS: Radar - Gyro - Echo sounder - Log - Voyage data recorder (2)

COMMUNICATION: Internal communication - Intercom - Sound powered telephones - External communication - VHF - GMDSS - Electronic components (3)

CONTROL SYSTEMS: Main engine controls - Generator controls - Propulsion control - Steering control - Vessel management systems - Application of PLC (4)

ELECTRICAL PROPULSION: Evolution - Advantages of electrical propulsion - Problems faced in electrical propulsion - application of electronics in propulsion (4)

TEXT BOOKS:

REFERENCES:
2. Basic Marine electricity learning resources, DNV India, 2005.

19UF04 MEDICAL IMAGE ANALYSIS

MEDICAL IMAGE MODALITIES: CT Basics, MRI Basics (T1/T2 weighted images), Physics of MRI. (2)

FEATURE DETECTOR: KLT, SIFT, Surf (2)

MEDICAL IMAGE SEGMENTATION: Active Shape, Active Contours, Graph Cuts (3)

MEDICAL IMAGE REGISTRATION: Rigid, Affine, Elastic Registration, Non-Rigid Registration- Introduction (BSplines), Mutual Information Metric (2)
COMPRESSED SENSING: CS and its application in MRI (2)

PATTERN CLASSIFICATION: Bayes Classifiers, Random Forests (2)

DEMO/HANDS ON PRACTICE ON SEGMENTATION, REGISTRATION: ITKSnap, c3d (Segmentation examples), Slicer3D, MevisLab, Elastix (Registration), Fiji (Image Analysis), Pythonxy. (2)

Total L: 15

REFERENCES:

19UF05 SYSTEM DESIGN AND IMPLEMENTATION

INTRODUCTION TO CONTROL SYSTEM DESIGN AND SIMULATION: Developing a plant model, transfer function model, State space model - Overview of Control Design Toolkit-Control Design VIs, Model representation, Model forms - Constructing Transfer function models, state space models and zero pole gain models (3)

MODEL CONVERSION AND INTERCONNECTION: Converting Model Forms- Continuous to Discrete model conversion - Connecting Models in series, Connecting models in parallel - Placing models in closed loop configuration (3)

TIME RESPONSE ANALYSIS: Calculating the time domain specification - Case study: Spring mass damper system, RLC circuit - Analyzing the time response of a system for an applied step and impulse inputs, Analyzing initial response of a given system (3)

FREQUENCY RESPONSE ANALYSIS: Frequency domain specifications, Bode frequency analysis - Gain margin, Phase margin - Nichols frequency analysis, obtaining frequency response data (3)

STABILITY ANALYSIS AND CLASSICAL CONTROLLER DESIGN: Determining stability: Root locus method, Pole zero map - PID Controller design and prototyping - Implementation of auto tuning PID controller. Case study- Speed control of a DC motor, Level and Flow control (3)

Total L: 15

REFERENCES:

19UF06 CALIBRATION TECHNIQUES

MEASUREMENT UNCERTAINTY: Background — random and systematic errors - type A and type B uncertainty - sensitivity coefficients — uncertainty evaluation (3)

CALIBRATION: Introduction - meaning — objectives - necessity of calibration - basic calibration process - various components of a calibration system (3)

STANDARDS AND STANDARDIZATION: Working standards, check standards and international standards - levels of standard accuracies, accuracy ratio between levels of calibration pyramid - Requirements of traceability - metrology standardization documents (3)


CALIBRATION SETUPS: Electrical calibration - Temperature calibration - Pressure and Flow calibration — demonstrations (3)

Total L: 15
REFERENCES:

19UF07 MOTION CONTROL SYSTEMS

INTRODUCTION: Motion Control System, Micro and nano level motion systems.

MOTION SENSING TECHNOLOGIES: Optical and magnetic encoders, magnetic and optical readers, resolvers, MEMS based accelerometers / gyros, multi-axis force/moment sensors, piezoresistive sensors, PSD sensors, tactile sensors, nanometrology.


CONTROL OF ACTUATORS: Force/Torque, speed, position control loops, importance of stiffness, damping and inertia in various applications, auto-tuning, motion profiling and trajectory generation.

ADVANCED MOTION CONTROL STRATEGIES: Multi-axis motion systems, master-slave bilateral operations.

SAFETY IN MOTION SYSTEMS: Application of brakes and clutches and international regulations.

REFERENCES:

19UF08 ELECTRICAL METROLOGY


TRACEABILITY AND SI UNITS: Traceability and its importance, International Metrology Structure – Calibration Hierarchy - Importance of SI Units and types of SI Units.

STANDARDS USED IN ELECTRICAL CALIBRATION: Absolute, Primary, secondary, working and census standards – measurement setup - Interpretation of specifications of various calibration standards and Device Under Calibration (DUCs).

CALIBRATION PROCEDURES FOR VARIOUS ELECTRICAL T & M INSTRUMENTS: Methods of Calibration: Oscilloscopes, clamp meter, Panel meters - Calibration procedure of Voltmeter, Multimeter, DMM - Case studies.


REFERENCES:

19UF09 STANDARD PRACTICES FOR POWER PLANT INSTRUMENTATION

OVERVIEW OF POWER PLANT: Role of Instrumentation engineers in large power & process plants. - Evolution of Instrumentation (Gauges to DCS and beyond) (2)

STANDARDS AND CONTROL SCHEMES: Communication standards of Instrumentation - Standards of Instrumentation (National/International), Instrument numbering system, KKS coding, Typical control schemes in power plants. (5)

SAFETY: Instrumentation in hazardous areas - Standards of Instrument enclosures. (3)


REFERENCES:

19UF10 AUTOMOTIVE INSTRUMENTATION AND CONTROL

AUTOMOTIVE INSTRUMENTATION CLUSTER: Measurement and display techniques of Vehicle Speed, Engine Speed and Odometer, Fuel Level, Oil Pressure, Engine Temperature, Battery Status, Gear Shift Indication, Seat Belt Indication, Door Open indication. (3)

VEHICLE CONTROL FUNCTION: Cruise Control (Simple and Adaptive), Speed Limiter, Vehicle Stability control. (3)

ENGINE CONTROL FUNCTION: Air system Control, Fuel System Control, Ignition Control, Exhaust Control, Water temperature control(Electric fan and pump), Engine speed control and Engine speed limitation. (3)

BODY ELECTRONICS: Immobilizer for vehicle security, Power Window control, Wiper speed control (with and without rain sensing) Head lamp intensity control based on Ambient light sensing. (3)

AUTOMOTIVE COMMUNICATION PROTOCOLS: Controller Area Network(CAN), Local Interconnect Network(LIN), FlexRay, Media Oriented Systems Transport(MOST). (3)

REFERENCES:

19UF11 AIRCRAFT INSTRUMENTATION

OVERVIEW: Introduction to aircraft instrumentation, Types of instruments, Location inside the cockpit. (2)

INTRODUCTION TO FLIGHT INSTRUMENTATION AND BAROMETRIC INSTRUMENTS: Pitot Static System, Air Speed Indicator(ASI), Altimeter, Rate of Climb Indicator(ROCI), Mach Meter. (3)

INTRODUCTION TO NAVIGATION INSTRUMENTS AND GYRO INSTRUMENTS: Artificial Gyro Horizon, Combined Course Indicator (CCI), Flight Director Indicator (FDI), Null Indicator, Turn and Slip Indicator. (3)

INDEPENDENT INSTRUMENTS: Chronometer, Magnetic Compass, Bomb Bay Compartment Temperature Indicator, Cabin Temperature Indicator, Cabin Pressure Indicator. (2)

REFERENCES:

19UF12 AUTOMATIC FLIGHT CONTROL SYSTEM

INTRODUCTION: Aircraft Stability, Directional Divergence, Spiral Divergence, Dutch Roll and Controllability. (2)

NEED AND ROLE OF FLIGHT CONTROL SYSTEM: Elements of flight control system. Functional diagram of a basic closed loop flight control system. Purpose of Altitude hold and airspeed hold (4)

CLASSIFICATION OF FCS: Single axis, two axis and three axis. Functional components of three axis FCS. (2)

INTRODUCTION TO SENSORS/ERROR DETECTORS: Gyros (Vertical, Directional, Displacement, Rate), Altitude Sensor, Air speed Sensor, Compass/Heading Sensor, Accelerometers (INS), Synchros. (3)

INTRODUCTION TO ACTUATORS: Electro Pneumatic Servo Actuators, Electro Hydraulic Servo Actuators, Electro Mechanical Servo Actuators, Position Control Servomechanism, Speed Control Servomechanism. (2)

SIGNAL PROCESSING: Functions of signal processing elements in a FCS, Signal Processing channel and its elements, Limiting Synchronizing, Gain and Adaptive Control, Feedback in a FCS. (2)

REFERENCES:

ENGLISH

19GF01 INTERPERSONAL AND ORGANIZATIONAL COMMUNICATION

INTRA ORGANIZATIONAL COMMUNICATION: Communication Networks in an Organization; Intra-organizational communication (2)

INTER ORGANIZATIONAL COMMUNICATION: Flow Nomenclature; Workplace diversity and intercultural aspects of communication (2)

COMMUNICATION FUNCTIONS IN ORGANIZATIONS: Teamwork and team dynamics; Conflict resolution strategies and styles; Leading and influencing others-facilitation skills (3)

WRITTEN COMMUNICATION: Email Writing, Professional Reports, and Memos (4)

INTERPERSONAL SKILLS: Nature and Dimensions of Interpersonal Communication; Personality and Communication styles; Active listening and intentional responding; Working with emotional intelligence (4)

REFERENCES:

19GF02 HUMAN VALUES THROUGH LITERATURE

PROSE: Kalam’s vision of college education in Wings of fire - Emerson’s advocacy of independence of Human will in Self-reliance - Harmony in Education-views of Bertrand Russell (4)

POETRY: Maintaining Human relations in Robert Frost’s Mending Wall - Quest for identity and freedom in Kamala Das’s An Introduction (2)

DRAMA: Statesmanship and friendship in Girish Karnad’s Tughlaq (3)

ONE-ACT PLAY: The theme of love in Chekhov’s The Bear (3)

SHORT STORY: Empathy in Somerset maugham’s Mr. Know-all - Family bond in Anita Desai’s Devoted son (3)

Total L: 15

TEXT BOOKS:
1. Faculty - Department of English, "Course materials", PSG College of Technology, Coimbatore, 2019.

REFERENCES:

HUMANITIES

19OFA1 EXPORT – IMPORT PRACTICES

INTRODUCTION: Export – Import Business – Preliminaries for starting Export – Import Business Registration. (3)

EXPORT PROCEDURES: Obtaining an Export License – Export Credit Insurance – Procedures and Documentation (4)

FOREIGN EXCHANGE: Finance for Exports – Pricing - Understanding Foreign Exchange Rates. (3)

IMPORT PROCEDURES: Import Policy – License - Procedure and Documentation. (3)

EXPORT INCENTIVES: Incentives - Institutional support (2)

Total L: 15

REFERENCES:

19OFA2 INSURANCE - CONCEPTS AND PRACTICES

INTRODUCTION TO INSURANCE AND RISK MANAGEMENT: Origin, History, Nature and Scope of insurance – Meaning, types
and significance of risk. (3)

INSURANCE LAWS AND REGULATIONS: Insurance Act, IRDA Act, Consumer Protection Act, Ombudsman Scheme. (2)

INSURANCE UNDERWRITING AND RISK MANAGEMENT: Meaning of underwriting and underwriter, guidelines and steps in the process of underwriting – characteristics, significance and principles of risk management. (4)

FINANCIAL ASPECTS OF INSURANCE MANAGEMENT: Role and functions of financial institutions, determination of premium for various insurance products. (3)

SETTLEMENT OF INSURANCE CLAIMS: Documents needed during various claims, Factors affecting insurance claims (3)

REFERENCES:

19OFA3 PUBLIC FINANCE

1001

INTRODUCTION: Nature and Scope of public finance – Principles of taxation. (2)

PUBLIC REVENUE AND TAXATION: Sources of Revenue – Tax and non-tax revenue – Classification of Taxes, GST. (4)

PUBLIC EXPENDITURE: Importance – Types – Causes of increase in public expenditure – Effects of public expenditure in India. (3)

DEFICIT FINANCING AND BUDGET: Sources of public debt – Debt redemption – Budget – Types – Preparation of Budget in India. (3)

FEDERAL FINANCE: Centre-State financial relations – Finance commissions. (3)

TOTAL: 15

REFERENCE BOOKS:

19OFA4 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

1001


TYPES OF SECURITIES: Trading – Orders, Margin Trading – Clearing and Settlement Procedures. (5)

SECURITY ANALYSIS I: Industry Analysis – Estimation of Rates of Return. (2)
SECURITY ANALYSIS II: Company Analysis — Estimation of Rates of Return. (2)

PORTFOLIO MANAGEMENT: Measuring Risk and Returns and Treatment in Portfolio Management. (4)

REFERENCES:

19OFA5SOCIAL ENTREPRENEURSHIP

1 0 0 1

INTRODUCTION TO SOCIAL ENTREPRENEURSHIP: Social Entrepreneur - Meaning, qualities and skills. Social Entrepreneurship – Characteristics, process and ecosystem – Case Studies. (3)

SOURCES OF FUNDING FOR SOCIAL ENTREPRENEURSHIP: The Social Entrepreneurship Framework. Start-ups and funding - Internal and External. Schemes for social entrepreneurship. (4)

STRATEGIES IN SOCIAL ENTREPRENEURSHIP: Industry and Market Analysis, Business planning, concepts of value creation, new ideas and risk taking. (4)

PROSPECTS AND PROBLEMS IN SOCIAL ENTREPRENEURSHIP: Opportunities for Social entrepreneurs, an overview of legal structure, tax structure and other liabilities. (4)

TOTAL: 15

REFERENCE BOOKS:

LANGUAGE ELECTIVES

19G001 COMMUNICATION SKILLS FOR ENGINEERS

0 0 4 2

COMMUNICATION CONCEPTS:
Process of Communication
Inter and Intrapersonal Communication
Inter and Intrapersonal Communication Activities

FOCUS ON SOFT SKILLS:
Etiquette — Work Place etiquette — Telephone etiquette
Body Language
Persuasive Communication
Public Speaking
Critical Reasoning and Conflict Management based on Case Studies
Group Communication
Meetings
Interview Techniques
TECHNICAL WRITING:
- Technical Writing Principles
- Style and Mechanics
- Technical Definitions – Physical, Functional and Process Descriptions
- Technical Report Writing
- Preparing Instructions and Manuals
- Interpretation of Technical Data

BUSINESS CORRESPONDENCE:
- Writing Emails
- Preparing Resumes
- Memos
- Technical and Business Proposals

TECHNICAL COMMUNICATION:
- Seminars
- Process Description and Group Discussions
- Use of Visual Aids

TEXT BOOKS:
1. Faculty Incharge "Course Material on "Communication Skills for Engineers"", PSG College of Technology, Coimbatore, 2019

REFERENCES:

19G002 GERMAN- LEVEL A1.1

GUTEN TAG!
1. To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages
2. Vocabulary: related to the topic

FREUNDE, KOLLEGEN UND ICH:
1. To speak about hobbies, jobs, learn numbers from 20; build dialogues and frame simple questions & answers
2. Vocabulary: related to the topic
3. Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural

IN DER STADT:
1. To know places, buildings, question, know transport systems, understand international words; build dialogues and write short sentences
2. Vocabulary: related to the topic
3. Grammar: Definite & indefinite articles, Negotiation, Imperative with Sien verbs

GUTEN APPETIT!
1. To speak about food, shop, converse; Vocabulary: related to the topic; build dialogues and write short sentences
2. Grammar: Sentence position, Accusative, Accusative with verbs, personal pronouns & prepositions, Past tense of haben & sein verbs

TAG FÝR TAG/ZEIT MIT FREUNDEN:
1. To learn time related expressions, speak about family, about birthdays, understand & write invitations, converse in the restaurant, ask excuse, fix appointments on phone
2. Vocabulary: related to the topic
3. Grammar: Time related prepositions, Possessive articles, Modalverbs

TEXT BOOKS:
2. Sandra Evans, Angela Pude "Menschen A1", Hueber Verlag., Germany, 2012

REFERENCES:
3. Rosa-Maria Dallapiazza "Tangram Aktuell 1 (Deutsch als Fremdsprache)", Max Hueber Verlag., Munchen, 2004

19G003 FRENCH LANGUAGE LEVEL 1

PARTS OF SPEECH:
1. inviter et répondre à une invitation, Pronoms sujets
2. L'article défini, l'article indéfini
3. Conjugation : présent, adjectifs possessifs
4. interrogation, décrire les personnes
5. La vie de quatre parisiens de professions différentes

ELEMENTS OF GRAMMAR:
1. Exprimer l'ordre et l'obligation demander et commander
2. l'adjectif possessifs, l'article partitif, l'article démonstratif, négation ne pas, l'article contracté
3. verbe pronominaux
4. prepositions

SENTENCE STRUCTURE:
1. Raconter et reporter-donner son avis
2. Futur simple, pronom complétement d'objet direct, passé composé
3. plusieurs région de France, imparfait, pronom y/en, imparfait

TENSES AND NUMBERS:
1. Demander l'autorisation-passé récent, futur proche
2. La vie administrative et régionale, Pluriel des noms, moyens de transport

DISCOURSE:
1. le discours rapporté, décrire un lieu, exprimer ses préférences
2. décrire la carrière, discuter du système éducation de France
3. parler de la technologie de l'information

TEXT BOOKS:
1. Christine Andant étal "À propos (livre de l'élève", LANGER., NEW DELHI, 2012

REFERENCES:
2. Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French", ..
3. Simone Renaud, Dominique van Hooff "En bonne forme", ..

19G004 BASIC JAPANESE

JAPANESE PEOPLE AND CULTURE:
1. Basic greetings and responses
2. Basic script — Method of writing hiragana and katakana — Combination sounds and simple words
4. Possessive noun particle "no" — Japanese apartments: Greeting your neighbor

PARTICLE "NI (AT)" FOR TIME:
1. kara (from) — made(until) — Particle "to (and)"
2. Time periods: Days of the week, months, time of day — Verbs (Present / future and past tense)
3. Telephone enquiry: Asking for a phone no. And business hours- Destination particle "e".
LIKES AND DISLIKES:

1. Potential verbs (wakarimasu and dekimasu) — “Kara (～ because)”
2. Adverbs — Asking someone one out over the phone-Verbs denoting presence
3. Introduction to Adjectives (na and ii type)-Verb groups — I, II and III — Exercises to group verbs- Please do (te kudasai)
4. Present continuous tenses (te imasu) — Shall I? (～mashou ka) — Describing a natural phenomenon (It is raining)

DIFFERENT USAGES OF ADJECTIVES:

1. Comparison — Likes and dislikes — Going to a trip- Need and desire (ga hoshii) — Wanting to . . . (Tabeti desu)- Going for a certain purpose (mi —ni ikimasu)
2. Choosing from a menu-Adjectives (“i” and “na” type) — Adjectives (Positive and negative usage)

ROLE PLAYS IN JAPANESE:

1. Framing simple questions & answers
2. Writing Short paragraphs & Dialogues
3. A demonstration on usage of chopsticks and Japanese tea party

TEXT BOOKS:


REFERENCES:

3. Minna No Nihongo “Translation & Grammatical Notes In English Elementary”