Uttarakhand Technical University

Program: **B.Tech, Electrical & Electronics Engineering (EEE)**

Year: 4 Session:2011-2012

Scheme and Evaluation Pattern

S No	Course No	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	TA	Total		
Semester: VII										
Theory										
1	TEE701	Switch Gear and Protection	3	1	0	30	20	50	100	150
2	TEE702	ANN & Fuzzy Logic	3	1	0	30	20	50	100	150
3	TEC701	Optical Fiber Communication System	3	1	0	30	20	50	100	150
4		Elective-1	3	1	0	30	20	50	100	150
5		Open Elective	3	1	0	30	20	50	100	150
Practical/Design										
1	PEE751	Power System Lab	0	0	2	0	0	25	25	50
2	PEC751	OFC Lab	0	0	2	0	0	25	25	50
3	PEE753	Industrial Training Seminar	0	0	2	0	0	25	25	50
4	PEE754	Project	0	0	2	0	0	50	50	100
Semester: VIII										
Theory										
1	TEE801	Electric Drives	3	1	0	30	20	50	100	150
2	TEE802	SCADA & Energy Management	3	1	0	30	20	50	100	150
3		Elective-2	3	1	0	30	20	50	100	150
4		Elective-3	3	1	0	30	20	50	100	150
Practical/Design										
1	PEE851	Electric Drive Lab	0	0	2	0	0	25	25	50
2	PEE852	Project	0	0	2	0	0	100	200	300
3	DIS850	Discipline	0	0	0	0	0	0	50	50

LIST OF ELECTIVE – I

TEE 011: Utilization of Electrical Energy and Traction
TEE 012: Digital Control System
TIC011: Fiber Optics and Laser Instrumentation
TIC012: Analytical Instrumentation

LIST OF ELECTIVE – II

TEE 021: Modern Control System
TEE 022: Bio-Medical Instrumentation
TEE 023: Power Plant Engineering
TIC 023: System Design Using Microcontroller

LIST OF ELECTIVE – III

TEE 031: Power Quality Improvement Techniques
TEE 032: Power Converter Application
TEE 033: EHV AC & DC TRANSMISSION
TEC 033: Adaptive Signal Processing
TEC 034: Embedded Systems

TEE701: SWITCHGEAR AND PROTECTION

Unit I:

Introduction to power system:

Introduction to protective system and its elements, function of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology.

Relays:

Electromagnetic, attraction and induction type relays, thermal relay, gas actuated relay, design considerations of electromagnetic relays.

Unit II:

Relay Applications and characteristics:

Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relays.

Static relays:

Comparison with electromagnetic relays, classification and their description, over current relays, directional relays, distance relays, differential relays.

Unit III:

Protection of transmission line:

Time graded protection, differential and distance protection of feeders, choice between impedance, reactance and MHO relays, Elementary idea about carrier current protection of lines, protection of bus, auto reclosing, pilot wire protection.

Unit IV:

Circuit Braking:

Arc phenomenon, properties of arc, arc extinction theories, recovery voltage and restriking voltage, current chopping, resistance switching, capacitance current interruption, circuit breaker ratings.

Testing of circuit breakers:

Classification, testing station & equipments, testing procedure, direct and indirect testing.

Unit V:

Apparatus protection:

Types of faults on alternator, stator and rotor protection, negative sequence protection, loss of excitation and overload protection. Types of fault on transformers, percentage differential protection, Ungraounded neutral system, grounded neutral system and selection of neutral grounding.

Circuit breakers:

Need of circuit breakers, types of circuit breakers, operating modes, principles of construction, details of Air Blast, Bulk Oil, Minimum Oil, SF6, Vacuum Circuit Breakers, DC circuit breakers.

Reference Books:

1. Power system protection & switchgear, Badriram & D.V. Vishwakarma, TMH
2. Switchgear & Protection, M.V. Deshpande, TMH

TEE702: ANN AND FUZZY LOGIC

Unit-I

Neural Networks-1(Introduction & Architecture): Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory

Unit-II

Neural Networks-II (Back propogation networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propogation algorithm, factors affecting back propagation training, applications.

Unit-III

Fuzzy Logic-I (Introduction) : Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory versus probability theory, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit-IV

Fuzzy Logic –II (Fuzzy Membership, Rules) : Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzifications, Fuzzy Controller,

Unit-V

Application of Neural Network and Fuzzy logic: Application of neural network, case study, Inverted pendulum, Image processing. Introduction to neuro & fuzzy logic controller.

Reference Books:

1. Siman Haykin,"Neural Networks "Prentice Hall of India.
2. Moore, Digital control devices, ISA press, 1986.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

TEC701: OPTICAL FIBRE COMMUNICATION SYSTEMS

UNIT 1

INTRODUCTION: Demand of Information Age, Block Diagram of Optical fiber Communication System, Technology used in OFC System, Structure and types of Fiber, modes and Configuration**,** mode theory for circular guide modal equation, modes in optical fiber, linearly polarized modes, attenuation factors, pulse broadening in optical fiber, single mode fiber, mode field diameter, single distortion in single mode fiber, Derivation of material dispersion and waveguide dispersion. Attenuation, Signal Degradation in Optical Waveguides, Pulse Broadening in Graded index fiber Waveguides, Mode Coupling.

UNIT 2

OPTICAL SOURCES:

LED: Visible LED, Infrared LED, LED structure and configuration, Loss mechanism, Application of LED, operating Characteristics materials for Visible LED.

LASER: Principle of LASER Action, Efficiency of LASER Diode, principles and structures, index guided and gains guided lasers, mode separation, quantum well laser, laser modulation.

UNIT 3

OPTICAL DETECTORS: Optical Absorption in semiconductors, Types of Photo Diodes, Principle of photo detection, working and structures of p-i-n and APD photo detectors, noises in photo detectors, SNR, detector response time effects, comparison of various photo detectors.

UNIT 4

ANALYSIS AND PERFORMANCE OF OPTICAL RECEIVER: Receiver Sensitivity, Photodiode for optical receiver, Optical Receiver Design, recent receiver circuits, System configuration and power budget.

UNIT 5

OPTICAL NETWORKS: WDM concepts and principles, passive components, SONET/SDH networks, performance of WDM.

SUGGESTED BOOKS

1. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
2. Text Book on Optical Fibre Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005

TEE011: UTILIZATION OF ELECTRICAL ENERGY AND TRACTION

Unit I: Electric Heating
Advantage & methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating,

Unit II: Electric Welding
Electric arc welding, electric resistance welding, Electric Welding control, Electrolyte Process: Principal of Electro deposition, laws of Electrolysis, application Electrolysis.

Unit III: Illumination
Various definition, laws of Illumination, requirement of good lighting, Design of indoor lighting & outdoor lighting system.
Refrigeration and Air Conditioning
Refrigeration system, domestic Refrigerator, water cooler, Types of Air conditioning, Window air Conditioner

Unit IV: Electric Traction – I
Types of electric traction, system of track electrification, Traction mechanics-types of services, speed time curve and its simplification, average and schedule speeds, Tractive effort specific energy consumption, mechanics of train movement, coefficient of adhesion and its influence

Unit V: Electric Traction – II
Salient features of traction drives, Series-parallel control of dc traction drives (bridge traction) and energy saving, Power Electronic control of dc & ac traction drives, Diesel electric traction.

Reference Book:

1. H.Pratab."Modern electric traction" Dhanpat Rai & Sons.
2. C.L. Wadhwa,"Generation, Distribution and Utilization of Electrical Energy "New Age International Publishers.

TEE012: DIGITAL CONTROL SYSTEMS

Unit I: Signal Processing in Digital Control
Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, z-transform and inverse z-transform, modeling of sample-hold circuit., pulse transfer function, solution of difference equation by z-Transform method.

Unit II: Design of Digital Control Algorithms
Steady state accuracy, transient response and frequency response specifications, digital compensator design using frequency response plots and root locus plots.

Unit III: State Space Analysis and Design
State space representation of digital control system, conversion of state variable models to transfer functions and vice versa, solution of state difference equations, controllability and observability, design of digital control system with state feedback.

Unit IV: Stability of Discrete System
Stability on the z-plane and Jury stability criterion, bilinear transformation, Routh stability criterion on rth plane. Lyapunov's Stability in the sense of Lyapunov, stability theorems for continuous and discrete systems, stability analysis using Lyapunov's method.

Unit: V Optimal digital control
Discrete Euler Lagrange equation, max. min. principle, otpimality & Dynamic programming, Different types of problem and their solutions.

Reference Books:

1. J.R.Leigh, "Applied Digital Control", Prentice Hall, International
2. C.H. Houpis and G.B.Lamont, "Digital Control Systems: Theory, hardware, Software", Mc Graw Hill.
1. B.C.Kuo, "Digital Control System", Saunders College Publishing.
2. M.Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill.

TIC011: FIBRE OPTICS AND LASER INSTRUMENTATION

UNIT 1

OPTICAL FIBRES AND THEIR PROPERTIES Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors & splicers – Fibre termination – Optical sources – Optical detectors.

UNIT 2

INDUSTRIAL APPLICATION OF OPTICAL FIBRES Fibre optic sensors–Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT 3

LASER FUNDAMENTALS Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT 4

INDUSTRIAL APPLICATION OF LASERS Laser for measurement of distance, length, velocity, acceleration, current, voltage and atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT 5

HOLOGRAM

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components.

TEXT BOOKS

1. J.M. Senior, ‘Optical Fibre Communication – Principles and Practice’, Prentice Hall of India, 1985.
2. R.K Singh, ` Optical Fibre Communication System`, Wiley India
. Wilson and J.F.B. Hawkes, ‘Introduction to Opto Electronics’, Prentice Hall of India, 2001.

TIC012: ANALYTICAL INSTRUMENTATION

UNIT 1

ELECTROMAGNETIC RADIATION – different regions, their wavelengths, frequencies and energies - interaction of EM radiations with matter – atomic, molecular, electronic interaction - Basic principles of spectroscopy – emission and absorption of radiations – resonance - radiation sources – dispersing and resolving techniques – detectors - typical atomic emission and absorption spectrographs in the UV and visible region.

UNIT 2

MOLECULAR SPECTRA – electronic, vibrational and rotational energies and spectra characteristic bands of radicals, OH, CH, CO, etc., - IR absorption – spectroscopy – single and double beam spectrophotometers - instrumentation techniques for analyzing solid, liquid and gaseous samples – sample handling techniques.

UNIT 3

MICROWAVE SPECTROSCOPY – NMR, ESR and EPR spectroscopy – basic principles – instrumentation techniques and applications - principles of ion optics – ion sources – single focusing and double focusing mass spectrometers – principles and application

UNIT 4

Principles of X-ray fluorescence spectrometry and flame photometry – detection of X-rays and nuclear radiations – ionization chamber - proportional counter – GM counter - scintillation counter - solid state detector - gamma ray spectrometers – isotope dilution and tracer techniques for quantitative estimation and analysis.

UNIT 5

ELECTROCHEMICAL METHODS – electrical conductivity of liquids conductivity and water purity – practical measurements and application – sulphur dioxide monitor – determination of pH – oxygen analyzers. Principles of gas and liquid chromatography – process chromatography – operation of typical process chromatography.

REFERENCE BOOKS

1. H.H. Willard, L.L. Merrit, J.A. Dean and F.A. Settle, Instrumental methods of Analysis, 6th edition - CBS Publishers and Distributers, 1986.
2. B.E.Noltingk (Edtr,) Jone's Instrument Technology, Vol. 2, Fourth Edition, Butterworths, 1986 (chapters 4 &5 for unit 5)
1. D.A. Skoog and D.M. West, Principles of Instrumental Analysis, 2 nd edition, Holt-Saunders, 1980.

PEE751: POWER SYSTEM LAB

Note: - At least 10 experiments should be performed out of which 3 should be simulation based.

1. To determine direct axis reactance (x_d) and quadrature axis reactance (x_q) of a salient pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (x_d) and sub transient quadrature axis reactance (x_q) of an alternator
4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
5. To study the IDMT over current relay and determine the time current characteristics
6. To study percentage differential relay
7. To study Impedance, MHO and Reactance type distance relays
8. To determine location of fault in a cable using cable fault locator
9. To study ferranty effect and voltage distribution in H.V. long transmission line using transmission line model.
10. To study operation of oil testing set.

Simulation Based Experiments (using MATLAB or any other software)

11. To determine transmission line performance.
12. To obtain steady state, transient and sub-transient short circuit currents in an alternator
13. To obtain formation of Y-bus and perform load flow analysis
14. To perform symmetrical fault analysis in a power system
15. To perform unsymmetrical fault analysis in a power system

PEC751: OFC LAB

Design of following ckt using appropriate software like VHDL/ FPGA and OFC kits.

1) 3-input NAND gate.
2) Half adder, Full Adder
3) D-Latch, T Flip Flop
4) Serial in-serial out shift register, Bidirectional shift Register
5) 3 Bit synchronous counter
6) To set up Fiber Optic Analog link.
7) To set up fiber Optic Digital link.
8) Measurement of Propagation loss and numerical aperture.
9) Characterization of laser diode and light emitting diode.

- NOTE: The institution can add 2 more practical in above prescribed list.

TEE801: ELECTRIC DRIVES

Unit I: Fundamentals of Electric Drive:
Electric Drives and its parts, advantages of electric drives, Classification of electric drives, Speed-torque conventions and multi-quadrant operations, Constant torque and constant power operation, Types of load, Load torque: components, nature and classification

Unit II: Dynamics of Electric Drive:
Dynamics of motor-load combination; Steady state stability of Electric Drive; Transient stability of electric Drive
Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty. Load equalization

Unit III: Electric Braking:
Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors. Dynamics During Starting and Braking: Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking

Unit IV: Power Electronic Control of DC Drives
Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only); dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Chopper control of separately excited dc motor and dc series motor.

Unit V: Power Electronic Control of AC Drives
Three Phase induction Motor Drive, Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo- converter based) static rotor resistance and slip power recovery control schemes.
Special Drives
Switched Reluctance motor, Brushless dc motor.

Reference Books:

1. M.Chilkin, “Electric Drives”, Mir Publishers, Moscow.
2. Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia, Pvt. Ltd. Singapore.
3. N.K. De and Prashant K.Sen, “Electric Drives”, Prentice Hall of India Ltd
4. V.Subrahmanyam, “Electric Drives: Concepts and Applications”, Tata McGraw Hill

TEE802: SCADA & ENERGY MANAGEMENT SYSTEM

Unit I: SCADA

Purpose and necessity, general structure, data acquisition, transmission & monitoring. general power system hierarchical Structure. Overview of the methods of data acquisition systems, commonly acquired data, transducers, RTUs, data concentrators, various communication channels- cables, telephone lines, power line carrier, microwaves, fiber optical channels and satellites.

Unit II: Supervisory and Control Functions

Data acquisitions, status indications, majored values, energy values, monitoring alarm and event application processing. Control Function: ON/ OFF control of lines, transformers, capacitors and applications in process in industry - valve, opening, closing etc. Regulatory functions: Set points and feed back loops, time tagged data, disturbance data collection and analysis. Calculation and report preparation.

Unit III: MAN- Machine Communication

Operator consoles and VDUs, displays, operator dialogues, alarm and event loggers, mimic diagrams, report and printing facilities.

Unit IV: Data basis

SCADA, EMS and network data basis. SCADA system structure - local system, communication system and central system. Configuration- NON-redundant- single processor, redundant dual processor. Multicontrol centers, system configuration. Performance considerations: real time operation system requirements, modularization of software programming languages.

Unit V: Energy Management Center

Functions performed at a centralized management center, production control and load management economic dispatch, distributed centers and power pool management.

Books Recommended:

1. Torsten Cergrell, " Power System Control Technology", Prentice Hall International.
2. George L Kusic "Computer Aided Power System Analysis",, Prentice Hall of India,
3. A. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley & Sons.
4. Sunil S Rao, "Switchgear Protection & Control System" Khanna Publishers 11th Edition.

TEE021: MODERN CONTROL SYSTEM

Unit I: Introduction to control systems
Introduction to control systems, properties of signals and systems. Convolution integral, Ordinary differential equation, Transfer function, Pole zero concepts, effect of pole location on performance specification.

Unit II: State Space analysis
State equations for dynamic systems, State equations using phase, physical and canonical variables, realization of transfer matrices, Solution of state equation, concepts of controllability, observability, Controllability and Observability tests.

Unit III: Discrete time control systems
Sampling theorem, Sampled-data systems, the sample and hold element, pulse transfer function, The Z-transform, stability analysis.

Unit IV: Stability
Liapunov's method, generation of Liapunov's function, Popov's criteria, design of state observers and controllers, adaptive control systems, model reference.

Unit V: Optimal Control
Introduction , formation of optimal control problems, calculus of variation, minimization of functions, constrained optimization, dynamic programming, performance index , optimality principles, Hamilton – Jacobian equation, linear quadratic problem, Ricatti II equation and its solution, solution of two point boundary value problem

Reference Books:

1. B.D.O. Anderson and IB. Moore, " Optimal Control System: Linear Quadratic Methods", Prenctice Hall International.
2. U. Itkis, "Control System of Variable Structure", John Wiley and Sons.
3. H. Kwakemaok and R. Sivan, "Linear Optimal Control System", Wiley Interscience.

TEE022: BIO –MEDICAL INSTRUMENTATION

Unit I: Basic Physiological system of body

Problem encountering measuring leaving system, bioelectric potential, biomaterial, Basic transducers principle, Active and passive transducers, transducer for biomedical applications, Generation, propagation and distribution of bioelectric potential (ECG, EEG and EMG)

Unit II: Bio Potential Electrode

Basic type (micro skin surface and needle electrodes), Biochemical transducer (PH, blood gas and specification electrodes), Cardiovascular System & Measurement, Heat and cardiovascular system and circulation block diagram blood pressure and, measurement, characteristics of blood flow and heart sound, Electrocardiography, ECG an lead, configuration, ECG recording and their types

Unit III: Nervous System

The anatomy of nervous system, neuronal communication, EPSP, IPSP, Organization of brain, Measurement from the nervous system, Systematic skin and body temperature measurement, Temperature measurement, Brief idea about ultrasonic measurements

Unit IV: Patient Care Monitoring

Element of intensive care, Organizational the hospital fore patient-care monitoring, Pace makers-type, systems, mode and generators, Defibrillator-types.Biotelemetry and application of telemeter inpatient care

Unit V: Automation of Chemical Test

Instrumentation for diagnostic X rays, Interfacing computer with medical instrumentation and other equipments, Bio medical computer application. Shock hazards from electrical equipments, methods of accident prevention.

Reference Books:

1. Cromwell- Biomedical Instrumentation and Measurements- PHI
2. Webster, J.G. –Bio- Instrumentation, Wiley (2004)
3. Ananthi, S. –A Text Book of Medical Instruments-2005-New Age International
4. Carr & Brown –Introduction to Biomedical Equipment Technology – Pearson
5. Pandey & Kumar-Biomedical Electronics and Instrumentation. - Kataria

TEE023: POWER PLANT ENGINEERING

UNIT 1

INTRODUCTION : Piping and instrumentation diagram of a thermal power plant, basic process on a boiler, Fuel measurement- review of pressure and temperature measurement steam and water flow measurement – instrument applications in power stations: review of indicating and recording instrument applications in power stations: review of indicating and recording instruments, water level gauge for boiler drums, closed circuit television instrument, gas analysis meters, smoke instruments, dust monitor-measurement of impurities in feed water and steam generator coolant controls and instruments, instrument maintenance aspects.

UNIT 2

BOILER CONTROL-I: Boiler control objectives-combustion of fuels (gaseous liquid, and solid), excess air, combustion chemistry and products of combustion, requirement for excess combustion, air-circulation of efficiency of boiler: input/output method-stream temperature control systems super heaters and de-superheaters.

UNIT 3

BOILER CONTROL-II: Feed water supply and boiler water circulation system-drum level control systems-boiler draft systems-measurement and control of furnace draft measurement and control of combustion-draft and air flow control related functions.

UNIT 4

FLUE GAS ANALYSIS TRIMMING OF COMBUSTION CONTROL SYSTEMS :

Combustion control for liquid and gaseous fuel boilers coal or solid fuel strokes combustion control for stoker-fired boilers- pulverised coal-fired boilers. Turbine monitoring and control: speed, vibration, shell temperature monitoring.

UNIT 5

NUCLEAR POWER PLANT INSTRUMENTATION: Piping and instrumentation diagram of different types of nuclear power plants-radiation detection instruments process sensors for nuclear power plants-spectrum analyzers-nuclear reactor control systems and allied instrumentation.

REFERENCE BOOKS:

1. A.Sherryet. Al. (Editors), Modern power station practice, Vol.6 (Instrumentation controls and testing), Pergamon Press, 1971.

TIC023: SYSTEM DESIGN USING MICROCONTROLLERS

UNIT 1

REVIEW OF MICROCONTROLLERS: Features of Typical Microcontroller – on Board peripherals – Processor Selection criteria – Microcontroller Design Specifications – Word length – Performance Issues - Power consumption – Package Types – Electrical requirements – Reset Hardware – oscillator Design – power Consideration - Development Tools –Firmware Development options – Assembly Language Vs High level Language Programming.

UNIT 2

MCS51 MICROCONTROLLER AND INTERFACING: Intel MCS51 Architecture – Derivatives - Special Function Registers (SFR), I/O pins, ports and circuits, Instruction set, Addressing Modes, Assembly Language Programming, Timer and Counter Programming, Serial Communication, Connection to RS 232, Interrupts Programming, External Memory interfacing , Introduction to 16 bit Microcontroller

UNIT 3

PIC MICROCONTROLLER AND INTERFACING: Introduction, CPU architecture, registers, instruction sets addressing modes Loop timing, timers, Interrupts, Interrupt timing, I/o Expansion, I 2C Bus Operation Serial EEPROM, Analog to digital converter, UART-Baud Rate-Data Handling-Initialization, Special Features - serial Programming- Parallel Slave Port.

UNIT 4

SOFTWARE DEVELOPMENT AND TOOLS: Embedded system evolution trends. Round - Robin, robin with Interrupts, function-One-Scheduling Architecture, Algorithms. Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

UNIT 5

REAL TIME OPERATING SYSTEMS: Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS. System Design Issues – Design of Industrial Control System.

REFERENCES:

1. Burns, Alan and Wellings, Andy, " Real-Time Systems and Programming Languages ", Second Edition. Harlow: Addison-Wesley-Longman, 1997.
2. Raymond J.A. Bhur and Donald L.Bialey, " An Introduction to real time systems: Design to networking with C/C++ ", Prentice Hall Inc. New Jersey, 1999.
3. Grehan Moore, and Cyliax, " Real time Programming: A guide to 32 Bit Embedded Development. Reading " Addison-Wesley-Longman, 1998.
4. Heath, Steve, " Embedded Systems Design ", Newnes 1997.

TEE031: POWER QUALITY IMPROVEMENT TECHNIQUE

Unit I: Power Quality Terms and Definitions
Introduction, transients, sag and swell, short duration/long duration voltage variations, voltage imbalance, waveform distortion, voltage fluctuations, power frequency variation.
Power Quality Problems:
Poor load power factor, loads containing harmonics, notching in load voltage, DC offset in loads, unbalanced loads, disturbance in supply voltage.
Unit II: Fundamentals of Harmonics: Representation of harmonics, waveform, harmonic power, measures of harmonic distortion; current and voltage limits of harmonic distortion: IEEE, IEC, EN, NORSOK
Causes of Harmonics: 2-pulse, 6-pulse and 12-pulse converter configurations, input current waveforms and their harmonic spectrum; Input supply harmonics of AC regulator, integral cycle control, cycloconverter, transformer, rotating machines, ARC furnace, TV and battery charger.

Unit III: Effect of Harmonics: Parallel and series resonance, effect of harmonics on static power plant-transmission lines, transformers, capacitor banks, rotating machines, harmonic interference with ripple control systems, power system protection, consumer equipments and communication systems, power measurement.

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Unit IV: Elimination/Suppression of Harmonics: High power factor converter, multi-pulse converters using transformer connections (Delta, polygon)
Passive Filters: Types of passive filters, single tuned and high pass filters, filer design criteria, double tuned filters, damped filters and their design.

Unit V: Active Power filters: Compensation principle, classification of active filters by objective, systems configuration, power circuit and control strategy.
Shunt Active Filter: Single phase active filter, principle of operation, expression for compensating current, concept of constant capacitor voltage control; Three phase active filter: Operation, analysis and modeling; Instantaneous racavitve power theory
Three phase series active filters: Principle of operation, analysis and modeling.
Other Techniques: Unified power quality conditioner, voltage source and current configurations, principle of operation for sag, swell and flicker control.

.
Reference books:

1. C. Sankarm,"Power Quality" CRC Press USA.
2. Barry W. Kennedy, "Power Quality Primer "McGraw Hill.
3. Wilson E. Kazibwe,"Electrical power quality controls techniques" Van Nostrand Reinhold.

TEE032: POWER CONVERTER APPLICATIONS

Unit I: HVDC Transmission
Schematic diagram; modes of operation, twelve pulse line commutated converters, effect of source inductance; control of HVDC converters, converter faults and protection, harmonic filters

Unit II: FACT Controllers
Principal of power transmission, principal of shunt compensation- and series compensation-TCR, TCS, SVC, STATCOM, Series compensator- TSSC, FCSC, TCSC, SSVC, phase angle compensator, unified power flow controller (UPFC), comparison of compensator
.

Unit III: Power Supplies
Desirable specification of power supply, draw back of linear power supply. Switch mode power supply (SMPS)-schematic diagram, fly back converters, forward converter, push pull converters, half bridge and full bridge converter; uninterruptible power supply,(UPS)-configuration of line and online UPS, switch mode and resonant power supplies, air craft power supply.

Unit IV: Industrial Applications
High frequency inverters for induction and dielectric heating, ac voltage controllers for resistance heating and illumination control, high frequency fluorescent lighting, electric welding control.

Unit V:
Interconnection of Renewable Energy Sources to the Utility Grid, Photovoltaic array interconnection, wind and small hydro interconnection, interconnection of energy storage system, DC circuit breaker, single phase and three phase ac switches, Excitation control of synchronous generator.

Reference Books:

3. K.R. Padiyar, "HVDC Power Transmission: Technology and System Reactions" New Age International

1. Ned Mohan, T.M. Undeland and William P. Robins, "Power Electronics: Converters, Applications and Design", John Wiley & Sons.
2. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications" Prentice Hall of India.

TEE033: EHV A.C. & D.C. TRANSMISSION

Unit I: Introduction

Need of EHV transmission, standard transmission voltage, comparison of EHV AC & DC transmission systems and their applications & limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC & DC transmission.

Unit II: EHV AC Transmission

Corona loss formulas, corona current, audible noise- generation and characteristics corona pulses their generation and properties, radio interference (RI) effects, over voltage due to switching, ferroresonance, reduction of switching surges on EHV system, principle of half wave transmission.

Unit III: Extra High Voltage Testing

Characteristics and generation of impulse voltage, generation of high AC and DC voltages, measurement of high voltage by sphere gaps and potential dividers. Consideration for Design of EHV Lines, Design factors under steady state limits, EHV line insulation design based upon transient over voltages. Effects of pollution on performance of EHV lines.

Unit IV: EHV DC Transmission-I

Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters, principle of dc link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of dc link.

Unit V: EHV DC Transmission- II

Converter faults, protection against over currents and over voltage, Smoothing reactors, generation of harmonics, ac and dc filters, multi –terminal dc systems (MTDC): Types, control, protection and application

Reference books:

1. M.H Rashid,"Power Electronics: Circuit, Devices and Applications "Prentice hall of India.
2. S .Rao, "EHV AC & HVDC Transmission Engineering and practice" Khanna Publishers.

TEC 033: ADAPTIVE SIGNAL PROCESSING

UNIT 1

INTRODUCTION: Definition and characteristics, general properties open and closed loop adaptation.

UNIT 2

ADAPTIVE LINEAR COMBINER: General description, input signal and Weight vectors, desired response and error performance function, gradient and minimum mean square, alternative definition of gradient, decorelection of error and input components.

UNIT 3

THEORY OF ADAPTATION WITH STATIONARY SIGNALS: Input correlation matrix, Eigen values and eigenvectors of the correlation matrix, and their geometrical significance. Basic ideas of gradient search methods, gradient search by newton's method and method of steepest descent, gradient component estimation by derivative measurement, effects of gradient noise, on weight vector solution, excess MSE, time constant and mis-adjustment, performance comparison of Newton and S.D. methods.

UNIT 4

ADAPTIVE ALGORITHMS: Least mean square algorithm, convergence, learning curve noise in Weight vector misadjustment and performances of LMS algorithms, sequential regression algorithm, adaptive recursive LMS algorithm, random search algorithm.

RECURSIVE LEAST SQUARE ALGORITHM: Preliminaries, matrix inversion lemma, exponentially weighted RLS algorithm, update recursion for the sum of weighted error squares, convergence analysis of RLS algorithm

UNIT 5

ADAPTIVE FILTER STRUCTURES: Lattice structures, all poles and all zeroes versions, adaptive lattice predictor. Lattice LMS algorithms, and lattice SER algorithms, adaptive filters with orthogonal signals, DFT and lattice preprocessors.

ADAPTIVE FILTER APPLICATIONS: (i) Adaptive modeling and systems identification. (ii) Inverse adaptive modeling, equalization and deconvolution

SUGGESTED BOOKS:

1. Adaptive Signal Processing, Widrow and Stearns, Pearson Education
2. Adaptive Filter Theory, Simon Haykin, Pearson Education

TEC 034: EMBEDDED SYSTEMS

UNIT 1

INTRODUCTION: Embedded systems and its applications, Embedded Operating system, Design parameters of an embedded system and its significance, design life cycle, tools introduction, hardware and software partitioning and co-design.

UNIT 2

HARDWARE FUNDAMENTALS FOR THE EMBEDDED DEVELOPERS : Digital circuit parameters- Open collector outputs Tristate outputs I/O sinking and Sourcing, PLD's, Watchdog Timers, Hardware design and development.

CUSTOM SINGLE PURPOSE PROCESSORS: Optimizing program, FSMD, Data path & FSM.

GENERAL PURPOSE PROCESSORS AND ASIP'S (Application Specific Instruction set Programming): Software and operation of general purpose processors-Programmers View Development Environment-ASIPs Microcontrollers-DSP Chips.

UNIT 3

INTRODUCTION TO MICROCONTROLLERS AND MICOPROCESSORS: Embedded versus external memory devices, CISC and RISC processors, Harvard and Von Neumann Architectures.

RTOS -Tasks, states, Data, Semaphores and shared data, Operating system services, Message queues, Mailboxes.

UNIT 4

ADVANCED PROCESSOR-(only architectures) 80386, 80486, ARM and DUAL CORE, Core to DUO, i3, i5, i7 (References)

COMMUNICATION BASICS: Microprocessor Interfacing I/O Addressing, Direct memory access, Arbitration, multilevel bus architecture, Serial protocols, Parallel protocols and wireless protocols.

UNIT 5

REAL WORLD INTERFACING: LCD, Stepping Motor, ADC, DAC, LED, Push Buttons, Key board, Latch Interconnection, PPI.

SUGGESTED BOOKS:

1. Embedded System Design-Frank Vahid/Tony Givargis, John Willey@2005.
2. Microcontroller (Theory and Applications) Ajay V Deshmukh, Tata McGraw-Hill@2005.
3. An Embedded Software Primer-David E.Simon, Pearson Education @ 1999.

REFERENCES:

1. The 8051 Microcontroller and embedded systems-Muhammad Ali Mazidi and Janice Gillispie.
2. Microcontrollers (Architecture, Implementation & Programming) Kenneth Hintz, Daniel Tabak, Tata McGraw-Hill@2005.
3. 8051 Microcontrollers & Embedded Systems 2nd Edition-Sampath Kr, Katson Books2006.

PEE851: ELECTRIC DRIVES LAB

Note: - Minimum 10 experiments are to be performed from the following out of which at least three should be simulation based.

1. To study speed control of separately excited dc motor by varying armature voltage using single-phase fully controlled bridge converter.
2. To study speed control of separately excited dc motor by varying armature voltage using single phase half controlled bridge converter.
3. To study speed control of separately excited dc motor using single phase dual converter (Static Ward-Leonard Control)
4. To study speed control of separately excited dc motor using MOSFET/IGBT chopper
5. To study closed loop control of separately excited dc motor
6. To study speed control of single phase induction motor using single phase ac voltage controller.
7. To study speed control of three phase induction motor using three phase ac voltage controller
8. To study speed control of three phase induction motor using three phase current source inverter
9. To study speed control of three phase induction motor using three phase voltage source inverter
10. To study speed control of three phase slip ring induction motor using static rotor resistance control using rectifier and chopper
11. To study speed control of three phase slip ring induction motor using static scherbius slip power recovery control scheme

Simulation Based Experiments (using MATLAB or any other software)

12. To study starting transient response of separately excited dc motor
13. To study speed control of separately excited dc motor using single phase fully / half controlled bridge converter in discontinuous and continuous current modes.
14. To study speed control of separately excited dc motor using chopper control in motoring and braking modes.
15. To study starting transient response of three phase induction motor
16. To study speed control of three phase induction motor using (a) constant/V/F control (b) Constant Voltage and frequency control.