## UTTARAKHAND TECHNICAL UNIVERSITY
### SESSION 2009-10
#### STUDY AND EVALUATION SCHEME
- **B.Tech. Electrical & Electronics Engineering**
- **Year 4<sup>th</sup>**
- **Semester-VII**

<table>
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<tr>
<th>S.No</th>
<th>Course No.</th>
<th>Subject</th>
<th>Periods</th>
<th>Evaluation</th>
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**LIST OF ELECTIVE – I**

- **TEE 011:** Utilization of Electrical Energy and Traction
- **TEE 012:** SCADA & Energy Management System
- **TEE 013:** Data Base Management System, Data Mining & Warehousing
- **TEE 014:** Digital Control System
- **TEE 015:** Neural Network and Fuzzy Logic
Unit No. 1
Introduction to Power System
Introduction to protective system and its elements, functions 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 No. II
Relay Applications and characteristics
Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay

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

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 Breaking
Arc phenomenon, Properties of arc, arc extinction theories, , Recovery Voltage and Restriking Voltage, current chopping, resistance switching, capacitive current interruption, , circuit breaker ratings.

Testing of Circuit breakers
Classification, testing station and 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, Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding.

Circuit breaker
Need for circuit breakers, types of circuit breakers, operating modes, principles and constructional details of Air Blast, Bulk Oil, Minimum Oil, SF6, Vacuum Circuit Breakers , D.C. circuit breakers

Text Books:
1) Switchgear and Protection Sunil S. Rao (Khanna Publishers)
2) Power System Engg. Soni Gupta & Bhatnager (Dhanpat Rai&Sons)
3) A Course in Electrical Power C.L.Wadhawa (New Age international Pvt. Ltd)
4) Power system protection and switchgear B.Ram (Wiley Eastern Ltd.)

Reference Books:
1.) Power system Protection & Switchgear Badriram & D.V.Vishwakarma (TMH)
2) Switchgears & Protection M.V. Deshpande (THM)
Unit I: Discrete-Time Signals And Systems
Sequences, discrete time systems, LTI systems, frequency domain representation of discrete time signals and systems, discrete time signals and frequency domain representation, Fourier transform.

Discrete Fourier Transform:
Discrete Fourier transforms, properties, linear convolution using DFT, DCT

Unit II: Sampling of Continuous Time Signals
Sampling and reconstruction of signals, frequency domain representation of sampling, discrete time processing of continuous time signals, continuous time processing of discrete time signals, changing the sampling rate using discrete time processing, multi rate signal processing, digital processing of analog signals, over sampling and noise shaping in A/D and D/A conversion.

Transform Analysis of LTI Systems
Frequency response of LTI systems, system functions, frequency response for rational system functions, magnitude-phase relationship, all pass systems, minimum phase systems, linear systems with generalized linear phase.

Unit III: Structures For Discrete-Time Systems
Block diagram representation, signal flow graph representation, basic structures for IIR systems: direct form, cascade form, parallel form, and feedback in IIR systems. Transposed forms, basic network structures for FIR systems: direct form, cascade form, and structures for linear-phase FIR systems. Overview of finite precision numerical effects, effects of coefficient quantization, effects of round-off noise in digital filters, zero-input limit cycles in fixed point realizations of IIR digital filters.

Unit IV: Filter Design Techniques
Design of D-T IIR filters from continuous-time filters, design of FIR filters by windowing, Kaiser Window method, optimum approximations of FIR filters, FIR equiripple approximation.

Unit V: Efficient Computation of the DFT
Goertzel algorithm, decimation in time and decimation in frequency, FFT algorithm, practical considerations, implementation of the DFT using convolution, effects of finite register length.

Fourier analysis of Signals Using DFT
DFT analysis of sinusoidal signals, time-dependent Fourier transforms: block convolution, Fourier analysis of non-stationary and stationary random signals, spectrum analysis of random signals using estimates of the autocorrelation sequence.

Text Book:

Reference Books:
5. De Fatta, D. J. Lucas, J. G. and Hodgkiss, W. S., “Processing” John Wiley and Sons
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. Supply harmonics, power factor and ripples in motor current 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.
Three Phase Synchronous motor
Self controlled scheme
Special Drives
Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications

Text Books:

Reference Books:
**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 hetero-associative memory

**Unit-II Neural Networks-II (Back propagation networks)**
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient; back propagation 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 in load flow study, load forecasting, detection of faults in distribution system and electric drives control, Industrial applications of fuzzy logic.

**Text Books:**
1. Kumar Satish, “Neural Networks” Tata Mc Graw Hill

**Reference Books:**
3. Siman Haykin,”Neural Networks “Prentice Hall of India
4. Timothy J. Ross, ”Fuzzy Logic with Engineering Applications“ Wiley India.
UNIT I: Electric Heating
Advantage & methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating,

UNIT II: Electric Welding

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.

Text books:

Reference Book:
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TEE - 012 SCADA & ENERGY MANAGEMNT

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, 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, mimics 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, multi control 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.

Text Books:
2. George L Kusic "Computer Aided Power System Analysis", Prentice Hall of India,

Reference Books:
Unit I: Introduction
An overview of data base management system, data base system v/s file system, database system concept and architecture, data model schema and instances, data impedance and data base language and interfaces, data definitions language, DML, overall database structure.
Data modeling using the Entity Relationship Model:
ER model concept nation for ER diagram, aping constrains, keys, concept of super key, candidate key, primary key, generalization aggregation, reduction of an ER diagrams to tables extended ER model, relationship of higher degree.

Unit II Relational data model and language
Relational data model concepts, integrity constraints: entity integrity, referential integrity, keys constraints, and domain constraints relational algebra, relational calculus, tuple and domain calculus.
Introduction to SQL
Characteristics of SQL-Advantage of SQL data types and literals, types of SQL commands, SQL operators and their procedure tables, view and indexes quarries. And sub quarries. aggregate functions insert, update and delete operations, joins, unions, intersection, minus, cursors in SQL

Unit III: Data base design & Normalization
Functional dependencies, normal forms, first, second and third normal forms. BCNF, inclusion dependences, loss less join decompositions, normalization using FD, MVD, AND JDs, alternative approaches to data base design.

Unit IV: Foundation ,Introduction to DATA Ware housing
Client/Server Computing model and data warehousing. Parallel process and system distributed DBMS implementations, Client/Server RDBMS Solutions.

Unit V: DATA Ware housing
Data warehousing components, building a data warehouse. Mapping the data warehouse to a multiprocessor architecture, DBMS Schemas for decision support. Data extraction, cleanup & transformation tools. Metadata.
Data Mining
Introduction to data mining.

Text books:
3. Alex Bersuon & Stephen J.Smith, 'data warehousing, data mining 7 OLAP”; Tata MC
   Graw Hill

Reference Books:
1. Elmasri, Navathe,"Fundamentals of database system", Addition Wesley
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, optimality & Dynamic programming,
Different types of problem and their solutions.

Text Books:

Reference Books:
5. Graw Hill.
UTTARAKHAND TECHNICAL UNIVERSITY
SESSION 2009-10
PEE – 751 POWER SYSTEM LAB

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

Hardware 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 reactance’s of an alternator.
3. To determine sub transient direct axis reactance ($X_d$) and sub transient quadrature axis reactance ($X_q$) of an alternator.
5. To study the IMDT 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 ferrety 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)

1. To determine transmission line performance.
2. To obtain steady state, transient and sub-transient short circuit currents in an alternator.
3. To obtain formation of Y-bus and perform load flow analysis.
4. To perform symmetrical fault analysis in a power system.
5. To perform unsymmetrical fault analysis in a power system.

PEE – 753 INDUSTRIAL TRAINING SEMINARS

Students will go practical & Industrial training of four weeks in any industry or reputed organization after the VI semester examination in summer. They will also prepare an exhaustive technical report of the training which will be duly signed by the officer under whom training was taken in the industry/organization. They will have to present about the training before a committee consisting of faculty members constituted by the concerned head of the department.


Note: Minimum of 10 experiments should be performed out of the following using DSP kit TMS 320 CXX.

1. To generate sinusoidal, square and triangular waveforms
2. To study response of audio (analog) input
3. To study response and stability of linear shift invariant system with given unit sample response
4. To study addition and multiplication of sequences
5. To study matrix multiplication
6. To find discrete Fourier Transform of given sequence
7. To implement Geartzd Algorithm
8. To implement FFT decimation in time algorithm
9. To implement floating point arithmetic
10. To implement Tone generation
11. To implement LPC computation
12. To implement Coding schemes
Project shall be assigned to students at the start of VII semester. There should not usually be more than 3 students in batch. The project should be based on latest technology as far as possible and it may be hardware or/and software based. The assessment of performance of students should be made at least twice in the semester. Students should be encouraged to present their progress of project using overhead projector or LCD projector.