FACULTY OF ELECTRICAL ENGINEERING

Approved Special Electives for
M.S. / Ph.D. Degree Programs
(upto 21st AC 07.01.2016)
### SPECIAL ELECTIVES FOR FACULTY OF ELECTRICAL ENGINEERING

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This course will help to understand how FACTS controllers can be represented in power system simulation programs and how power studies can help to evaluate their applicability and performance characteristics.

**INTRODUCTION TO FACTS**

FACTS-Concepts and general system considerations, Types of FACTS controllers, Voltage source converters, Self and line commutated current sourced converters, Special purpose FACTS controllers, Generalized and multifunctional FACTS controllers. Types of computer analysis of power systems with FACTS controllers.

**SIMULATION AND MODELING OF FACTS CONTROLLERS FOR TRANSIENT STABILITY STUDIES.**


**SIMULATION AND MODELING OF FACTS CONTROLLERS FOR SMALL SIGNAL STABILITY STUDIES.**

Introduction to small signal analysis. Simulation and modeling of FACTS controllers for small signal analysis. Comparison between dynamic and transient stability results.

**FACTS CONTROLLERS FOR ELECTROMAGNETIC TRANSIENTS**

Introduction to EMTP. Steady state and time step solutions in EMTP and their uses. Models of synchronous machines. Modeling of FACTS controllers for power system studies using EMTP.

**CUSTOM POWER DEVICES**


**REFERENCES:**

# EVOLUTIONARY COMPUTING

**UNIT I**  
**GENETIC ALGORITHM**

**UNIT II**  
**EVOLUTIONARY COMPUTATION**
- The evolution program for numerical optimization, Evolution program versus other methods. An evolution program the GENOCOP system, the GAFOC system.

**UNIT III**  
**EVOLUTIONARY STRATEGIES**

**UNIT IV**  
**EVOLUTIONARY PROGRAMMING**
- Features of Evolutionary programming, Classical Evolutionary programming, Adaptive Evolutionary programming, object oriented analysis, design and implementation. Evolutionary programming. Object oriented testing.

**UNIT V**  
**HYBRID EVOLUTIONARY ALGORITHMS**
- And Artificial Neural networks, an Evolutionary programming approach to reactive power planning, optimal reactive power dispatch using Evolutionary programming, Application of Neural networks and Evolutionary programming, to short term load forecasting

**TEXT BOOK:**

**REFERENCES:**
1. Z.Michalewiez, Genetic algorithms + Data Structures = Evolution Programmes  
2. J.A.Momoh,Electric power system applications of optimization  

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# POWER SYSTEM OPTIMISATION

**UNIT I**  
**OPTIMAL POWER FLOW**

**UNIT II**  
**LINEAR PROGRAMMING**
UNIT III NON-LINEAR PROGRAMMING 10

UNIT IV INTERIOR POINT METHOD 5

UNIT V UNIT COMMITMENT & DYNAMIC PROGRAMMING 10
Formulation of unit commitment, modeling in unit commitment, Priority list unit commitment schemes, Different types, unit commitment of Thermal units using dynamic programming. Characteristics of Dynamic programming, Computational economy in Dynamic programming, Illustrative examples.

TEXT BOOKS
1. James A. Momoh, Electric power system applications of Optimization

REFERENCES
2. Hadi Saadat, Power system Analysis, WCB/ Mcgraw Hill,1999
UNIT V  STABILITY STUDIES UNDER MULTIPLE FACTS ENVIRONMENT

Introduction to small signal analysis – simulation and modeling of FACTS controllers for small signal analysis. Comparison between dynamic and transient stability results.

Introduction to EMTP – (Electromagnetic Transient programme / Package), Modeling of FACTS controllers for power system studies using EMTP.

REFERENCES:
2. Driankov, Hellendroon, “Introduction to Fuzzy control” Narosa Publisher.

Faculty of Electrical Engineering

(Approved in 8th AC – 18.03.2006) ITEM NO.8.5.7

FE1911( Old Code PS 1901) DC – DC CONVERTERS L T P C 3 0 0 3

UNIT I  INTRODUCTION
Historical review – Multiple – Quadrant Choppers – Pump Circuits Development of DC / DC conversion Techniques – Prototypes – DC / DC Converters family.

UNIT II  VOLTAGE – LIFE CONVERTERS

UNIT III  SUPER –LIFT CONVERTERS

UNIT IV  CASCADED BOOST CONVERTERS

UNIT V  MULTIPLE QUADRANT OPERATION

TOTAL: 45 PERIODS

TEXT BOOK:
REFERENCES:

Faculty of Electrical Engineering

ITEM NO. FE 9.3

FE1912 NANO ELECTRONICS 3 0 0 3

UNIT I NANOTECHNOLOGY 9
Introduction to Nanotechnology- history & recent trends- Application of Nanotechnology to Electrical engineering- Nanotechnology advantages and various issues.

UNIT II NANO-ELECTRONICS DEVICES: INTRODUCTION 9
Nanoelectronics Devices: Carbon nanotube, FINFET, Quantum transport devices- RTD, Super conducting Digital Electronics, Quantum computing using super conductors- Molecular electronics – Nanoelectronics Memories- nanoelectronics interfacing systems.

UNIT III FABRICATION & DEVICE MODELLING 9

UNIT IV SINGLE ELECTRON TECHNOLOGY 9

UNIT V SIMULATION 9
Simulating single electron devices & circuits- Binary , Multiple valued and mixed mode logics- SET spice modelling- MAT LAB Modelling-SET CMOS Hybrid process.

TOTAL: 45 PERIODS

REFERENCES:
UNIT I INTRODUCTION
Necessity of optimization in power system, Types of optimization problem, Unconstrained problems, Constrained problems.

UNIT II UNCONSTRAINED OPTIMIZATION TECHNIQUES

UNIT III CONSTRAINED OPTIMIZATION TECHNIQUES

UNIT IV INTERIOR POINT METHODS

UNIT V DYNAMIC PROGRAMMING

L = 45, T = 15. TOTAL = 60 PERIODS

TEXT BOOKS:

REFERENCES:
Faculty of Electrical Engineering

ITEM NO. FE 10.3(ii)

FE1915 WIND ELECTRIC CONVERSION SYSTEM

UNIT I THE WIND RESOURCES

UNIT II AERODYNAMICS OF WIND TURBINES

UNIT III WIND TURBINE PERFORMANCE AND DESIGN LOADS FOR WIND TURBINE

UNIT IV CONCEPTUAL DESIGN AND COMPONENT DESIGN OF WIND TURBINE

UNIT V WIND TURBINE CONTROLLER AND HARMONICS
Function of the wind turbine controller – Closed loop control; issues and objective, general techniques, analytical design methods, Pitch actuators control system implementation - Embedded wind generation – Power quality; voltage flicker, harmonics.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
FE1916 MODELLING AND SIMULATION OF FACTS DEVICES

UNIT I INTRODUCTION

UNIT II STATCOM

UNIT III SSSC

UNIT IV MODELLING OF UPFC

UNIT V CONTROL AND IMPLEMENTATION OF UPFC

REFERENCES:
UNIT II  MODELING
Optimal power flow (OPF) as a basic tool – OPF model, examples – characteristic features of OPF – Unit commitment (UC) – basic model, additional issues – Formation of power pools – The Energy Brokerage system.

UNIT III  STRUCTURE OF Deregulated MARKET

UNIT IV  CONCEPT OF WHEELING
Power wheeling – Transmission open access – types of transmission services in open access – Cost components in transmission – Pricing of power transactions, and embedded cost based transmission pricing, incremental cost based transmission based transmission pricing – transmission open access and pricing mechanisms in various countries – United kingdom, Chile and Sweden.

UNIT V  CONGESTION MANAGEMNET
Developments in international transmission pricing in Europe – security management in deregulated environment, scheduling of spinning reserves, interruptible load options for security management – Congestion management in deregulation, economic instruments for handling congestion.

TOTAL: 45 PERIODS

TEXT BOOK :

REFERENCES:
UNIT III NETWORK PROCESSOR TECHNOLOGY

UNIT IV NETWORK PROCESSORS
Overview of Intel Network Processor, Embedded RISC Processor, Packet Processing hardware, Reference System and Software Development Kit.

UNIT V PROGRAMMING MODELS

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:

Faculty of Electrical Engineering

(Approved in 10th AC 09.06.2007) ITEM NO. FE 10.3(vi)

FE1919 SMART SENSORS: ANALYSIS AND COMPENSATION 3 0 0 3

UNIT I ANALYSIS OF TRANSDUCERS AND ACTUATORS (9)
Characteristics and analysis of I and II order Transducers, Study of Electrical, Thermal, Mechanical and Magnetic Transducers and Electromagnetic Actuators.

UNIT II SENSOR COMPENSATION TECHNIQUES (9)
Software Techniques, Digital adaptive techniques, Analog adaptive techniques, and Kalman filtering.

UNIT III FAULT DETECTION AND ISOLATION (12)
Fault detection and localization using Decorrelation Matrix, Fault reconstruction form sensor and actuator failures, Covariance based Hardware selection, Observer architecture for failure detection and isolation.

UNIT IV BUSES AND SENSOR NETWORKS (6)
Smart Transducer Interface Module, Network Capable Application Processor, Transducer Electronic Data Sheet, IEEE 1451 Standards.

UNIT V ANALOG AND DIGITAL IMPLEMENTATION CASE STUDIES (9)

TOTAL: 45 PERIODS
TEXT BOOKS:

Faculty of Electrical Engineering

(Approved in 10th AC 09.06.2007) ITEM NO. FE 10.3(vii)

FE 1920 DISTRIBUTED ALGORITHMS 3 0 0 3

UNIT I SYNCHRONOUS NETWORK ALGORITHM

UNIT II ASYNCHRONOUS ALGORITHMS

UNIT III ASYNCHRONOUS NETWORK ALGORITHMS
Asynchronous Network Model, Basic Asynchronous Network Algorithms, Synchronizers, Shared Memory Vs Networks, Logical time.

UNIT IV RESOURCE ALLOCATION AND FAILURES

UNIT V PARTIALLY SYNCHRONOUS ALGORITHMS
Partially Synchronous System Models, Mutual Exclusion with Partial Synchrony, Consensus with Partial Synchrony.

TEXT BOOK:

REFERENCES:
UNIT I LEARNING AND SOFT COMPUTING

UNIT II GENERALIZATION AND OPTIMIZATION THEORY

UNIT III SUPPORT VECTOR MACHINE

UNIT IV KERNEL INDUCED FEATURE SPACE
Learning in Feature Space – The Implicit Mapping into Feature Space – Making Kernels Kernels and Gaussian Processes – PCA.

UNIT V APPLICATION OF SVM

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
1. T. Hastie, R. Tibshirani, Friedman, The Elements of Statistical Learning, Springer.
UNIT I

UNIT II
Enclosures for the range of function : Analysis of interval evaluation: inclusions algebras and recursive differentiation: The mean value form and other centered forms: interpolation forms.

UNIT III

UNIT IV

UNIT V

REFERENCES:
FE1923 LOSS ALLOCATION IN A Deregulated Power System 3 0 0 3

UNIT I INTRODUCTION TO Deregulated Power System 8

UNIT II BILATERAL TRANSACTION 8

UNIT III TRANSMISSION LOSS ALLOCATION & ECONOMIC POWER SYSTEM OPERATION 12

UNIT IV LOSS ALLOCATION IN BILATERAL MARKET 7

UNIT V LOSS ALLOCATION IN A COMBINED POWER POOL AND BILATERAL MARKET USING ANN 10

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

Faculty of Electrical Engineering (Approved in 11th AC 05.01.2008) ITEM NO. FE 11.04(2)

FE1924 INTRODUCTION TO NONLINEAR SYSTEMS 3 0 0 3

UNIT I INTRODUCTION TO NONLINEAR CONTROL 9
Nonlinear systems, Examples of nonlinear dynamics, Simple examples of nonlinear control, Basic notions of Euclidean and topological spaces, Illustrative examples.

UNIT II STABILITY OF NONLINEAR SYSTEMS 9

UNIT III DIFFERENTIABLE MANIFOLDS – LOCAL THEORY 9
Differentiability Classes, Tangent Vectors, Smooth Maps and Their Differentials – Diffeomorphisms, Applications in Control.

UNIT IV INTRODUCTION TO FEEDBACK LINEARIZATION 9
Smooth Vector Fields, Input – Output Linearization, Relative DegreeNormal Form Zero Dynamics, Control examples.

UNIT V CONTROLLABILITY OF NONLINEAR SYSTEMS 9
Definition of a distribution, Lie brackets, Involutive distributions, Accessibility Applications in Control.

TOTAL: 45 PERIODS

REFERENCES:
FE1925 SERVICE ORIENTED ARCHITECTURE

UNIT I SOA FUNDAMENTALS
Entities – characteristics – development – life cycle and design – verification and validation.

UNIT II WEB SERVICES

UNIT III STANDARDS AND DIFFERENT MODELS

UNIT IV JAVA IMPLEMENTATION STANDARDS AND TOOLS
Java Based distributed applications - JAXB – JAXRPC – JAX – JAXM – other distributed models (composition with web services) – RPC – CORBA – RMI – DCOM etc.

UNIT V APPLICATIONS AND PRACTICAL CONSIDERATIONS

TOTAL: 45 PERIODS

REFERENCES:

FE1926 MODELS AND MEASUREMENTS IN BIOMECHANICS

UNIT I INTRODUCTION TO BIOMECHANICS
Introduction to mechanics in medicine - stress, shear and strain, principal stresses and transformations, loading modes, shear rate, Newtonian and non-Newtonian laws - viscosity, viscoelasticity - biosolid and biofluid mechanics, composition and microstructure of blood vessels, mechanical properties of soft tissues.

UNIT II MATHEMATICAL MODELS IN BIOMECHANICS
Constitutive models and development of constitutive equations; pseudo elastic, randomly elastic, poroelastic and viscoelastic models, representation of the pseudo elastic stress – strain relationship, numerical models in biomechanics - generalized stochastic models.

UNIT III COMPUTATIONAL METHODS IN BIOMECHANICS
Models of structure and deformations, single layer and multi layer models, strain energy function - image based morphological modeling - measurement based physiological modeling - patient specific computational mechanical modeling.
UNIT IV        INSTRUMENTATION IN BIOMECHANICS
Ultrasound imaging technique in biomechanics; instrument design, application in blood vessel
structure and functions - MRI in biomechanics, 3D visualization - instrumentation in cardiovascular
biomechanics.

UNIT V        Experimental Biomechanics
Evaluation of structural and functional properties of bone - micro tensile tester for stress relaxation
test - experimental investigation on the dynamics of vessel and vessel wall.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. J. D. Humphrey, S.L. Delange, ‘An Introduction to Biomechanics, Solids and Fluids, Analysis and

REFERENCES:

Faculty of Electrical Engineering
(Approved in 11th AC 05.01.2008) ITEM NO. FE 11.04(5)

FE1927        MODEL PREDICTIVE CONTROL 3 0 0 3

UNIT I
Model Predictive Control - Introduction Model Predictive Control strategy – model predictive control
elements – prediction model process model – objective function – control law – state space
formulation.

UNIT II
Model predictive control schemesDynamic matrix control – model algorithmic control – predictive
functional control -Formulation of generalized model predictive control – closed loops relationships.

UNIT III
Non-linear model predictive controlNon-Linear model predictive control Vs Linear model predictive
control – Non-linear models – solution of non-linear model predictive control problem – techniques for
non-linear model predictive control – stability of non-linear model predictive control.
UNIT IV
Methods for implementing model predictive control Model predictive control and multiparametric programming – implementation of model predictive control for uncertain systems – closed loop min-max model predictive control implementation of model predictive control and dead time consideration.

UNIT V
Case Study Model predictive control on a chip – FPGA implementation of MPC – FPGA implementation of MPC for a petrochemical process.

REFERENCES:
FE1929 MODELLING AND SIMULATION OF WIND ENERGY CONVERSION SYSTEMS

UNIT I : Introduction 5
Components of WECS – Major WECS schemes – Power obtained from wind – simple momentum theory – Sabinin’s theory – with velocity components at blade element.

UNIT II : Wind turbines 10

UNIT III : Special Machines for WECS 10

UNIT IV : Modelling of PMSG 10
Traditional dq0 model – Embedded phase domain model for real time simulation –Model including magnetic saturation – Dynamic model including losses.

UNIT V : Grid Interconnection 10
Grid Interconnection Issues – Cost benefits – Grid side controllers – WECS in various countries – Simulation of PMSG based WEC.

REFERENCES
FE1930 DESIGN OF ELECTRICAL MACHINES – ELECTROMAGNATIC APPROACH

UNIT I INTRODUCTION

UNIT II METHODS OF FIELD COMPUTATION

UNIT III THERMAL ANALYSIS OF ELECTRICAL MACHINES

UNIT IV FEA OF SYNCHRONOUS MACHINE

UNIT V MODELING OF MACHINES

REFERENCES:
2. INTRODUCTION TO CUSTOM POWER DEVICES
   DSTATCOM Structure, DSTATCOM in Voltage control mode: State/ Output feed back control. DVR Structure: State/ Output Feed back Control. UPQC –Structure and Control of Right - Shunt /Left - Shunt UPQC.

3. SOLID STATE LIMITING, BREAKING AND TRANSFERRING DEVICES

4. MODELLING AND SIMULATION TECHNIQUES FOR HARMONIC FILTERS

5. NEURO-FUZZY CONTROLLER FOR STATCOM

TOTAL = 45PERIODS

TEXT BOOKS:

REFERENCES
FE 1932  
FAULT DIAGNOSIS IN ELECTRICAL MACHINES  
3 0 0 3

UNIT I
Technology trends in fault diagnosis of Electrical Machines - a) Transformers b) Electrical machines - State Estimation methods for Electrical Machines modeling Simulation studies of transients in Electrical Machines (PSPICE, MATLAB).

UNIT II
Occurrence of faults in transformer and machines due to aging - Types of faults in transformer – insulation breakdown-winding breakdown - Types of faults in Machines – insulation, winding and mechanical breakdown.

UNIT III
Condition monitoring of Electrical machines - Acoustic monitoring of Core - Vibrations in Transformers and Bearing Noise in Machines - Study of faults in Inverter-fed Machines.

UNIT IV
Fourier transform and Wavelet Transforms for fault diagnosis - Model based prediction theory applied to fault detection in Electrical Machines - Discrete Event Systems approach for fault detection - Markov models for Fault diagnosis.

UNIT V
Behavior-Modulation Techniques for fault detection - Pattern Recognition applied to fault detection - Application of Artificial Intelligence tools like Fuzzy Logic, Neural Networks for fault diagnosis in Electrical Machines.

TOTAL: 45 PERIODS

REFERENCES:
FE 1933  OPTIMIZATION TECHNIQUES FOR POWER SYSTEM RESTORATION  3 0 0 3

1. **INTRODUCTION** 06
Necessity of optimization in power system, Types of optimization problem, Unconstrained problems, Constrained problems.

2. **UNCONSTRAINED OPTIMIZATION TECHNIQUES** 10

3. **CONSTRAINED OPTIMIZATION TECHNIQUES** 10

4. **NON LINEAR AND DYNAMIC PROGRAMMING** 10

5. **CASE STUDY** 09
Application of optimization techniques to power system restoration C.P.M and P.E.R.T for Project scheduling

**TOTAL : 45 PERIODS**

**TEXT BOOKS**

**REFERENCES**
ITEM NO. FE 13.01(1)

FE1934 MODELLING AND SIMULATION OF DVR AND ITS CONTROLLERS  L T P C  3 0 0 3

UNIT I INTRODUCTION
Introduction to power quality – Overview of power quality phenomena – voltage sags – Characterization, Equipment behavior – Mitigation of voltage sags.

UNIT II ANALYSIS OF INVERTER

UNIT III DYNAMIC VOLTAGE RESTORER

UNIT IV DVR CONTROLLERS

UNIT V APPLICATIONS OF DVR
Mitigation of voltage sags – Mitigation of voltage swells – Reduction of voltage harmonics – Minimum active power injection – Simulations with commercial software packages.

TOTAL: 45 PERIODS

REFERENCES:
UNIT I  POWER HARMONICS & LINE COMMUTATED RECTIFIERS  9
Average power RMS value of a waveform – Power factor-AC line current harmonic standards  IEC 1000-IEEE 519. The Single phase full wave rectifier-Continuous Conduction Mode-Discontinuous Conduction Mode-Behaviour when C is large-Minimizing THD when C is small. Three phase rectifiers – Continuous Conduction Mode- Discontinuous Conduction Mode- Harmonic trap filters.

UNIT II  PULSE WIDTH MODULATED RECTIFIERS  9

UNIT III  RESONANT CONVERTERS  9

UNIT IV  DYNAMIC ANALYSIS OF SWITCHING CONVERTERS  9
Review of linear system analysis-State Space Averaging-Basic State Space Average Model – State Space Averaged model for an ideal Buck Converter, ideal Boost Converter, ideal Buck Boost Converter, for an ideal Cuk Converter.

UNIT V  CONTROL OF RESONANT CONVERTERS  9
Pulse Width Modulation – Voltage Mode PWM Scheme- Current Mode PWM Scheme – Design of Controllers: PI Controller, Variable Structure Controller, Optional Controller for the source current shaping of PWM rectifiers.

TOTAL: 45 PERIODS

REFERENCES:
2. William Shepherd and Li zhang “ Power Converters Circuits” Marceled Ekkerin,C.
3. Simon Ang and Alejandro Oliva “Power Switching Converters” Taylor & Francis group
UNIT I DC-DC CONVERTERS AND SMPS

UNIT II CONTROL TECHNIQUES
Industrial PWM driver chips for power supplies such as UC3843,3825 or equivalent- voltage mode control – current mode control- one step control – SMC controller.

UNIT III EMI IN POWER ELECTRONIC EQUIPMENT
EMI from power semiconductors – EMI from controlled Rectifier circuits – EMI calculation for semiconductor Equipments – Predicting EMI from a power supply with Rectifiers – EMI Prediction and design of filters- EMI Prediction for switching power supplies.

UNIT IV SPREAD SPECTRUM TECHNIQUE

UNIT V APPLICATION
Application of frequency hop spread spectrum technique into Buck converter through simulation.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Simon.S.Ang, Alexandro Oliver, “Power-Switching converters”, Taylor and Francis

REFERENCES:
FE1937 MODELLING AND CONTROL OF HYBRID SYSTEMS

UNIT I HYBRID SYSTEMS AND THEIR REPRESENTATION
Hybrid dynamical system structure – Hybrid P phenomen – Classification of Hybrid System models – Hybrid automata – Example of Hybrid systems: Thermostat control, Water level control, Two tank system.

UNIT II MODELING OF HYBRUID SYSTEMS (Conventional approach)

UNIT III MODELLING USING PETRINET

UNIT IV TOOLS FOR MODELLING HYBRID SYSTEMS

UNIT V CONTROL OF HYBRID SYSTEMS

TOTAL: 45 PERIODS

TEXT BOOKS:
3. “Modelling and control of Hybrid systems” Lecture notes
FE1938  DESIGN AND CONTROL OF SWITCHED RELUCTANCE MACHINE FOR AUTOMOTIVE APPLICATIONS  L T P C  3 0 0 3

UNIT I  DESIGN OF SWITCHED RELUCTANCE MACHINE  09

UNIT II  CONVERTERS FOR SWITCHED RELUCTANCE MACHINE DRIVES  09
Converter configurations – asymmetric bridge converter – single switch per phase converter – (q+1) switch and diode configurations – C-dump converter – design procedure – two – stage power converter.

UNIT III  CONTROL OF SWITCHED RELUCTANCE MACHINE DRIVES  09

UNIT IV  FEA OF SWITCHED RELUCTANCE MACHINE MOTORS  09

UNIT V  NOISE AND VIBRATION OF SWITCHED RELUCTANCE MACHINE  09

TOTAL: 45 PERIODS

TEXT BOOKS:
UNIT III  OPEN LOOP & CLOSED LOOP CONTROLLER OF STEPPING MOTOR  9
Drive system – Logic sequencers – Motor driver – Input controller – Acceleration and deceleration by a Microprocessor Limitations of open-loop operation and need for closed loop operation – The concept of lead angle – A closed-loop operation system using a microprocessor – Direct-drive servomotor - Development of integrated circuits for closed-loop operation – Switched reluctance drive – Use of current waveforms as a position sensor.

UNIT IV  CONVERTERS  9
Control of Stepping motor using Converter, Inverter, Chopper - Implementation of PWM techniques

UNIT V  CASE STUDY  9
Application of stepping motors in Robotics

REFERENCES :
2. IEEE papers

TOTAL: 45 PERIODS

Faculty of Electrical Engineering (Approved in 14th AC 29.08.2009) ITEM NO. VC 14.08-III(3)

FE1940  PRINCIPLES, DESIGN AND FABRICATION OF MEMS DEVICES  3 0 0 3

UNIT I  FUNDAMENTALS OF MEMS DEVICES  9

UNIT II  BIO-MEMS: SENSORS AND ACTUATORS  9

UNIT III  PRESSURE, VIBRATION AND TEMPERATURE SENSORS  9

UNIT IV  DESIGN, FABRICATION AND PACKAGING OF MEMS DEVICES  9
Fabrication of cantilever beams- Modeling of micro-electro mechanical systems - Micro pump applications in BIOMEMS – Packaging

UNIT V  BIO-MEMS APPLICATIONS  9
Lab on a chip based on BIO-MEMS - System on a chip model of a micro pump – MEMS piezoresistive pressure sensor for biomedical applications - MEMS viscometric sensor for continuous glucose monitoring.

TOTAL: 45 PERIODS

REFERENCES :

Faculty of Electrical Engineering

(Approved in 14th AC 29.08.2009) ITEM NO. VC 14.08-III(4)

FE1941 ANALYSIS AND CONTROL OF SPECIAL MACHINES 3 0 0 3

UNIT I SWITCHED RELUCTANCE MOTOR (9)

UNIT II CONVERTERS (9)
Converters for SRM drives – Asymmetric bridge converters – Single switch per phase – Two phase power converters- Resonant converter circuits.

UNIT III CONTROL STRATEG (9)
Control of SRM drive – Closed loop speed controlled SRM – Design of current controller flux linkage controller Torque control and speed control – Modeling of SRM noise control in SRM

UNIT IV STEPPER MOTORS (9)

UNIT V DRIVE SYSTEM (9)
Drive system and circuitry for open loop control system – Driver system – Logic sequence motor drive input controller – Closed loop control of stepping motor – Concept of lead angle – Closed loop operation system – Direct drive servo motor – Switched reluctance drive.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
FE1942 INTELLIGENT CONTROL APPLICATIONS TO BLDC MOTORS 3 0 0 3

UNIT I GENETIC ALGORITHM 9
Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm.

UNIT II ARTIFICIAL NEURAL NETWORKS 9
Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller

UNIT III FUZZY LOGIC SYSTEM 9
Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Stability analysis of fuzzy control systems.

UNIT IV PERMANENT MAGNET BRUSHLESS DC MOTORS 9
Commutation in DC motors. Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives - Torque and emf equation, Torque-speed characteristics - Mathematical Model Controller design.

UNIT V APPLICATIONS TO MOTION CONTROL 9
GA application to motor control optimisation problem, Identification and control of linear and nonlinear dynamic systems using Neural Network. Implementation of fuzzy logic controller for DC motor speed control.

TOTAL: 45 PERIODS

REFERENCES:
UNIT I  
HVDC OPTIONS  
Developments in line commutated High Voltage Direct Current Schemes (HVDC) schemes – STATic COMpensator (STATCOM) aided DC transmission – comparison of Line Commutated Converter (LCC) link and Voltage Source Converter (VSC) link – frequency cross modulation across LCC.

UNIT II  
TOPOLOGIES FOR DC TRANSMISSION  

UNIT III  
VSC HVDC FOR WIND POWER EVACUATION  

UNIT IV  
HYBRID SCHEMES  
Basic Current Source Converter (CSC) operation – modulated tripole DC transmission – hybrid VSC and CSC transmission – hybrid VSC and LSC transmission – power transfer characteristics - current relationships – harmonics – comparison of various multilevel topologies.

UNIT V  
MODELLING AND SIMULATION  

REFERENCES:

Faculty of Electrical Engineering

ITEM NO. FE 15.02(1)

FE 9001 ADVANCED OPTIMAL CONTROL 3 0 0 3

1. THE CALCULUS OF VARIATIONS

2. DYNAMIC PROGRAMMING

3. THE MINIMUM (MAXIMUM) PRINCIPLE

4. OPTIMAL CONTROL SYSTEM DESIGN
LQR design method, kalman filter technique, LQG design method. Robust optimal control system design using loop transfer recovery technique. Implementation of optimal controller and its related issues.

5. ON-LINE OPTIMIZATION AND CONTROL
Model based predictive controllers, MPC elements-prediction model, objective function, control law. DMC, algorithmic control, predictive functional control, generalized predictive control. Simple implementation of GPC for industrial process.

TOTAL : 45 PERIODS

REFERENCES:
FE9002 INSULATION CO-ORDINATION OF GAS INSULATED SYSTEMS 3 0 0 3

1. SOURCES OF VERY FAST TRANSIENT OVERVOLTAGES
Type of over voltage stresses imposed on Gas Insulated substations (GIS) - Temporary over voltages, lightning over voltages, switching over voltages - Principle of over voltage propagation in GIS - Origin and severity of over voltages entering the GIS.

2. GAS INSULATED SUBSTATIONS

3. FACTORS AFFECTING INSULATION STRENGTH AND ON-SITE TESTING

4. EFFECT OF VFTO ON POWER APPARATUS
Withstand strength of GIS and on switchgear, transformers, surge arresters -Influence of substation and line parameters - interaction between line parameters on over voltages stressing GIS insulation – Equipment insulation -Different means to limit the over voltages.

5. INSULATION CO-ORDINATION
Insulation Co-ordination of GIS using Surge Arresters- Selection and location - Conventional method based on specified Incoming over voltages - Probabilistic Method - Economical aspects of insulation level.

REFERENCES:
### FE 9003  
**STATISTICAL TECHNIQUES FOR HIGH VOLTAGE ENGINEERING**  
3 0 0 3

1. **REVIEW OF FUNDAMENTALS**  
   9  

2. **STOCHASTIC NATURE OF BREAKDOWN**  
   9  
   Statistical features of breakdown - Weibull Distribution and other statistical distributions - Effect of voltage and time on the failure statistics

3. **STOCHASTIC MODELS OF BREAKDOWN**  
   9  
   Statistical and physical connections - Fluctuation model - Fractal description of breakdown - Cumulative defect models of breakdown - Differences and similarities in model statistics

4. **TEST METHODS**  
   9  
   Distribution Tests - Graphical Methods, Mathematical methods - F test - Double-t test - U test - Test of independence of realizations - laboratory tests - constant stress test, progressive test tests, effect of voltage on lifetime

5. **STATISTICAL DESCRIPTION OF INSULATION CAPACITY**  
   9  
   Choice of Variate - Air, Compressed-gas, Liquid and Solid insulation - uniform and Non Uniform insulation - Statistics of partial discharges

**TOTAL: 45 PERIODS**

**REFERENCES:**

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### FE 9004  
**ENERGY EFFICIENT ILLUMINATION**  
3 0 0 3

**GREEN ENGINEERING: CHOICE OF LIGHTING TECHNOLOGIES**  
9  

**TRANSITION TO SOLID STATE LIGHTING**  
9  

**RETROFIT ECONOMICS**  
9

LUMINAIRE FIXTURE

LIGHT FITTINGS
Focusing Lours for flood lighting-Shielding angle- Cut-off angle- Barn doors- colour filters- Light Distribution- Symmetric- and Asymmetric- Diffused and Focussed- Direct and Indirect Beam spread classification- Batwing light distribution

REFERENCES:
1. Craig Delouse-"The Lighting Management Hand Book"- The FAIRMONT PRESS.
3. A.R. Bean and R. H. Simons-“Lighting Fittings”.

Faculty of Electrical Engineering (Approved in 15th AC 13.02.2010) ITEM NO. FE 15.02(5)

FE 9005 ROBUST CONTROL AND SLIDING MODE CONTROL 3 0 0 3

1. INTRODUCTION TO ROBUST CONTROL AND H∞ NORM

2. PARAMETRIZATION AND ROBUST STABILIZATION

3. H2 AND H∞ OPTIMIZATION

4. INTRODUCTION TO SMC, PASSIVITY AND FLATNESS
Dynamics in the sliding mode – linear system, non-linear system, chattering phenomenon – sliding mode control design – reachability condition, robustness properties – application to boost dc-dc
converters- flatness, passivity properties through flatness, non - minimum phase output stabilization, trajectory planning.

5. STABILITY AND STABILIZATION


REFERENCES:

Faculty of Electrical Engineering

FE9006 FOOD PRESERVATION TECHNIQUES

1. DRYING & THERMAL PROCESSING
Recent developments in drying including spray drying, freeze drying, foam mat drying and other newer drying processes; newer methods of concentration and evaporation; freeze concentration design aspects; membrane filtration for recovery of low concentration products; applications of ultra-filtration and reverse osmosis.
Use of electric current for thermal processing of foods; relationship of conductance and heating of foods; Ohmic heating: principle & applications.

2. NON-THERMAL METHODS
Chemical preservatives - Food additives, functional chemical additives applications. Chemical preservatives and antibiotics; Preservation by ionizing radiations- technology aspects of the radiations, pasteurization of foods; public health aspects, microbiology of irradiated foods; Ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology. Hurdle technology.

3. RADIATION PROCESSING
Generation of irradiation by different techniques including gamma rays and electron acceleration; Safety and effect of radiation doses; Radiation processing of cereals & grains, meat, fish & poultry products, spices & herbs etc. Control of ripening of fruits by irradiation; Infra-red heating: interaction of infra-red (IR) radiation with penetration properties, equipment; dairy and food application, advantages and disadvantages of IR heating.

4. PULSED ELECTRIC FIELDS
Introduction-definitions, descriptions and applications-mechanisms of microbial in-activations-electrical breakdown-electroporation-inactivation models -Critical factors-analysis of process, product and microbial factors-pulse generators and treatment chamber design-Research needs.
5. APPLICATION OF PEF TECHNOLOGY IN FOOD PRESERVATION

Processing of juices, milk, egg, meat and fish products- Processing of water and waste. Industrial feasibility, cost and efficiency analysis.

TOTAL: 45 PERIODS

TEXT BOOKS
2. Gopala Rao, Chandra “Essentials of Food Processing Engineering”, BS

REFERENCES:

Faculty of Electrical Engineering
(Approved in 15th AC 13.02.2010) ITEM NO. FE 15.02(7)

FE9007 WEB BASED EMBEDDED SYSTEMS 3 0 0 3

1. EMBEDDED SYSTEMS


2. EMBEDDED NETWORKING


3. ROUTING METHODOLOGIES


4. WEB BASED CLIENT- SERVER COMMUNICATION


5. CASE STUDIES


TOTAL: 45 PERIODS

43
REFERENCES:
3. Designing embedded Internet devices by Dan Eisen Reich, Brian DeMuth
4. Embedded networking with CAN and CAN open by Copperhill Technologies Corporation’ Olay Pfeiffer, Andrew Ayre, Christian Keydel
5. A methodology for client/server and web application development by Roger Fournier
6. The Internet directory by Eric Eugene Braun.

Faculty of Electrical Engineering  
(Approved in 15th AC 13.02.2010) ITEM NO. FE 15.02(8)

FE9008  ADVANCED PID CONTROL  3 0 0 3

1. INTRODUCTION  9
Feedback fundamentals, PID controller-Two degree freedom controller- Issues related to implementation- integral windup. Stability, sensitivity functions, robustness to process variations, requirements and specifications.

2. PID STABILIZATION  9
PI, PID stabilization – characterization and computation.

3. PID CONTROLLER DESIGN  9
ZN & related methods, rule based empirical tuning, pole placement, lambda tuning, algebraic design, optimization methods, robust loop shaping, and frequency response methods. IMC based PID tuning. Design for disturbance rejection.

4. ROBUST PERFORMANCE AND PERFORMANCE ASSESSMENT  9

5. ADAPTIVE PID CONTROL  9
Autotuning, Adaptive Technique-model based methods-rule based methods, Multimodel based PID Controller design, nonlinear PID Controller design.

TOTAL: 45 PERIODS

REFERENCES:

Faculty of Electrical Engineering  
(Approved in 15th AC 13.02.2010) ITEM NO. FE 15.02(9)

FE9009  CONTROL OF POWER CONVERTER  3 0 0 3

UNIT I  REVIEW OF SWITCH-MODE DC –DC CONVERTERS  9
UNIT II  STATE -SPACE AVERAGED MODEL

UNIT III  SLIDING MODE CONTROL AND HYSTERIS CONTROL

UNIT IV  FUZZY LOGIC CONTROL

UNIT V  STABILITY ANALYSIS OF POWER CONVERTERS

TOTAL: 45 PERIODS

REFERENCES:
UNIT V 
CASE STUDY
Study of Commercial RTOS, Case Studies of Programming with RTOS.

TOTAL: 45 PERIODS

REFERENCES:

Faculty of Electrical Engineering
(Approved in 15th AC 13.02.2010) ITEM NO. FE15.02(11)

FE9011 INTelligent controller for robotics

1. ARM ARCHITECTURE AND PROGRAMMING 12

2. TRANSPORT AND APPLICATION LAYERS 9

3. ONE DIMENSIONAL RANDOM VARIABLES 12

4. COMMUNICATION WITH BUSES FOR DEVICES NETWORKS 12
   I/O devices: timer and counting devices, serial communication using I2C, CAN, USB, Buses: communication using profi bus, field bus, arm bus, interfacing with devices/ serial port and parallel ports, device drivers.

5. ARM APPLICATION DEVELOPMENT 15

REFERENCES:
1. Steve Furber, ‘ARM system on chip architecture’, Addison Wesley
5. Siva Ramamurthy and B.B. Manoj, ‘Ad Hoc wireless network Architectures and protocols’

Faculty of Electrical Engineering
(Approved in 15th AC 13.02.2010)

ITEM NO. FE 15.02(12)

FE9012 EXPERIMENTAL STRESS ANALYSIS TECHNIQUES 3003

UNIT 1 Normal stress, Normal strain, Poisson’s ratio, Young’s Modulus, Shear Strain, Shear stress, Shear modulus, Stress-strain diagram for various materials, Principal planes, Stress strain Transformation for different cases, Mohr’s circle, Beam bending, Shear force and bending moment diagrams, Deflection of beams, Thermal stresses, Stress tensor, Strain tensor, Compatibility conditions, Plane stress, Plane strain, Bi-harmonic equation, Airy’s stress function.

UNIT 2 Electrical properties of the strain gauges, Strain sensitivity, Materials used for strain gauges, Carrier materials, Adhesive materials, Bonding procedure, Different configuration of strain gauges, Study of change in resistance with strain for various strain gauge materials, Gauge factor, Cross sensitivity factor, Response of a strain gauge.


UNIT 4 Wheatstone bridge circuit, Balancing, Sensitivity of circuit, Temperature compensation, measuring strain in beams and bar, Effect of resistance ratio, Power calculation, Advantages of Wheatstone bridge circuit, Total strain measurements, Static and Dynamic strain measurements, Full bridge circuit, Half bridge circuit, Quarter bridge circuit.

UNIT 5 Calibration of strain measuring circuits, Rosettes, Rectangular rosettes, Delta rosettes, T- rosettes, Stress gauges, Applications of strain gauges and stress gauges.

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
Faculty of Electrical Engineering

(Approved in 15th AC 13.02.2010) ITEM NO. FE 15.02(13)

FE9013 FINITE ELEMENT ANALYSIS OF BOUNDARY VALUE PROBLEMS 3 0 0 3

UNIT 1
Revision of analytical methods for solving ordinary differential equations: variable separable method, Bernoulli’s method; initial conditions and boundary conditions, finite difference methods, understanding the difference between numerical methods and classical methods, polynomial type approximate solutions and trigonometric type approximate solutions, essential boundary conditions, natural boundary conditions, domain residue, boundary residue, classification of classical methods.

UNIT 2
Weighted residual methods: Least square method, collocation methods, sub domain method, method of moments, Galerkin method, and modified Galerkin method.
Variational method: Elementary study on calculus of variation, and Rayleigh Ritz method.

UNIT 3
Different coordinate systems: Global coordinate system, local coordinate system, natural coordinate system. Interpolation functions for linear and quadratic elements, h-approximation, p-approximation, solving boundary value problems using classical methods with different elements (linear elements and quadratic elements), solving boundary value problems in different coordinate systems, element stiffness matrix, element load vector, global stiffness matrix, global load vector, reduced stiffness matrix, Gauss elimination procedure.

UNIT 4
Study of one dimensional structural mechanics problems: bar, truss, beam, column. Study of one dimensional potential problems: heat transfer, fluid flow, current flow. Different 2-d elements, Lagrangian Interpolation, shape functions for 2-d elements, iso-parametric, sub-parametric, super-parametric elements, Serendipity elements, Jacobian, EICJ and EILJ, constant strain triangle elements, linear strain triangle elements, Two dimensional boundary value problems.

UNIT 5
Numerical Integration, Gaussian Integration (one point, two points, three points), Finite element analysis on: time dependent, Eigen value and initial value problems convergence criteria, Banded symmetric matrix, Finite Element analysis software.

TOTAL: 45 PERIODS

TEXT BOOKS
2. Concepts and Applications of Finite Element Analysis, by Robert Davis Cook (Editor), David S. Malkus, Michael E. Plesha, Robert Davis
3. Concepts and Applications of Finite Element Analysis Cook (Editor), Robert Davis Cook (Editor), Robert D. Cook, Robert J. Witt. Hardcover, John Wiley & Sons Inc (October 2001)

REFERENCES:
1. Introduction to Finite Elements in Engineering, by Tirupathi R. Chandrupatla, Ashok D. Belegundu, Other, Prentice Hall (March 2002).
FE9014 ADAPTIVE CONTROL AND RELAY FEEDBACK L T P C 3 0 0 3

1. ADAPTIVE CONTROL AND REALTIME PARAMETER ESTIMATION

2. DETERMINISTIC, STOCHASTIC AND PREDICTIVE SELF TUNING REGULATOR

3. MRAC ADAPTIVE SYSTEM

4. DESCRIBING FUNCTION AND STATE SPACE BASED PROCESS IDENTIFICATION

5. ONLINE TUNING AND GAIN SCHEDULING
   Online tuning of controllers – Model based and model free tuning – Principle and design of gain scheduling controllers – Nonlinear transformations – Applications of gain scheduling – Robust high gain feedback control – Self oscillating adaptive systems.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Astrom and Wittenmark, “Adaptive Control”, PHI.

REFERENCES
UNIT II HARMONIC ANALYSIS

UNIT III FLICKER ANALYSIS
Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects-Summary.

UNIT IV ELECTRICITY PRICING - VOLATILITY, RISK AND FORECASTING

UNIT V SUPPORT VECTOR MACHINES
Introduction – An overview – Classification – Pattern Classification - Linear Support Vector Machines – Non Linear Support Vector Machines.

TOTAL: 45 PERIODS

TEXT BOOKS
2. Astrom and Wittenmark,” Adaptive Control”, PHI

REFERENCES :
3. William S. Levine, “Control Hand Book”.
5. “Support vector machines “Steinwart, Ingo; Christmann, Andreas.
51


UNIT III  OPTIMUM ROTOR DESIGN FOR MAXIMUM EFFICIENCY  

UNIT IV  PERFORMANCE SIMULATION STUDIES OF RADIAL FLUX PMSG  
Performance characteristics of radial flux PMSG using MAGNET software - Comparison of performance characteristics of various configurations - Saturation characteristics - Flux distribution – Losses – Thermal equivalent circuit[5] - Case Study for 1 MW machine

UNIT V  TESTING, COMMISSIONING AND COMPARISON OF TEST RESULTS WITH SIMULATION RESULTS  
Acceptance test - Performance test - Parameter test under steady state – Sub-transient and transient parameter test - Standstill frequency response tests - Comparison of test results with simulation results[5] – Case Study for 1 MW machine

TOTAL: 45 PERIODS

REFERENCES:

Faculty of Electrical Engineering  (Approved in 16th AC (Ad hoc) 02.12.2010) ITEM NO. FE 16.02(1)

FE 9017  MODELING AND SIMULATION OF SOLAR ENERGY SYSTEMS  L T P C 3 0 0 3

UNIT I  SOLAR RADIATION AND COLLECTORS  

UNIT II  APPLICATIONS OF SOLAR THERMAL TECHNOLOGY  

51

**UNIT II**
**SOLAR PV FUNDAMENTALS**


**UNIT IV**
**SOLAR PHOTOVOLTAIC SYSTEM DESIGN AND APPLICATIONS**

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - use of computers in array design - quick sizing method - array protection and trouble shooting - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

**UNIT V**
**SOLAR PASSIVE ARCHITECTURE**


**TEXT BOOKS:**


**REFERENCES:**

FE9018  SLIDING MODE AND ADAPTIVE CONTROL  L T P C
UNIT I  INTRODUCTION TO SMC, PASSIVITY AND FLATNESS  9
Dynamics in the sliding mode – linear system, non-linear system, chattering phenomenon – sliding mode control design – reachability condition, robustness properties – application – flatness, passivity properties through flatness, non-minimum phase output stabilization, trajectory planning.

UNIT II  STABILITY AND STABILIZATION  9

UNIT III  DETERMINISTIC, STOCHASTIC AND PREDICTIVE SELF TUNING REGULATOR  9

UNIT IV  DESCRIBING FUNCTION AND STATE SPACE BASED PROCESS IDENTIFICATION  9

UNIT V  ONLINE TUNING AND GAIN SCHEDULING  9
Online tuning of controllers – Model based and model free tuning – Principle and design of gain scheduling controllers – Nonlinear transformations – Applications of gain scheduling – Robust high gain feedback control – Self oscillating adaptive systems.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Astrom and Wittenmark,” Adaptive Control “, PHI.

REFERENCES

Faculty of Electrical Engineering  (Approved in 16th AC (Ad hoc) 02.12.2010) ITEM NO. FE 16.02(3)

FE9019  NETWORKING WIRELESS SENSORS  L T P C
UNIT I  INTRODUCTION  8

UNIT II  LOCALIZATION AND TIME SYNCHRONIZATION  10
Localization – Overview – Coarse grained node localization using minimal information – Fine grained node localization using detailed information – Network-wide localization – Theoretical analysis of
localization techniques – Time synchronization – Overview – key issues – Fine grained clock synchronization – Coarse grained clock synchronization

UNIT III MEDIUM ACCESS WITH SLEEP SCHEDULING 9
MAC protocols - Overview – Traditional MAC protocols – Energy efficiency in MAC protocols – Asynchronous sleep techniques – Sleep scheduled techniques – Contention free protocols – Sleep based topology control – Constructing topology for connectivity – Constructing topologies for coverage – Set K cover algorithms – Cross layer Issues

UNIT IV ROUTING & DATA CENTRIC NETWORKING 9

UNIT V CASE STUDIES 9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES:
2. MOHAMMAD ILYAS AND IMAD MAHGOUB, ‘Handbook of sensor Networks: Compact wireless and wired sensing systems’, CRC Press, 2005
UNIT III NUCLEAR TECHNOLOGY AND AGEING


UNIT IV GAMMA RAY IRRADIATION EFFECTS ON POLYMERS

Study of gamma ray irradiation inhibiting surface charge accumulation on polymers-Nuclear technology and ageing studies—Analysis of electrical and mechanical properties of polymers and their blends.

UNIT V ELECTRON BEAM IRRADIATION ON POLYMERS

Study of di-electric and mechanical properties of electron beam irradiated polymer insulation materials-Study of electron beam irradiation effects on morphologic properties of the PET/PP/PE/EVA polymeric blends.

REFERENCES:


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**Faculty of Electrical Engineering**

(Approved in 16\(^{th}\) AC (Ad hoc) 02.12.2010) **ITEM NO. FE 16.02(5)**

<table>
<thead>
<tr>
<th>FE9021</th>
<th>BIFURCATION ANALYSIS OF POWER SYSTEMS</th>
<th>L T P C</th>
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**UNIT I**  
**INTRODUCTION TO BIFURCATION [1]**
Introduction to bifurcation, Types of bifurcation SNB, HB, CFB, PDB, SIB, Torous and Intermittency. Mathematical background - Differential Equations (qualitative theory)- Differential-Algebraic systems- Multiple-time scales.

**UNIT II**  
**MODELING OF POWER SYSTEM COMPONENTS FOR BIFURCATION ANALYSIS [3,4]**
Modeling of Synchronous Generators (Type 0, 1B, 1A, 2B, 2A), excitation systems, transformer, transmission line, PSS, LTC, and FACTS Controllers- Different types of wind turbine generators SCIG, DFIG and PMSG - Modeling of Grid integrated solar conversion system and other Grid integrated Renewable energy sources.

**UNIT III**  
**METHODS AND TOOLS FOR BIFURCATION ANALYSIS OF NON-AUTONOMOUS SYSTEM [1, 2, 4]**
Algorithm for tracing local and global bifurcation diagrams for ODE systems with single variations. Bifurcation diagrams: time response plot, Phase plane and Poincare maps.

**UNIT IV**  
**METHODS AND TOOLS FOR BIFURCATION ANALYSIS OF AUTONOMOUS SYSTEM [1, 2, 4]**
Algorithm for tracing local and global bifurcation diagrams for ODE and DAE systems with single and multi-parameter variations- Bifurcation diagrams: time response plot, Phase plane and Poincare maps. PB Theorems.

**UNIT V**  
**CASE STUDY [2,4,5,6,7]**
Simulation of the single parameter Bifurcation diagram: ODE and DAE power systems - Analysis with the use of simulation software packages - coding for the sample power system.

L= 45 T =15  TOTAL = 60 PERIODS

**REFERENCES**

Faculty of Electrical Engineering

(Approved in 16th AC (Ad hoc) 02.12.2010) ITEM NO. FE 16.02(6)

FE9022 POWER QUALITY ANALYSIS FOR GRID INTEGRATED RENEWABLE ENERGY L T P C 3 0 0 3

UNIT I RENEWABLE ENERGY 9

UNIT II ENERGY STORAGE SYSTEMS 9

UNIT III GRID INTEGRATION OF RENEWABLE ENERGY 9
Renewable Power and Grid Stability - Connection and Operational Requirements (Grid Codes) - Integration in Existing Grid / Barriers - Decentralized Generation / Future Integration - Advanced Renewable Energy Technology Solutions for Grid Integration

UNIT IV POWER QUALITY ISSUES 9

UNIT V MITIGATION TECHNOLOGIES 9

L: 45+T:15 = 60 PERIODS

REFERENCES:

Faculty of Electrical Engineering

(Approved in 16th AC (Ad hoc) 02.12.2010) ITEM NO. FE 16.02(7)

FE9023 OPTIMIZATION TECHNIQUES IN DESIGN L T P C 3 0 0 3

UNIT I INTRODUCTION 5
Problem formulation, degree of freedom analysis, objective functions, constraints and feasible region, Types of optimization problem.

UNIT II UNCONSTRAINED OPTIMIZATION TECHNIQUES 10

57
Introduction to optimum design - General principles of optimization – Problem formulation & their classifications - Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods.

UNIT III CONSTRAINED OPTIMIZATION TECHNIQUES 10
Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - Geometric programming

UNIT IV MULTI OBJECTIVE OPTIMIZATION 10
Weighted Sum of Squares method, Epsilon constrains method, Goal attainment Examples.
Introduction to optimal control and dynamic optimization

UNIT V ADVANCED OPTIMIZATION TECHNIQUES 10
Multi stage optimization – dynamic programming; stochastic programming; Multi objective optimization, Genetic algorithms and Simulated Annealing techniques; Neural network & Fuzzy logic principles in optimization.

REFERENCES:

Faculty of Electrical Engineering
(Approved in 16th AC (Ad hoc) 02.12.2010) ITEM NO. FE 16.02(8)

FE9024 MATRIX CONVERTERS L T P C 3 0 0 3

UNIT I AC – AC CONVERTERS 9
Introduction-AC-AC Voltage Controllers,Cycloconverters – single phase ,three phase,Control scheme,Cycloconverter harmonics & I/P current, Power quality Issues, Forced commutated cycloconverter,Matrix Converter.

UNIT II MATRIX CONVERTERS 9
Basic circuit, Bidirectional switches, single phase, three phase, mathematical modelling ,Switching algorithm,Commutation methods, I/P filter and O/P filter, Unbalanced supply and Load conditions.

UNIT III MODULATION TECHNIQUES 9
Operation and modulation techniques of Matrix Converter-Venturini – Modified Venturini -, SVPWM-Indirect Transfer function - scalar modulation algorithm, protection Issues. Power regulation – Control of reactive power.

UNIT IV CONTROLLER DESIGN & APPLICATIONS 9
PID controller, Neuro controller,Fuzzy controller,Neuro fuzzy ,PR controller.
Applications – For Induction motor drives,Hybrid vehicle applications,Frequency changing power supply applications,aircraft applications,Renewable Energy applications.

UNIT V MATRIX CONVERTER FOR WIND ENERGY CONVERSION SYSTEMS 9
Introduction ,Advantages of MC applied to Wind Energy Conversion Systems(WECS),Comparison of WECS technologies,Modelling and simulation of wind energy systems with matrix converters – PMSG wind turbine system,DFIG wind turbine system,SCIG wind turbine system.
REFERENCES:
2. S.N.Bhadra "WIND ELECTRICAL SYSTEMS", Oxford University Press, 2005
UNIT V  EXPERIMENTAL TECHNIQUES
Low temperature resistivity measurements; Four probe and Vander Paw resistivity technique, AC and DC susceptibility measurements, SQUID measurements, Different types of cryostat, Closed cycle refrigerators system.

TOTAL: 45 PERIODS

TEXT BOOKS:
2. Preliminary investigation of small scale superconducting magnetic energy storage (SMES) systems by J. Schwartz, Publisher: US Army Corps of Engineers, Construction Engineering Research Laboratories National Technical Information Service, distributor

REFERENCES:

Faculty of Electrical Engineering
(Approved in 17th AC (Ad hoc) 27.04.2012) ITEM NO. FE 17.02(1)

FE 9026 STABILITY ANALYSIS OF GRID INTEGRATED WIND ENERGY CONVERSION SYSTEM L T P C 3 0 0 3

UNIT I  INTRODUCTION
Classification of Stability-Types of WECS- Fixed speed wind generator -Variable speed wind generator - FACTS- Basic concepts- Static Var Compensator (SVC), Static Synchronous Compensator (STATCOM), Thyristor Switched Series capacitor (TCSC), Static Series Synchronous Compensator (SSSC) and Unified power flow controller (UPFC).

UNIT II  MODELLING OF WIND FARMS FOR LOAD FLOW ANALYSIS
Aggregated modelling of wind farms for load flow analysis-Different types of aggregation-Simulation.

UNIT III  MODELLING OF WECS AND FACTS FOR STABILITY
Modelling of synchronous generators (Type 0, 1B, 1A)-Modelling of Wind turbine, Squirrel cage Induction generator (SCIG), Doubly Fed Induction Generator (DFIG) –Introduction to vector control-Modelling of SVC, STATCOM-TCSC.

UNIT IV  SMALL SIGNAL STABILITY ANALYSIS

UNIT V  TRASIENT STABILITY ANALYSIS

TOTAL: 45 PERIODS

REFERENCES :
7. Modeling of Wind
8. Load flow analysis for variable speed offshore wind farms by M.Zhao et al.,
9. Small signal stability analysis of large scale variable speed wind turbines integration by Xiangi Li et.al,
10. Modeling and performance of fixed-speed induction generators in power system oscillation stability studies by Jian Zhang et al.,
11. Small Signal stability analysis of Wind Turbines with Squirrel Cage Induction Generators by Yuri Ullianov Lopez et al.,
12. Ph.d Thesis," On the Use of Wind Power for Transient stability Enhancement of Power systems” by Katherin Elkington, Royal Institute of Technology,
13. Ph.d Thesis," Small signal modeling and Analysis of DFIG in wind power application” by Francoise Mei, University of London,
17. Initialization of Wind turbine models in Power system Dynamic Simulation by Slootweg et.al., IEEE conference.

Faculty of Electrical Engineering
(Approved in 17th AC (Ad hoc) 27.04.2012) ITEM NO. FE 17.02(2)

FE 9027 MODERN OPTIMISATION TECHNIQUES IN POWER SYSTEM L T P C
UNIT I INTRODUCTION
Power system optimisation-Emerging optimisation techniques and its application in Power system-Simulated annealing applications-Multi-objective optimisation-Constrained and Unconstrained Optimization problems.

UNIT II CONVENTIONAL METHODS

UNIT III GENETIC ALGORITHM
Genetic Algorithm- Genetic Algorithm for Unit Commitment-Problem formulation- Generator maintenance scheduling using Genetic Algorithm-Transmission Network Planning problem- Genetic Algorithm model for Transmission Network Planning-Ant colony search algorithms -Tabu search-Particle Swarm Optimization technique

UNIT IV ARTIFICIAL NEURAL NETWORK AND FUZZY BASED
OPTIMISATION TECHNIQUES


UNIT V CASE STUDIES


REFERENCES:
Direction flow and pressure control valves-Methods of actuation, types, sizing of ports-pressure and temperature compensation - Overlapped and underlapped spool valves-operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance.

REFERENCES:
UNIT V DATA CONVERTERS – BASICS AND ARCHITECTURE
ADC,DAC Basics – Analog Vs Discrete Time signals; Sample and Hold circuits; Differential Nonlinearity, Integral nonlinearity, offset, Gain error, latency, SNR, Dynamic rang, aliasing; DAC architectures- Digital input code, R-2R ladder network, Current steering, pipeline DAC; ADC Architecture – Flash, Two step flash, pipeline ADC, SAR ADC, oversampling ADC.

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:

Faculty of Electrical Engineering

(Approved in 17th AC (Ad hoc) 27.04.2012) ITEM NO. FE 17.02(6)

FE 9031 ENERGY HARVESTING TECHNOLOGIES L T P C

UNIT I PIEZOELECTRIC ENERGY HARVESTING

UNIT II ELECTROMAGNETIC ENERGY HARVESTING

UNIT III ENERGY HARVESTING CIRCUITS AND ARCHITECTURES

UNIT IV THERMOELECTRIC ENERGY HARVESTING

UNIT V APPLICATIONS OF ENERGY HARVESTING SYSTEMS

TOTAL: 45 PERIODS

REFERENCES:
Faculty of Electrical Engineering

ITEM NO. FE 17.02(7)

FE 9032 ELECTRIC FIELDS IN COMPOSITE DIELECTRICS AND THEIR APPLICATIONS  L T P C  3 0 0 3

UNIT I BASIC PROPERTIES OF ELECTRIC FIELDS IN COMPOSITE DIELECTRICS  9
Background – Fundamentals of Composite Dielectric Fields- Effect of Conduction – Outline of Field Behavior near a Contact Point.

UNIT II ELECTRIC FIELD BEHAVIOR FOR A FINITE CONTACT ANGLE  9
Analytical Treatment – Numerical Treatment – Effect of Volume and Surface Conduction

UNIT III ELECTRIC FIELD FOR A ZERO CONTACT ANGLE  9

UNIT IV ELECTRIC FIELD BEHAVIOR FOR THE COMMON CONTACT OF THREE DIELECTRICS  9
Contact of Straight Dielectric Interfaces – Perpendicular Contact of a Solid Dielectric with Another Solid – Numerical Analysis of Field Behavior.

UNIT V ELECTRIC FIELD IN HIGH VOLTAGE EQUIPMENT  9
Finite Contact Angle: Prevention of Field Singularity near a Contact Point – Zero Contact Angle in Gas Insulated Equipment – Common Contact of Three Dielectrics – Application of High Field Emission Devices.

TOTAL: 45 PERIODS

REFERENCES

Faculty of Electrical Engineering

ITEM NO. FE 17.02(8)

FE 9033 EMBEDDED PROCESSORS AND EMBEDDED OS  L T P C  3 0 0 3

UNIT I ARM PROCESSOR  9
ARM Processor Fundamentals, Introduction to the ARM Instruction set, Efficient C Programming, Digital Signal Processing, Memory Management Units, Simple Interface programs.
UNIT II  OMAP PROCESSOR  9
Introduction, architecture, instruction set, addressing modes, applications – Interface to I/O.

UNIT III  OMAP AM/DM 37x PROCESSOR  9
Functional block diagram, Key features, Memory and I/O Mapping, I/O Interface, Power Module, Case study.

UNIT IV  UBUNTU OPERATING SYSTEM  9
Introduction, Features, Building a Ubuntu Linux host under Virtual-box, Configuring Virtual Machine, Installing Ubuntu on the Virtual machine, Sharing files between Ubuntu and windows. Configuring a Proxy in Ubuntu, Case study.

UNIT V  ANDROID  9
Introducing Android, Key Concepts, Designing the User Interface, Multimedia, Storing local data, case study

TOTAL: 45 PERIODS

REFERENCES
2. OMAP Reference manual from Texas instruments, 2006.
4. AM37x EVM SDK 4.00 Release Notes, 2010.
UNIT IV
Use of Analysis tools, Fourier transforms, power spectrum, correlation methods, windowing and filtering. Application of VI in process control designing of equipments like oscilloscope, Digital multi meter, Design of digital Voltmeters with transducer input Virtual Laboratory.

UNIT V
Distributed I/O modules – Application of Virtual Instrumentation: Development of process database management system, Simulation of systems using VI, Development of Control system, Image acquisition and processing, Development of Virtual Instrument using GUI.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
UNIT V  COOLING AND HEAT TRANSFER OF AFPM MACHINE  

REFERENCES  

Faculty of Electrical Engineering  
(Approved in 17th AC (Ad hoc) 27.04.2012) ITEM NO. FE 17.02(11)  

<table>
<thead>
<tr>
<th>FE 9036</th>
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<tr>
<td>UNIT I</td>
<td>Introduction to Solar</td>
<td>9</td>
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<td></td>
<td>Semiconductor – properties - energy levels - basic equations of semiconductor devices physics - Basic characteristics of sunlight - Solar angles - day length - angle of incidence on tilted surface – Sun path diagrams – Equivalent circuit of PV cell , PV cell characteristics (VI curve, PV curve) - Maximum power point, Vmp, I_MPI, V Viện, I_ABC – types of PV cell - Block diagram of solar photo voltaic system, PV array sizing.</td>
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<td>UNIT II</td>
<td>DC-DC Converter</td>
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<td>UNIT III</td>
<td>Charge Controllers</td>
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<td>UNIT IV</td>
<td>Battery</td>
<td>9</td>
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<td>Types of Battery, Battery Capacity – Units of Battery Capacity-impact of charging and discharging rate on battery capacity-Columbic efficiency-Voltage Efficiency, Charging – Charge Efficiency, Charging methods, State of Charge, Charging Rates, Discharging - Dept of discharge-Discharge Methods, Battery Management System (BMS), selection of Battery.</td>
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<td>UNIT V</td>
<td>Simulation of PV Module &amp; Converters</td>
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<tr>
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<td>Simulation of PV module - VI Plot, PV Plot, finding V_MPI, I_MPI, V Viện, I_ABC of PV module .Simulation of DC to Dc converter -buck, boost, buck-boost and Cuk converters. Simulation of solar photo voltaic system.</td>
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TOTAL: 45 PERIODS
REFERENCES:
TEXT BOOKS

REFERENCES

Faculty of Electrical Engineering
(Approved in 18th AC 09.08.2014) ITEM NO. FE 18.03 (01)

FE9038 DESIGN OF CABLE FED INDUCTION MOTOR DRIVE SYSTEMS – AN ELECTROMAGNETIC APPROACH
L T P C 3 0 0 3

UNIT I INTRODUCTION

UNIT II METHODS OF FIELD COMPUTATION
Computational Methods – Finite element model for electrical machines – equations for magnetic field and windings – transient time stepping simulation – direct coupling of field and circuit equations – coupling by the current output approach – circuit parameter approach

UNIT III FEA OF INDUCTION MACHINE

UNIT IV HIGH FREQUENCY MODEL OF INDUCTION MACHINES AND CABLES
Design of high frequency induction motor parameter - induction capacitances of windings and frame (Csf) - stator windings and rotor (Csr) - rotor and frame (Crf) and bearings (Cb ) in induction motors - based on the finite element technique - common mode - differential mode- Determination of self and mutual inductance - capacitance between conductors of three phase cable - Variation of parameters as a function of frequency – FEM approach
UNITV  STRESS GRADING
Transient Finite Element Analysis of Stress Grading of winding insulation under Fast Rise Time Pulses for Conductive Armor Tape (CAT) - Semi conductive Stress-Grading Tapes (SSGT) of medium and high voltage induction motor.

REFERENCES
6. By Joao Bastos, Bastos/Sadowski, Nelson Sadowski, Marcel Dekker (Firma comercial) Electromagnetic modeling by finite element methods
7. High Performance AC Drives: Modelling Analysis and Control By Mukhtar Ahmad
UNIT III  SLIDING MODE CONTROL OF DFIG
Introduction-Characteristics of VSC-VSC for linear systems: Basic Definitions – Switching schemes-Reaching conditions and reaching mode- Control law – VSC for Non-linear systems-Reaching mode design and control law-Design of SMC based controller for active and reactive power regulation of DFIG

UNIT IV  MODEL PREDICTIVE CONTROL OF DFIG
Basic structure of MPC-MPC with linear models: Target Calculation- Receding Horizon Regulator-State Estimation MPC with non-linear models: State feedback- Control problem formulation- Design of MPC based controller for active and reactive power regulation of DFIG.

UNIT V  IMPACT OF WIND POWER ON POWER SYSTEM DYNAMICS
Introduction-Power system dynamics- Actual Wind Turbine Types- Impact of wind power on Small signal stability: Eigenvalue- frequency domain analysis- analysis of the impacts of wind power on small signal stability- simulation results- Preliminary conclusions.

TOTAL: 45 PERIODS

REFERENCES

73


UNIT V STABILITY OF LOAD MODELS & THEIR APPLICATION ISSUES

Difficulties in establishing the range of load model parameters that may be used for different transient conditions. Issues with load-mix and ways of dealing with it.

REFERENCES:
6. “Modelling of Load During and After System Faults Based on Actual Field Data”, IEEE 2003
12. “Dynamic Load Models: Where are we?”, A. Ellis, Senior Member, IEEE, D. Kosterev and Anatoliy Meklin Member, IEEE
21. “Significance of Load Modeling in Power System Dynamics”, Ian A. Hiskens, University of Wisconsin-Madison, USA
25. “A Real Application of Measurement-based Load Modeling in Large-Scale Power Grid and its Validation” Dong Han, Jin Ma, Renmu He, Zhao-yang Dong, IEEE Transactions on Power Systems Aug 2009

Faculty of Electrical Engineering

ITEM NO. FE 18.03 (04)

FE9041 MODEL REDUCTION FOR CONTROL SYSTEM DESIGN L T P C 3 0 0 3

UNIT I LINEAR METHODS FOR REDUCTION
UNIT II  NON-LINEAR METHODS FOR REDUCTION  9
Introduction to model and controller reduction model reduction by truncation-singular perturbation-Linearization method- Quadratic method-Piece-wise-linear method -Balancing technique -Proper orthogonal decomposition POD method

UNIT III  MULTIPLICATIVE APPROXIMATION  9
The multiplicative approximate problem: Balanced stochastic truncation, theory and extension-multiplicative Hankel norm approximation

UNIT IV  LOW ORDER CONTROL DESIGN  9
Approaches to the design of lower order controllers-controller and plant reduction via frequency weighted approximation- frequency weighted balanced truncation- frequency weighted Hankel norm reduction-frequency weighted reduction using partial fraction

UNIT V  MODEL AND CONTROLLER REDUCTION BASED ON COPRIME FACTORIZATION  9
Coprime factorization: definition and use- coprime fractional description-reducing controller dimension using coprime fractions-controller reduction via coprime fraction and frequency weighting-controller reduction via multirelative coprime factor approximation

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS
UNIT III MODELLING AND SIMULATION OF SSR FOR GRID INTEGRATED WECS
Squirrel cage induction Generator (SCIG) and Doubly fed induction generator (DFIG) model – Network model – Two mass model – Induction generator effect and Torsional interaction - Time domain using PSCAD and frequency domain simulation of modified IEEE FBM and SBM.

UNIT IV MODELLING OF FACTS CONTROLLER FOR SSR ANALYSIS
Modelling of Static Var Compensator (SVC) and Static synchronous compensator (STATCOM) for SSR analysis – Time domain simulation of SVC and STATCOM for modified IEEE FBM and SBM system using PSCAD

UNIT V COUNTERMEASURES FOR SSR
Subsynchronous damping controller (SSDC) for SVC and STATCOM - Filters – Time domain simulation using PSCAD and Frequency scanning method.

TEXT BOOKS:
4. P.M. Anderson et al., Subsynchronous Resonance in power systems, IEEE press1990

REFERENCES:

UNIT IV DISTRIBUTED ENERGY RESOURCES (DER)
Introduction-Distributed generation plants- Combined heat and power plants, Renewable energy generation -Small-scale hydro generation, Wind power plants, Offshore wind energy, Solar photovoltaic generation, Distributed generators and their connection to the system, Distributed generators Synchronous generators Induction generators, Doubly fed induction generator, Full power converter (FPC) connected generators- Integration of distributed generation in electricity system planning- Pricing of distribution networks with distributed generation- Distributed generation and future network architectures

UNIT V DEMAND-SIDE PLANNING AND EVALUATION

REFERENCES
2. The Advanced Smart Grid Edge Power Driving Sustainability by Andres Carvallo & John Cooper, Artech house 2011
5. Integration of Demand Side Management, Distributed Generation, Renewable Energy Sources and Energy Storage State of the art report Vol 1: Main report
6. ‘Load management,’ S.N.Talukar, IEEE press publications
generator reactive power resources – Asymmetry issues – Energising HV and EHV lines during restoration- restoration based on wide area measurement systems.

UNIT III SYSTEM RESTORATION PLANNING AND RESTORATION TRAINING

UNIT IV KNOWLEDGE BASED SYSTEMS

UNIT V NON LINEAR AND DYNAMIC PROGRAMMING TECHNIQUES FOR RESTORATION

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:
UNIT II CONSTRAINED OPTIMAL FEEDBACK CONTROL


UNIT III REAL-TIME IMPLEMENTATION OF NON LINEAR MODEL PREDICTIVE CONTROL


UNIT IV LEAST-SQUARES FINITE ELEMENT METHOD FOR OPTIMIZATION AND CONTROL PROBLEMS

Quadratic Optimization and Control Problems in Hilbert Spaces with Linear Constraints – Least-Squares Formulation of the Constraint Equations – Methods Based on Constraining by the Least-Squares Functional – Examples for Optimization Problems.

UNIT V GENERALIZED SQP METHODS WITH PARAREAL TIME DOMAIN DECOMPOSITION


TOTAL: 45 PERIODS

REFERENCE BOOKS


Faculty of Electrical Engineering

(Approved in 18th AC 09.08.2014) ITEM NO. FE 18.03 (09)

FE 9046 ANDROID BASED EMBEDDED SYSTEM L T P C

3 0 0 3

AIM

To expose the students to the fundamentals of Android for embedded system design.

OBJECTIVES

To impart knowledge on

1. Fundamentals of Android
2. Android Native Development
3. Android Application Development
4. How to build Android based Embedded Systems

UNIT I ANDROID COMPONENTS AND BIG PICTURE

Four kinds of Android components-Android Platform-Different layers of Android OS-Building on the Linux kernel-Running in the DVM-Android SDK-Creating an Android Application-Understanding activities and views-Exploring the Activity life cycle-Working with resources.
UNIT II ANDROID SYSTEM DEVELOPMENT AND ANDROID NATIVE DEVELOPMENT


UNIT III ANDROID APPLICATION DEVELOPMENT

Android UI components-Android database-Broadcast Receivers-Services.-Android Content Providers-Location Manager-Phone Accessing-Advanced Android application development.

UNIT IV ANDROID POWER MANAGEMENT TECHNIQUES

Android power management architecture- power management at the application level-Power management from Linux kernel to Android-Android Linux device driver development-Power management at the device driver level-Tools for power measurement and optimization.

UNIT V BUILDING ANDROID BASED EMBEDDED SYSTEMS

Introduction to Beagle board Xm-Building Boot Loader-Building X-Loader and Kernel for Beagle Board Xm-Building Android File System-Porting Android OS onto the Beagle Board Xm-Porting Android Application to the Beagle board-

TOTAL: 45 PERIODS

REFERENCES

4. TI Android GingerBread 2.3 DevKit 1.0 Developers Guide

Faculty of Electrical Engineering

(Approved in 18th AC 09.08.2014) ITEM NO. FE 18.03 (10)

FE 9047 ADVANCE CHEMICAL REACTOR THEORY

UNIT I
Overview of Chemical reaction engineering: Classification of Reactions, variables affecting the rate of reaction, definition of rate of reaction, kinetics of homogeneous reaction. Interpretation of batch reactor data: constant volume batch reactor, irreversible unimolal type first order, bimolecular type second order, trimolecular type third order reaction. Zero order reaction, irreversible parallel homogeneous catalyzed reaction, autcatalytic & reversible reactions.

UNIT II
Reaction Engineering overview- reactor design- ideal reactor design equations- single & multiple reactions, instantaneous and overall yields. Design of parallel reactors, Plug flow, batch reactors.
UNIT III
Mass & Energy balance in stirred batch, semi-batch and continuous vessels - energy balance in plug flow vessels - optimal design for exothermic reversible reactions - stability and multiplicity of steady states in CSTR.
Design of packed tubular reactors - Gas solid reactions, shrinking core model, pseudo steady state hypothesis for ash layer control, gas solid reactions in rotary kiln and fluid beds.

UNIT IV
Non ideal flow, RTD of ideal vessels, modeling non ideal flow, conversion from RTD theory, tanks in series model, dispersion model -catalyst deactivation, design for deactivating catalysts.
Introduction to population balance, application to RTD of CSTR, application to gas solid reactions in Rotary kiln and fluid beds, performance of reactor regenerator system from PBE modeling.

UNIT V
Design for Immobilized cell reactor, design for fermentation alcohol, design for polymerization reactors, biological waste water treatment - flow and reaction through porous media, acid leaching of rocks-liquid liquid reactions-gas liquid reactions , applications in CO2 capture and global warming.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS
2. Modelling of Chemical Kinetics and Reactor design – Coker AK, Gulf Professional publishing, 2001
UNIT IV Polymeric MEMS Fabrication Techniques
Rapid prototyping; microstereolithography, micromolding of polymeric 3D structures, Incorporation of metals and ceramics by polymeric processes, electrochemical fabrication (EFAB); combined silicon and polymer structures

UNIT V Polymer MEMS devices

TOTAL: 45 PERIODS

REFERENCES:

Faculty of Electrical Engineering

ITEM NO. FE 18.03 (12)

FE9049 ELECTRIC PROPULSION

OUTLINE:
Upon completion of the course, students will learn the governing physics of electric propulsion, working and performance of electro-thermal, electrostatic and electromagnetic thrusters.

UNIT I INTRODUCTION TO THE BASIC PHYSICS OF ELECTRIC PROPULSION SYSTEMS
Historical outline - Definition of Electric Propulsion - High impulse Space Missions - Exhaust velocity and specific impulse - Power supply penalty – Electric charges and Electrostatic fields - Currents and Magnetic interactions - Time dependent fields and Electromagnetic wave propagation - Application to ionized gas flows

UNIT II PHYSICS OF IONIZED GASES
Atomic structure of gases - Ionization processes - Particle collisions in an ionized gas - Electrical conductivity of an ionized gas - Kinetic Theory

UNIT III ELECTRO-THERMAL PROPULSION
One dimensional model - Enthalpy of high temperature gases - Frozen flow efficiency - Resistojets - Electrical discharges - Arcjets - Operation and Analysis - Materials - Advantages and Disadvantages

UNIT IV ELECTROMAGNETIC PROPULSION
The Lorentz force - Magnetogasdynamic channel flow - Ideal steady flow acceleration - Thermal and viscous losses - Geometry considerations - Self induced fields - Sources of the
conducting gas - The magnetoplasmodynamic arc - Magneto- plasmodynamic (MPD) thrusters - Pulsed plasma acceleration - Pulsed plasma thrusters (PPT) - Quasi steady acceleration - Pulsed inductive acceleration - Traveling wave acceleration

UNIT V  ELECTROSTATIC PROPULSION  9
One dimensional space-charge flows - Basic relationships - The acceleration- deceleration concept - Ion engines - Design and Performance - Hall effect – Hall thrusters - Field emission electric propulsion (FEEP) - Colloid thrusters

TOTAL: 45 PERIODS

REFERENCES

Faculty of Electrical Engineering
(Approved in 18th AC 09.08.2014) ITEM NO. FE 18.03 (13)

FE 9050  NUCLEAR REACTOR ENGINEERING  L T P C
UNIT I  INTRODUCTION TO NUCLEAR REACTOR  9

UNIT II  COMPONENTS OF NUCLEAR REACTOR  9

UNIT III  TYPES OF NUCLEAR REACTOR  9

UNIT IV  MODELING OF NUCLEAR REACTOR  9

UNIT V  CONTROL OF NUCLEAR REACTOR  9
REFERENCES:

Faculty of Electrical Engineering
(Approved in 18th AC 09.08.2014) ITEM NO. FE 18.03 (14)

FE9051 CONTROL AND PROTECTION OF MICROGRID L T P C 3 0 0 3

COURSE OBJECTIVES
- To familiarize the power quality management issues in microgrid.
- To Discuss about different energy storage systems
- To study the concepts behind economic analysis and Load management.
- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Microgrid and its configuration

UNIT I DISTRIBUTED ENERGY RESOURCES 9
Introduction - Combined heat and power (CHP) systems - Micro-CHP systems - Wind energy conversion systems (WECS) - Wind turbine operating systems - Solar photovoltaic (PV) systems - Types of PV cell - Small-scale hydroelectric power generation - Other renewable energy sources - Storage devices - Island mode of operation - Problem of power quality.

UNIT II VOLTAGE AND CURRENT CONTROL IN DISTRIBUTED GENERATION SYSTEMS 9
Distributed energy system description - DGS control requirements - Distributed generation system modeling - Control system design- Load sharing control algorithm - Power converter system - control theory: perfect control of robust servomechanism problem - discrete-time sliding mode control - control system development - step-by-step control flow explanations.

UNIT III PROTECTION ISSUES FOR MICROGRIDS 9

UNIT IV IMPACT OF DG INTEGRATION ON POWER QUALITY AND RELIABILITY 9
Introduction - Power quality disturbances - Transients - Voltage sags and swells - Over-voltages and under-voltages - Outage - Harmonic distortion - Voltage notching - Flicker -
Electrical noise - Power quality sensitive customers - Existing power quality improvement technologies - Alternative power supply technologies - Power-conditioning technologies - Impact of DG integration - Simple standby generation scheme - Secondary DG system with power quality support - Primary DG system with power quality support to priority loads - Soft grid-connected DG with power quality support to priority loads - DG with intermittent solar PV within power quality environment - DG with intermittent wind generator within power quality environment - Ultra-high reliability scheme using dual link DC bus - Issues of premium power in DG integration.

UNIT V  POWER FLOW CONTROL OF A SINGLE DISTRIBUTED GENERATION UNIT


TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

UNIT II  LINEAR PROGRAMMING  10

UNIT III  NON-LINEAR PROGRAMMING  10

UNIT IV  INTERIOR POINT METHOD  5

UNIT V  UNIT COMMITMENT & DYNAMIC PROGRAMMING  10
Formulation of unit commitment, modeling in unit commitment, Priority list unit commitment schemes, Different types, unit commitment of Thermal units using dynamic programming. Characteristics of Dynamic programming, Computational economy in Dynamic programming, Illustrative examples.

TOTAL : 45 PERIODS

TEXT BOOKS
1. James A. Momoh, Electric power system applications of Optimization

REFERENCES
2. Hadi Saadat, Power system Analysis, WCB Mcgraw Hill,1999