MAHAMAYA TECHNICAL UNIVERSITY
NOIDA

Syllabus

M.TECH. SECOND YEAR COURSES

Branch: Electrical Engineering

Specialization: Power Electronics and Drives / Power Electronics

[Effective from the Session : 2013-14]

Semester-III

Specialization: Power Electronics & Drives / Power Electronics

S No	Course Code	Subject	Periods			Evaluation Scheme							Total	Credit
						Sessional					External			
			L	T	P	CT	AT	TA	P	Total	Th	P		
1	EE 930/ PE 930	Power Converter Application	3	1	0	40	15	15		70	130		200	4
2	EE 931/ PE 931	Research Methodology	2	0	0				20	20	80		100	2
3	EE 93?/ PE 93?	Elective-II	3	1	0	40	15	15		70	130		200	4
4	EE 937/ PE 937	Seminar	0	0	2				50	50			50	1
	EE 938/ PE 938	Dissertation	0	0	8					150	300		450	9
Total			8	2	10								1000	20

EE93? /PE93? Elective-II

EE932/PE932: Neural Network and fuzzy system

EE933/PE933: Electronic Instrumentation and Process Control.

EE934/PE934: Microprocessor Controlled Electric Drives

EE935/PE935: Electrical Power Quality

EE936/PE936: Modeling and Simulation of Electrical Machines

Whenever the Theory Exam is of 130 marks, 15 short answer questions of 2 marks each shall be asked in the question paper.

Semester-IV

S No	Course Code	Subject	Periods			Evaluation Scheme							Total	Credit
						Sessional					External			
			L	T	P	CT	AT	TA	P	Total	Th	P		
1	EE 940/ PE 940	Dissertation	0	0	20				200	200		500	700	14
2	EE 941/ PE 941	Compressive Viva										300	300	6
Total					20								1000	20

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EE930/PE930: POWER CONVERTER APPLICATIONS

L T P
3 1 0

1. **Electric Utility Applications:**

   (a) HVDC Transmission:
   Schematic diagram, modes of operation, control characteristics, twelve pulse converters, converter faults and protection, harmonic filters and power factor correction capacitors.

   (b) Static VAR Control:
   Concept of static VAR control, thyristor controlled VAR compensation techniques, series compensation, synchronous link converter based VAR compensation, unified power flow controller (UPFC).

   (c) Interconnection of Renewable Energy Sources to the Utility Grid:
   Photo voltaic array interconnection, wind and small hydro interconnections.

2. **Industrial Applications:**
   Concept of resistance and induction heating, high frequency inverters for induction heating, ac voltage controllers for resistance heating and illumination control, electric welding control.

3. **Power Supplies:**
   Switched mode dc power supplies, UPS, aircraft power supplies.

4. **Power Generation:**
   Excitation control of synchronous generators.

Reference:

1. N. Mohan, T.M.Undeland and W.P. Robbins, "Power Electronics Converters, Applications and design", John Wiley and Sons, 1995.
2. M.H. Rashid, "Power Electronics Circuits, Devices and Applications", Prentice Hall of India, 1996.
3. E.W. Kimbark, "Direct current Transmission", Vol-I, Wiley Inter science, 1982.
4. T.J. Miller, "Reactive Power Control in Electric System", Wiley Interscience.

EE931/PE931: RESEARCH METHODOLOGY L T P
3 1 0

Objectives:
To enable the students to understand:

(a) Some basic concepts of research and its methodologies.

(b) To select and define appropriate research problem and parameters.

(c) The issues involved in planning, designing, executing, evaluating and reporting research.

(d) The technical aspects of how to do empirical research using some of the main data collection and analysis of techniques used by researchers.

(e) The meaning and techniques of sampling.

UNIT - I

Introduction: Research objective and motivation. Types of research. Research approaches. Significance. Research method vs. methodology. Research process.

UNIT - II

Formulating a research problem: Literature review. Formulation of objectives. Establishing operational definitions. Identifying variables. Constructing hypotheses.

UNIT - III

Research design and data collection: Need and characteristics. Types of research design. Principles of

experimental research design. Method of data collection. Ethical issues in collecting data.

UNIT - IV

Sampling and analysis of data: Need of sampling. Sampling distributions. Central limit theorem. Estimation: mean and variance. Selection of sample size. Statistics in research. Measures of central tendency. Dispersion. Asymmetry and relationships. Correlation and regression analysis. Displaying data.

UNIT -V

Hypothesis testing: Procedure. Hypothesis testing for difference in mean. Variance limitations. Chisquare test. Analysis of variance (ANOVA). Basic principles and techniques. Writing a research proposal.

Text Books:

1. R. C. Kothari, Research Methodology: Methods and Techniques, 2nd edition, New Age
   International Publisher, 2009
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition,
   SAGE, 2005

References:

1. Trochim, William M. The Research Methods Knowledge Base, 2nd Edition. Internet WWW
   page, at URL: <http://www.socialresearchmethods.net/kb/> (version current as of October 20,
   2006).
2. (Electronic Version): StatSoft, Inc. (2012). Electronic Statistics Textbook. Tulsa, OK: StatSoft.
   WEB: http://www.statsoft.com/textbook/.
   (Printed Version): Hill, T. & Lewicki, P. (2007). STATISTICS: Methods and Applications.
   StatSoft, Tulsa, OK.

EE/932/PE932 NEURAL NETWORKS AND FUZZY SYSTEM

L	T	P
3	1	0

A. Neural Networks :

1. Basics :

Simple neuron, nerve structure and synapse, concept of neural network multilayer nets, auto-associative and hetero-associative nets, neural network tools (NNTs), artificial neural network (ANN) and traditional computers.

2. Neural Dynamics :

Neurons as functions, neuronal dynamic systems, signal functions, activation models

3. Synaptic Dynamics :

Learning in neural nets, Unsupervised and supervised learning, signal hebbian learning competitive learning, differential hebbian learning, differential competitive learning single layer perception models, the back propagation algorithm.

4 Applications :

Applications in load flow study, load forecasting detection of faults in distribution system and steady state stability, neural network simulator, applications in electric drive control.

B. Fuzzy System :

5. Basics :

Fuzzy sets and systems, basic concepts, fuzzy sets and crisp sets, fuzzy set theory and operations, fuzzy entropy theorem, fuzzy and crisp relations, fuzzy to crisp conversions.

6. Fuzzy Associative Memories :

Representation of fuzzy sets, membership functions, basic principle of interference in fuzzy logic, fuzzy IF-THEN rules, fuzzy systems and algorithms, approximate reasoning, forms of fuzzy implication, fuzzy inference engines, fuzzification/defuzzification

7. Applications :

Fuzzy control system design and its elements, fuzzy logic controller applications of fuzzy control in electric drive, power system, measurement and instrumentation.

References :

1. Bart Kosko, "Neural Networks fuzzy systems", Prentice Hall International
2. George J. Klin, & Tina A. Polger, "Fuzzy Sets, uncertainty and Information",
3. Russel C. Ebehart Roy W. Dobbins, "Neural Network PC tools", Academic press Inc.
4. Martin T. Hagan, H.B. "Neural Network design", Thomson Demuth Mark Beate, Asia Pvt Ltd.
5. Simon Haykin "Neural Network and Learning machines" Third Edition, PHI learning, new Delhi,2011.
6. J.R. Jang, C. Sun and E. Mizuatani, "Neuro-fuzzy Soft computing: A Computational Approach to learning and Machine Intelligence." PHI, 2011.

EE/933/PE933: ELECTRONIC INSTRUMENTATION & PROCESS CONTROL

L T P
3 1 0

1. **Introduction :**
   Objectives of instrumentation and applications, measurement accuracy, types of errors

2. **Instrumentation for Measurement of Non-Electrical Quantities**
   General Instrumentation system; transducer classification, selection; pressure position, velocity, flow, level and temperature transducers.

3. **Data Acquisition System :**
   Concept of data acquisition system and its block diagram representation.

   Signal Conditioning :
   Elements, dc and ac signal conditioning systems, isolation devices and isolation amplifier, sample and hold circuit, A/D and D/A converters, multiplexing-time and frequency division multiplexing, analog and digital multiplexer.

   Telemetry :
   Basic concept, various types of telemetry system; telemetry in power system; pulse telemetry-PAM,PCM,PPM and PWM.

   Signal Recovery :

   Filtering, averaging, correlation and coding of signals, data processing, display and recording.

4. **Process Control:**
   Process Control,- concept, on-off, proportional, proportional-integral, proportional-integral-derivative control actions, three term control action, selection of control action, introduction to digital process control ; pneumatic and electronics controllers and their comparison.

5. **Special purpose instruments :**
   Storage and sampling CROs; Spectrum Analyzer ; Recorders-strip chart, magnetic and digital type, digital data display devices..

6. **Microprocessor Based Instrumentation :**
   Introduction to Microprocessor based instrumentation, interface system, communication protocols.

References :

1. E.O. Doeblin, Measurment System-Application and Design, Mc Graw Hill, 1985
2. G.C. Barney, Intelligent Instrumentation Prentice Hall International, EEE Edition, 1985.
3. A.K. Sawhney, Electrical and Electronics Measurement and Instrumentation, Dhanpat rai and Sons, 2003
4. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques Prentice Hall of India, 2001
5. Curtis Johnson, Process Control Instrumentation Technology, 8th Edition, Prentice Hall of India, 2009.
6. N. Mathivanan "PC based Instrumentation" PHI learning 2009
7. DVS Murthy "Transducers and Instrumentation" PHI learning 2011
8. MMS Anand "Electronic Instruments and Instrumentation Technology" Prentice Hall India 2004.

EE/934/PE934: MICROPROCESSOR CONTROLLED ELECTRIC DRIVES

L	T	P
3	1	0

1. **Microprocessor and Microcomputers:**
   Review of architecture and operation of 8 bit and 16 bit microprocessors, interfacing devices, microprocessor controlled system versus dedicated hardware system, functions of microprocessor in electric drive control, selection criteria, concept of microcomputer and its applications.

2. **Concept of power converters:**
   Control strategies and microprocessor based control schemes for line converters, ac voltage controllers, cyclo-converters, choppers and bridge inverters.

3. **Sensing and Processing of Feedback Signals:**
   Sensing of position, speed, current torque for feedback purpose and signal conditioning, synchronizing signals, quantization, digitization, filtering and implementation.

4. **Closed Loop Drives:**
   Review of closed loop control of electric drives, microprocessor based control schemes and flow charts for closed loop control of:
   (a) DC drives fed from single phase and three phase line converters and choppers.
   (b) Induction motor drives fed from ac voltage regulators, VSI, CSI and PWM inverters, static slip power recovery scheme.
   (c) Synchronous motor drive using LCI fed control.

References:

1. R.S. Gaonker, "Microprocessor Architecture, Programming and Applications", Wiley Eastern Limited.
2. M.D. Singh and K.B. Khanchandani, "Power Electronics", Tata McGraw Hill, 2001.
3. B.K. Bose, "Power Electronics and Variable Frequency drive", Standard Publishers, 2000

EE/935/PE935: ELECTRICAL POWER QUALITY

L T P
3 1 0

1. **Power Quality Problems and Monitoring :**
   Introduction, surges, voltage sag and swell, over voltage, under voltage, outage voltage and phase angle imbalances, electrical noise, harmonic, frequency deviation monitoring.

2. **Solution to power quality problems :**
   Design, measures to minimize the frequency and duration of outages in distribution systems, voltages regulators, harmonic filters, power conditioners, uninterruptible power supplies, emergency and stand by power systems, application of power conditioners.

3 **Minimization of disturbances at Customer site :**
   Power quality standards, standard test waveforms, power distribution system design, measure to minimize voltage disturbances.

References :

1. Roger C. Dugan, Mark F. Mcgranaghan, Surya Santoso, "Electrical Power System Quality", McGraw Hill
2. C. Sankaran, Power Quality CRC Press, USA
3. Wilson E. Kazibwe, "Electrical Power Quality Control Techniques", Van Nostrand Reinhold.
4. M. H. J. Bolen "Understanding Power Quality Problems", IEEE Press 2000.
5. J. Arrillaga, N.R. Watson, S. Chen "Powr System Quality Assessment", John Wiley, 2000.

EE/936/PE936: MODELING AND SIMULATION OF ELECTRICAL MACHINES

L T P
3 1 0

Energy state functions, basic principles of electromechanical energy conversion, basic modeling of electrical machines from coupled circuit point of view, methods of transformation viz dc, phase variable, instantaneous, symmetrical component techniques, reference frames, general volt – ampere and torque equations under stationary and rotating reference frames.

1. **Modeling of D.C. Machines:**
   Analysis under motoring and generating, simulation for transient and dynamic conditions, voltage build up in generators, effects of load change, run up and dynamic operations of motors under different excitations, response under load change, reversal and braking.

2. **Modeling of Synchronous Machines:**
   D-Q transformations fixed to field structure – steady sate and dynamic equations, electromagnetic and reluctance torques, response under short circuit conditions, computer simulation using mathematical software.

3. **Modeling of Induction Machines:**
   Equations under stationary and rotating reference frames, derivation of equivalent circuits, correlation of inductances, runup transients, dynamics under load change, speed reversal and braking; computer simulation to predict dynamic response, unbalanced and symmetrical operations, modeling and simulation of single phase motors,
   Modeling and analysis of permanent magnet, switched reluctance and stepper motors.
   Development of computer softwares using latest simulation tools to predict the behavior of different machines.

References:

1 B. Adkins and R.G. Hartley, "The General theory of Electrical Machines", Chapman & Hall Ltd., 1975.
2 Paul C. Krause, "Analysis of Electric machinery", Mc Graw Hill, 1987.
3 C.V. Jones, "Unified theory of Electrical machines", Butterworths Publishers.
4 D.C. White and H.H. Woodson, "Electromechanical Energy Conversion", John Wiley & Sons, 1951.
5 G. Kron, "Equivalent Circuits of Electric Machinery", John Wiley & Sons, 1951.
A.W. Fitzerald and C. Kingsley, "Electric Machinery", Mc Graw Hill, 1961.