

# Syllabus for M.Tech in Electrical Engineering

## Semester II

ECB010	Soft Computing
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### ARTIFICIAL NEURAL NETWORKS-I

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron and convergence theorem, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network.

### ARTIFICIAL NEURAL NETWORKS-II

Back propagation-RBF algorithms-Hopfield networks, Introduction to Kohonen's Self organization map, architecture and algorithms and recurrent network.

**FUZZY LOGIC SYSTEMS** - Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate Reasoning, Fuzzification, Membership value assignment, inference and defuzzification. Fuzzy knowledge and rule bases. Self-organizing fuzzy logic control.

**GENETIC ALGORITHM** - Basic concept of Genetic algorithm Mutation, Reproduction and crossover and detail algorithmic steps. Engineering applications.

**APPLICATIONS FUZZY LOGIC:** Design of Fuzzy PI controller for speed control of DC motor using Matlab fuzzy-logic toolbox. Inverted pendulum Neuro controller, **GA** with examples

### REFERENCES:

1. Neural Networks: A comprehensive Foundation – Simon Haykins, Pearson Edition, 2003.
2. Fuzzy logic with Fuzzy Applications – T.J.Ross – Mc Graw Hill Inc, 1997.
3. Genetic Algorithms- David E Goldberg.
4. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
5. Introduction to Artificial Neural Systems - Jacek M. Zurada, Jaico Publishing House, 1997.

**GENERALISED MEASUREMENT SYSTEMS:**

System concept of measurement schemes, Generalized performance characteristics of measurement systems. Error Analysis: types of errors, Methods of error analysis, uncertainty analysis, statistical analysis, and propagation of errors.

**SENSORS & TRANSDUCERS:**

Classification, selection of Transducer, transducer conditioning, transducer selection and specification, capacitive transducer, inductive transducer, resistive transducer, electromagnetic transducer, magnetostrictive transducer, photosensors, hall effect sensors. Smart Sensors.

**DATA ACQUISITION:**

Introduction to data acquisition, Sampling fundamentals, Input/output techniques and buses. ADC, DAC, Digital I/O, Data acquisition interface requirements. Signal conditioning, DAQ hardware configuration.

**RADIATION DETECTION:**

Ionization Chamber, Geiger Muller Counter, Proportional Counter, scintillation Counters. Methods of data

**TRANSMISSION:**

General telemetry systems, DC & AC telemetry system, Modulation, Pulse telemetry systems, Digital telemetry.

**REFERENCES:**

1. D. Partanabis Instrumentation and control
2. D. Partanabis Sensors and transducers
3. E. O. Doebelin Measurement Systems
4. E. Frank Electrical Measurement Analysis
5. Foard & Hauge A.C. Bridge Methods
6. B.S. Sonde Transducer and Display Systems
7. W. D. Cooper Electrical Instrumentation & measurement Techniques

# **EBB620 Power Electronics for Renewable Energy Systems**

## **INTRODUCTION**

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

## **ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION**

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

## **POWER CONVERTERS**

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing

Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

## **ANALYSIS OF WIND AND PV SYSTEMS**

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS Grid Integrated solar system.

## **HYBRID RENEWABLE ENERGY SYSTEMS**

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

## **REFERENCE BOOKS**

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi.

# **EBB690 High Voltage Direct Current Transmission**

## **INTRODUCTION:**

Introduction to AC and DC Transmission – application of DC Transmission – description of DC transmission – DC system components and their functions – modern trends in DC Transmission

**CONVERTER:** Pulse Number – Converter configuration – analysis of Graetz circuit – converter bridge characteristics – characteristics of 12 Pulse converter

## **HVDC CONTROLLERS:**

General principle of DC link control – converter control characteristics – system control hierarchy – firing angle control – current and extinction angle control – Dc link power control – high level controllers

## **FILTERS**

Introduction to harmonics – generation of harmonics – design of AC filters – DC filters – carrier frequency and RI noise

## **PROTECTION:**

Basics of protection – DC reactors – voltage and current oscillations – circuit breakers – over voltage protection – switching surges – lightning surges – lightning arresters for DC systems

## **REFERENCE BOOKS**

1. Kimbark, "Direct Current Transmission – Vol. I", John Wiley and Sons Inc., New York, 1971
2. Padiyar. K. R., "HVDC Power Transmission Systems", Wiley Eastern Limited, New Delhi, 2000.
3. Arrillaga. J, "High Voltage Direct Current Transmission", Peter Peregrines, London, 1983