

Electrical Engineering

M.Tech Semester : 1

Teaching Scheme

Course Code	Course Name	Lecture Hours	Tutorial Hours	Practical Hours	Credit
EE 195001	Special Electrical Machines	3	0	3	4.5
EE 195002	Power Electronic Converters Operation Design and Control	3	0	3	4.5
EE 5001	Renewable Energy Infrastructure	3	0	0	3

Elective I(Any Two)

Course Code	Course Name	Lecture Hours	Tutorial Hours	Practical Hours	Credit
EE 195003	Intelligent System and Control	3	0	0	3
EE 195004	Advanced Power System	3	0	0	3
EE 195005	Fuzzy Set Theory and Fuzzy Control	3	0	0	3

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I	Course Code	EE 195001			
II	Title of the course	Special Electric Machines			
III	Credit Structure	L	T	P	C
		3	0	3	4.5
IV	Prior Exposure	Electrical Machines			
V	Course Content	<p>Permanent Magnet Brushless D.C. Motors - Fundamental equations; EMF and Torque equations; Torque speed characteristics; Rotor position sensing; Sensorless motors; Motion control. Permanent Magnet Synchronous Motors Construction; Principle of operation; EMF and torque equations; Starting; Rotor configurations; Dynamic model. Synchronous Reluctance Motors - Constructional features; axial and radial flux motors; operating principle; characteristics Switched Reluctance Motors - Constructional features; principle of operation; torque production; characteristics; power controllers Stepping Motors Features; fundamental equations; PM stepping motors; Reluctance stepping motors; Hybrid stepping motors; Torque and voltage equations; characteristics</p>			
VI	Text/Reference Books	<p>[1] K. Venkataratnam, "Special Electrical Machines", Universities Press References [2] T. J. E. Miller, "Brushless Permanent Magnet and Reluctance Motor Drives", Oxford Science Publications</p>			

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I	Course Code	EE 195002			
II	Course Title	Power Electronic Converters Operation, Design & Control			
III	Credit Structure	L	T	P	C
		3	0	3	4.5
IV	Prior Exposure	Network Theory, Analog Electronics, Digital Electronics			
V	Course Content	<p>Peripheral Design Aspects: power semiconductor devices characteristics; device selection for target application, design considerations for gate drive, magnetic components, filters, snubbers, heat sinks.</p> <p>AC-DC Converters: line & forced commutated 1-ph & 3-ph converters; multi-pulse converters, input p.f.-current requirements, regeneration.</p> <p>DC-AC Converters: 2-level, multilevel, modular converter topologies; switching-control schemes.</p> <p>DC-DC Converters: non-isolated/isolated unidirectional/bidirectional converter topologies, control schemes.</p> <p>Applications of Converters: overview of converters applications.</p>			
VI	Text/References	<ol style="list-style-type: none"> 1. 'Power Electronics: Converters Applications and Design Mohan, Undeland and Robbins, 3rd edition - Wiley 2. Power Electronics Handbook M. H. Rashid, Academic Press 			

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I	Course Code	EE 5001			
II	Course Title	Renewable Energy Infrastructure			
III	Credit Structure	L	P	T	C
		3	0	0	3
IV	Prerequisite(If any the students)	Basics of Electrical and Electronics Engineering, Power Systems			
V	Course Contents	Sustainability: Why Energy Matters (and Money); Global Warming (Physics), History and Impact; Renewable Sources that are replenished: Wind, Solar, Ocean Waves, Geothermal; Wind Energy: Forecasting Challenges, Wind Turbines: Dynamics and Control, Wind Wakes; Solar Energy: Harnessing the Power of Sun: Science and Technology of Solar Photovoltaics (PV), Solar PV Connection to virtual Grid, Optimization issues; Renewable Energy storage Issues, Challenges; Hybrid Solar-Wind System; Wind Farm; Solar Farm; Policy and Ethical Issues; Energy Conservation related issues; Hydrogen and Fuel Cells; Bio-energy.			
VI	Reference Books	<p>[1] Wind Energy Handbook, 2nd Edition, Tony Burton, Nick Jenkins, David Sharpe, Ervin Bossanyi,</p> <p>[2] Solar Electricity Handbook - 2015 Edition: A simple, practical guide to solarenergy - designing and installing solar PV systems, Michael Boxwell, Greenstream Publishing; 2015 Edition,</p> <p>[3] Hydrogen and Fuel Cells: A volume in Sustainable World, Bent Sorensen,</p> <p>[4] Non-conventional Energy Resources, B H Khan, Third Edition, McGrawHill Education</p>			

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I	Course Code	EE 195003			
II	Course Title	Intelligent System and Control			
III	Credit Structure	L	T	P	C
		3	0	0	3
IV	Prerequisite(If any for the student)	<ul style="list-style-type: none"> – Introduction of artificial Intelligence and background and related fields. – Biological foundations to intelligent systems II: Fuzzy logic, knowledge representation and inference mechanism, genetic algorithm, and fuzzy neural networks. – Biological foundations to intelligent systems I: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks. – Fuzzy and expert control (standard, Takagi-Sugeno, mathematical characterizations, design example), Parametric optimization of fuzzy logic controller. – Application of neuro-fuzzy inference systems to robotics. – System identification using neural and fuzzy neural networks. –Genetic Algorithm and applications. – Stability analysis: Lyapunov stability theory and Passivity Theory. –Applications to ball and beam system, helicopter system, flight system, robot manipulator, inverted pendulum and inertia wheel pendulum control and visual motor coordination. 			
V	Course Content	<ul style="list-style-type: none"> – Intelligent Control Systems Using Soft Computing Methodologies, Edited by Ali Zilouchian Mo Jamshidi, CRC press, 2001. – - Intelligent systems and control,:Principles and applications, L. Behera and I Kar, Oxford, 2009 –Intelligent Control A hybrid - Approach Based on Fuzzy Logic, Neural Networks and Genetic Algorithms by Nazmul siddique , springer2013 			

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I	Course Code	EE 195004			
II	Title of the course	Advanced Power Systems			
III	Credit Structure	L	T	P	C
		3	0	0	3
IV	Exposure	Power System (EE 3005).			
V	Course Content	<p>Operating states of power system. State-transition diagram. Introduction to power system security analysis. Major components of on-line security analysis.</p> <p>Introduction to power system state estimation. Processes involved in state estimation: observability analysis, bad data detection and identification. Power system state estimation using method of least squares: Statistics, errors, and estimates, test for bad data. Structure and formation of H-matrix.</p> <p>Introduction to synchro-phasor technology, Phasor Measurement Unit (PMU): Structure, operation and applications. Phase angle estimation techniques in distribution systems: Micro PMU, Phase Locked Loop (PLL), and Discrete Fourier Transform (DFT) based approach. OpenPMU</p> <p>Phase shifting transformer in transmission lines: Modelling and admittance matrix formulation.</p> <p>Revision of gauss-seidal and newton-raphson power flow analysis, concept of distributed slack and distributed slack power flow analysis. DC power flow analysis, loss-compensated DC power flow analysis. Optimal power flow analysis: formulation of objective function and constraints.</p> <p>Representation of loads in power system: constant impedance, constant current and constant power loads. ZIP model and composite load representation</p> <p>Sparse matrix storage techniques in power system. Fill-in and optimal ordering.</p>			
VI	Text/Reference Books	<p>[1] J. Grainger, W. D. Stevenson Jr, Power System Analysis, Mc-Graw Hill Publications.</p> <p>[2] Literature work reported in IEEE Xplore digital library.</p>			

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I	Course Code	EE 195005			
II	Course Title	Fuzzy Set Theory and Fuzzy Control			
III	Credit Structure	L	P	T	C
		3	0	0	3
IV	Prerequisite(If any the students)	NIL			
V	Course Contents	<p>Classical Set Theory: Fundamental Concepts, Relations, Operation on Relations, Interval Arithmetic: Fundamental Concepts, Arithmetic operations on intervals, Algebraic Properties of Interval Arithmetic, Width of an Interval, Interval Matrix Operations, Fuzzy Set Theory: Introduction, Fuzzy set, strong -cut and weak -cut, Convex fuzzy set, Normal fuzzy set, Height and core of a fuzzy set, Resolution Principle, Extension Principle, fuzzy number, Arithmetic operations on fuzzy numbers, Linguistic variables, Fuzzification and Defuzzification, Fuzzy Relations. Fuzzy Logic Theory: Classical logic, Boolean Algebra, Multi-Valued Logic, Fuzzy logic, Approximate Reasoning, Fuzzy Logic Rule Base.</p> <p>Fuzzy and expert control (standard, Takagi Sugeno, mathematical characterizations, design examples), Parametric optimization of fuzzy logic controller using genetic algorithm; System identification using fuzzy neural networks; Stability analysis: Lyapunov stability theory and Passivity Theory; Adaptive control using fuzzy neural networks, Applications to flight control, robot manipulator dynamic control, under actuated systems such as inverted pendulum and inertia wheel pendulum control.</p>			
VI	Text/References	<p>Ross, T. J., "Fuzzy Logic with Engineering Applications", Wiley India Pvt. Ltd., 3rd Ed.</p> <p>Zimmerman, H. J., "Fuzzy Set theory and its application", Springer, India Pvt. Ltd., 4th Ed.</p> <p>Klir, G. and Yuan, B., "Fuzzy Set and Fuzzy Logic: Theory and Applications", Prentice Hall of India Pvt. Ltd.</p> <p>Klir, G. and Folger, T., "Fuzzy Sets, Uncertainty and Information", Prentice Hall of India Pvt. Ltd.</p> <p>Guanrong Chen and Trung Tat Pham, "Introduction to fuzzy sets, fuzzy logic and fuzzy control systems" CRC Press, Boca Raton London New York Washington, D.C.</p>			