PANDIT DEENDAYAL PETROLEUM UNIVERSITY

SCHOOL OF TECHNOLOGY

COURSE STRUCTURE FOR B.TECH. ELECTRICAL ENGINEEING

SEMESTER VIII			**B.TECH. ELECTRICAL ENGINEEING**											
Sr. No	**Course Code**	**Course Name**	**Teaching Scheme**					**Exam Scheme**						
			L	**T**	**P**	**C**	**Hrs/wk**	**Theory**			**Practical**		**Total Marks**
								MS	**ES**	**IA**	**LW**	**LE/Viva**	
1	EE 429T	Electrical Machine Design - II	4	0	0	8	4	30	60	10	--	--	100
2	EE 430T	Electrical Power Utilization and Traction	3	0	0	6	3	30	60	10	--	--	100
	EE 430P		0	0	2	1	2	--	--	--	25	25	50
3	EE 431T	Digital Signal Processing	3	0	0	6	3	30	60	10	--	--	100
	EE 431P		0	0	2	1	2	--	--	--	25	25	50
4	EE 4xxT	Department Elective II	3	0	0	6	3	30	60	10	--	--	100
5	EE 434P	Major Project	0	0	12	6	12				100	50	150
6	EE 435T	Project Management	3	0	0	6	3	30	60	10	--	--	100
		Total	**16**	**0**	**14**	**40**	**32**	**150**	**300**	**50**	**150**	**100**	**750**

MS = Mid Semester, ES = End Semester; IA = Internal assessment (like quiz, assignments etc)

LW = Laboratory work; LE = Laboratory Exam

EE 429T Electrical Machine Design-II										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
4	-	-	8	4	30	60	10	-	-	100

UNIT I **18**

SYNCHRONOUS MACHINES DESIGN: Introduction, Choice of specific electrical loadings, Choice of specific magnetic loadings, Design of Salient pole machines: Output equations, Main dimension, Short Circuit Ratio, Effect of SCR on machine performance, Length of air gap and shape of pole face, Examples. **ARMATURE DESIGN:** Number of armature slots, Coil span, Turns per phase, Conductor section Slots dimension, Length of mean turn, Stator Core, Elimination of harmonics, Armature resistance and Leakage reactance, Estimation of air gap length, examples. Design of rotor, Height of pole, Design of damper winding, Height of pole shoe, Pole profile drawing , examples .Design of magnetic circuit. Determination of full load field MMF, examples. Design of field winding, examples. Determination of Direct and Quadrature axis synchronous reactance.

DESIGN OF TURBO ALTERNATORS: Main dimensions, Length of air gap, Stator and Rotor design.

UNIT II **18**

INDUCTION MACHINES DESIGN: Introduction, Choice of specific electrical loadings, Choice of specific magnetic loadings, Output equation, Separation of D & L, Examples

STATOR DESIGN: Turns per phase, Stator conductors, Shape of stator slots, Number of stator slots, Area of stator slots, Length of mean turn, Stator teeth, Stator core, examples, Length of air gap, Relation for calculation of length of air gap, Examples

SQUIRREL CAGE ROTOR DESIGN: Number of rotor slots, Rules for selecting rotor slots, Harmonic induction torque, Harmonic synchronous torque, vibration and noise, voltage ripples, Reduction of harmonic torques, Design of rotor bars & slots, Design of end rings, examples

WOUND ROTOR DESIGN: Number of rotor slots, number of rotor turns, area of rotor conductors, Rotor windings, Rotor teeth, check of rotor tooth density, design of rotor core, examples, Estimation of operating characteristics- No load current calculation, short circuit current calculation, Stator and rotor resistance and leakage reactance calculation, examples, Circle diagram, Dispersion coefficient – Effect on maximum power factor and overload capacity, Effect of change of air gap length, number of poles and frequency, Relation between D&L for best power factor, Performance calculation, examples

UNIT III **06**

DESIGN OF THREE PHASE INDUCTION MOTOR: Output equation, Choice of specific loadings, Main dimensions, Design of stator, Air gap length, Design of rotor, Operating characteristic and parameters,

DESIGN OF SINGLE PHASE INDUCTION MOTOR:Design of starting winding for split phase and capacitor start motor, examples

UNIT IV **10**

CONCEPT OF COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES and OPTIMIZATION: Introduction, Advantages and Limitations of Computer Aided Design**.** Different approaches for computer aided design**.** Selection of Optimal Design, Explanation of lowest cost and significance of Kg/ kVA Flowchart of electrical machines for overall design of d.c machine, transformer,

synchronous machines and induction machines.

TOTAL HOURS	**52**

Texts and References:

1. A. K. Sawhney and A. Chakrabarti, "***A course in Electrical machine design***", Dhanpat Rai and Co.
2. K M Vishnu Murthy, "***Computer Aided design of electrical machines***", B S Publications
3. M. G. Say, "***The performance and design of alternating current machines***", CBS Publishers and Distributors
4. Juha Pyrhonen, Tapani Jokinen, Valeria Hrabovsova, "***Design of rotating electrical machines***", Wiley publication
5. K. G. Upadhyay, "***Design of electrical machines***", New age international publishers
6. V. N. Mittal and A. Mittal, "***Design of electrical machine***s", Standard Publishers distributors
7. A. E. Fitzerald, Charles Kingsley, Stephen . D. Umans, "***Electric Machinery***", 6th Edition, Tata Mcgraw Hill

EE 430T Electrical Power Utilization and Traction										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	-	-	6	3	30	60	10	-	-	100

UNIT I **15**

ELECTRIC DRIVES: Type of electric drives, choice of motor**,** Starting characteristics of D.C. Series and shunt Motor, 3-phase induction motor, Soft Starters, Running characteristics of D.C, Series and shunt Motor, 3-phase induction motor**,** Speed control of D.C, Series and shunt Motor, 3-phase induction motor**,** Methods of electric braking, of D.C motor, and 3-phase induction motor, Mechanical features of electric drive, Load Equalization, Flywheel calculations, examples. Types of industrial loads, continuous, intermittent and variable loads, load equalization. Temperatures rise of electric drives beating And cooling curves, Standard ratings of motors, Examples Applications of electric drives and selection of drives for particular service, Energy efficient drives**,** Introduction to Vector Control**.**

UNIT II **09**

ELECTRIC HEATING: Advantages and methods of electric heating, Resistance heating.

INDUCTION HEATING: principle, types of induction furnaces, Direct core type, Vertical core type, Indirect core type, Core less type, Advantages and disadvantages.

DIELECTRIC HEATING: principles, advantages and disadvantages, applications, Eddy current heating, Applications examples.

ARC-FURNACE: principle, Types, direct and indirect arc furnaces, Power supply and control, Condition for maximum output, Examples.

ELECTRIC WELDING: Different types of resistance and arc welding Electric welding equipment, comparison between A.C. and D.C. Welding

UNIT III **15**

ELECTRIC TRACTION: Features of an ideal traction system, systems of electric traction Locomotives, Tramways, trolleys, Track electrification, Comparison between A.C and D.C systems of railway electrification Mechanism of train movement, speed-time curves Tractive effort, power, Output, examples., Energy output from driving axles, Energy output using simplified speed-time curves, Examples, Factors affecting energy consumption, dead weight, accelerating weight, Adhesion weight, examples. Traction motors and their characteristics, Speed control Schemes and Braking of traction motors.

TOTAL HOURS	**39**

Texts and References:

1. J. B. Gupta, "***Electrical Power Utilization***", S.K.Kataria and Sons
2. H. Partab, "***Electric Traction***", Dhanpatrai and sons
3. Taylor O, "***Electrical Power Utilization***", Longman Publications
4. B.L. Theraja, "***Electrical Power Utilization***", S Chand pub.
5. Wadhwa. C.L.,Generation, "***Distribution and utilization of electrical energy***", Wiley Eastern

Limited,1993.
6 Soni, Gupta, Bhatnagar, "***A Course in Electric Power***", Dhanapat Rai and sons, 2001.
7 S.L.Uppal, "***Electrical Power***", Khanna Pulishers, 1988.
8 G.K.Dubey. "***Fundamentals of Electrical Drives",*** Alpha Science International Limited.

EE 430P Electrical Power Utilization and Traction										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
--	**--**	**2**	**1**	**2**	**--**	**--**	**--**	**25**	**25**	**50**

List of Experiments:

1 Speed control of separately excited DC motor using controlled rectifier
(i) open loop (ii) closed loop
2 Chopper based speed control of separately excited DC motor
3 Brush Less DC motor control using PWM technique
4 Variable frequency control of induction motor with Sinusoidal PWM control
5 Variable frequency control of induction motor with Space Vector Modulation
6 To compare SPWM and SVM techniques
7 To study induction heating fundamentals and induction furnace
8 To study different types of electric welding systems
9 To compare A.C and D.C systems of railway electrification
10 To study different traction motors and their characteristics

EE 431T Digital Signal Processing										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **08**

Introduction: Introduction to Digital Signal Processing, Discrete – Time Signals and Systems, Introduction to LTI Systems

UNIT II **10**

Frequency Spectra of Signals: Frequency Analysis of Continuous-Time and Discrete-Time Signals, Frequency and Time Domain Signal Properties. The Discrete Fourier Transform: Its Properties and Applications, Efficient Computation of the DFT: Fast Fourier Transform Algorithm.

UNIT III **11**

DSP Controller: Introduction to the TMS320F2XXX DSP Controller, its architecture, C2XXX DSP CPU and Instruction Set, Assembly programming using the C2XXX DSP Instruction Set, General Purpose Input-Output Functionality in Brief, Introduction to Interrupts, The Event Managers

UNIT IV **10**

DSP Controller and Electric Motors: Electric Motor (Stepper Motor, DC Motor, PMSM, Induction Motor etc.) Control using TMS320F2XXXX.

TOTAL HOURS	**39**

Texts and References:

1. Richard G. Lyons, "***Understanding Digital Signal Processing***", Prentice Hall, 1996.
2. S. W. Smith, "***The Scientist and Engineer's and Guide to Digital Signal Processing***", California Technical Publishing, 1997.
3. John G. Proakis, Dimitris Manolakis, "***Digital Signal Processing - Principles, Algorithms and Applications***", Pearson.
4. Hamid A. Toliyat and Steven Campbell, "***DSP-based Electromechanical Motion Control***", CRC Press
5. Ashfaq Khan, "***Digital Signal Processing Fundamentals***", Charles River Media
6. John G. Proakis, "***A Self-Study Guide for Digital Signal Processing***", Prentice Hall.
7. Sanjit K. Mitra, ***"Digital Signal Processing",*** Mc-graw Hill, 2011.
8. Alan V. Openheim, ***"Discrete Time Signal Processing"***, Pearson Education India,2006.
9. www.ti.com

EE 431P Digital Signal Processing										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

List of Experiments:

1 Introduction to Signal Analysis

2 Write a program to generate periodic square wave from a Fourier series representation containing 25 harmonics. Analyze the effect of adding/removing harmonics on the generated waveform.

3 To study properties of Fourier Transform using MATLAB.

4 Demonstration of DFT using FFT function and without using FFT function using MATLAB.

5 To observe the frequency and phase spectra of square wave using MATLAB.

6 To study Evaluation board of DSP Controller.

7 To study various Addressing Modes.

8 To study how to write simple Assembly programs for DSP Controller.

9 To control Stepper Motor using DSP Controller.

10 To control Permanent Magnet Brushless DC Machines using DSP Controller.

EE 435T Project Management										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **07**

Overview of Project Management: Introduction to Project management, Characteristics of projects , Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Project management Process and role of Project Manager, Establishing Project organization

UNIT II **09**

Project Management concepts and techniques: Project screening and Selection Techniques, Structuring concepts and Tools (WBS, OBS, and LRC), Project Planning Tools (Bar charts, LOB, CPM, and PERT), Risk Analysis and Management.

UNIT III **12**

Project Cost Estimating: Types of Estimates and Estimating Methods, Project Budgeting.

Project Planning and Scheduling: Dynamic Project Planning and Scheduling, Project Scheduling with Resource Constraints, Resource Levelling and Resource Allocation

Project Monitoring and Control: Monitoring Techniques and time control System, Project Cost Control and Time cost Tradeoff, Crashing Heuristic

UNIT IV **11**

Project procurement Management: Project Procurement and Materials Management

Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management; Post Project Analysis.

Integrated Examples/Cases

TOTAL HOURS	**39**

Texts and References:

1. Shtub, Bard and Globerson, **"Project Management: Engineering, Technology, and Implementation"**, PH Inc.
2. Lock, Gower, **"Project Management Handbook"**.
3. Cleland and King, **"VNR Project Management Handbook"**.
4. Wiest and Levy, **"Management guide to PERT/CPM"**, PHI.
5. Horald Kerzner, **"Project Management: A Systemic Approach to Planning, Scheduling and Controlling",** CBS Publishers, 2002.
6. S. Choudhury, **"Project Scheduling and Monitoring in Practice"**.
7. P. K. Joy, **"Total Project Management: The Indian Context"**, Macmillan India Ltd.

Department Elective II

EE 432T Advances in Power System										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	-	-	6	3	30	60	10	-	-	100

UNIT I **16**

HVDC TRANSMISSION: HVDC system configuration and components**,** HVDC links**,** converter theory and performance equation**,** valve characteristic, converter circuit and its analysis with no ignition delay, with ignition delay, commutation overlap, Inverter equivalent circuits, Converter chart, converter transformer rating, multi bridge converters, abnormal operation of HVDC system, control of HVDC system, Converter firing control systems, harmonics and filters, Influence of AC system strength on AC/DC system interaction**,** HVDC light.

UNIT II **12**

FLEXIBLE AC TRANSMISSION SYSTEMS: Facts concept, basic types of FACTS controllers, difference between HVDC and FACTs, limitations of AC system, Advantages of FACTs, Static Shunt Compensators: (SVC and STATCOM), their V-I and V-Q characteristics, Static Series Compensators: (TCSC, GCSC, SSSC, TCPAR, TCPST), their vector diagram, active and reactive power equations, V-I and V-Q characteristics, Unified Power Flow Controller (UPFC), its application and vector diagrams**,** power flow injection model of STATCOM and TCSC

UNIT III **06**

SMART GRID: Concept of a smart grid, Real time information infrastructure power grid**,** Substation information architecture, wide area control Phasor measurement unit (PMU), its application , Optimal placement of PMU**,** Solutions for enhancing generation and transmission based on coherent real time data

UNIT IV **05**

DISTRIBUTED GENERATION : Various terms and definitions related to DG: Rating of DG, Power delivery area, Various technology, Environmental impact, Mode of operation, Ownership, Penetration of DG, Distributed resources, Distributed capacity, Distributed utility, Distribution network issues, Connection issues. Types of fuel cells, Probability-of-outage reliability analysis, reliability of combined DG and TandD systems, Monte Carlo analysis of generation.

TOTAL HOURS	**39**

Texts and References:

1 P. Kundur, "***Power system stability and control"***
2 Hingorani, "***Understanding FATS***", IEEE press
3 H. Lee Willis and Walter G. Scott, "***Distributed Power Generation: Planning and Evaluation-Power Engineering***"
4 Kimbark, "***Direct current transmission***", Wiley-interscience
5 V. Kamaraju, "***HVDC transmission***", Tata Mcgraw Hill
6 Padiyar, "***HVDC power transmission systems***", New age international

7 Padiyar, "Facts"

8 JanakaEkanayake, N. Jenkins, K. Liyanage, J. Wu, Akihiko Yokoyama, "***Smart Grid: Technology and Applications***", Wiley

EE 433T EHV AC AND DC TRANSMISSION										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **10**

INTRODUCTION : Need of EHV transmission, standard transmission voltage, comparison of EHV ac and dc transmission systems and their applications and limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC and DC transmission.

EHV AC TRANSMISSION: Corona loss formulas, corona current, audible noise – generation and characteristics corona pulses their generation and properties, radio interference (RI) effects, over voltage due to switching, feroresonance, reduction of switching surges on EHV system, principle of half wave transmission.

UNIT II **10**

EXTRA HIGH VOLTAGE TESTING: Characteristics and generation of impulse voltage, generation of high Ac and Dc voltages, measurement of high voltage by sphere gaps and potential dividers.

CONSIDERATION FOR DESIGN OF EHV LINES: Design factors under steady state limits, EHV line insulation design based upon transient over voltages. Effects of pollution on performance of EHV lines.

UNIT III **10**

EHV DC TRANSMISSION – I: Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters. Principle of dc link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of dc link.

UNIT IV **09**

EHV DC TRANSMISSION – II: Converter faults, protection against over currents and over voltages, smoothing reactors, generation of harmonics, ac and dc filters, Multi Terminal DC systems (MTDC): Types, control, protection and applications.

TOTAL HOURS	**39**

Text and References:

1 R. D. Begamudre, "***Extra High Voltage AC Transmission Engineering***", Wiley Eastern.

2 K. R. Padiyar, "***HVDC Power Transmission Systems: Technology and System Reactions***", New Age International.

3 J. Arrillaga, "***High Voltage Direct Current Transmission***", IFFE Power Engineering Series 6, Peter Peregrinus Ltd, London.

4 M. S. Naidu and V. Kamaraju, "***High Voltage Engineering***", Tata Mc Graw Hill.

5 M. H. Rashid, "***Power Electronics: Circuits, Devices and Applications***", Prentice Hall of India.
6 S. Rao, "***EHV AC and HVDC Transmission Engineering and Practice***", Khanna Publisher.
7 EPRI, Transmission Line Reference Book, 345 KV and above, Electric Power Research Institute. Palo Alto, California, 1982.