SHRI VENKATESHWARA UNIVERSITY

EVALUATION SCHEME

M.TECH

Power Electronics

(Two Years Post Graduation Programme)
I Semester

(w.e.f. 2019-20)

SCHOOL OF ENGINEERING & TECHNOLOGY

M.Tech (Power Electronics)

SEMESTER-I

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	MPE-101	Electric Drives System	3	0	0	20	10	30		70		100	3
2	MPE-102	Modeling and Analysis of Electrical Machines	3	0	0	20	10	30		70		100	3
3	MPE-011	Advanced Power Electronic Circuits	3	0	0	20	10	30		70		100	3
4	MPE-023	Power Semiconductor Devices & Modeling	3	0	0	20	10	30		70		100	3
5	MLC-101	Research Methodology and IPR	2	0	0	20	10	30		70		100	2
6	MPE-111	Electrical Drives Lab	0	0	4				25		25	50	2
7	MPE-112	Power Quality lab	0	0	4				25		25	50	2
8	AUD-101	English for Research Paper Writing	2	0	0	20	10	30		70		100	0
		Total										700	18

Course Objectives:

Students will be able to:

Understand Basic electrical drives and their analysis.

Learn Design of controller for drives.

Understand Scalar control of electrical drives.

Syllabus

Content

Dynamics of Electric Drives: Fundamentals of torque equation.Speed torque convention and ulti-quadrant operation, components of load torques.Classification of load torques steady state stability.

Load equation, Speed control and drive classification.Close loop control of drives.

DC motor Drives-Modeling of DC machines.Steady state characteristics with armature and speed control.

Phase controlled DC motor drives, chopper controlled DC motor drives.Poly-phase induction machines-Dynamic modeling of induction machines. Small signal equations, control characteristics of induction machines.Phase-controlled induction machines.Stator voltage control.

Slip energy recovery scheme, frequency control and vector control of induction motordrives.

Traction motor: Starting.Speed-Time characteristics.Braking.

Traction motors used in practice.Industrial Drives-Digital Control of Electric Drives.Stepper motor.Servo motor and their Applications.

Suggested reading

G.K, Dubey, "Power semiconductor controlled Drives", Prentice Hall international, New Jersey,1989.

R.Krishanam, “Electric motor drives modeling, analysis and control”, PHI-India-2009.

G. K. Dubey,“Fundamentals of electric Drives, Narosa Publishing House”, 2nd edition, 2011.

W. Leonhard, “Control of Electrical drives”, Springer, 3rd edition, 2001.

P.C. Krause –, “Analysis of Electric Machine”, Wiley-IEEE press 3rdedition.

K. Bose,“Modern Power Electronics and AC Drives”, Prentice Hall publication, 1st edition,2001.

Course Outcomes:

Students will be able to:

Model and simulate electric drive systems

Design modulation strategies of power electronics converters, for drives applicationDesign appropriate current/voltage regulators for electric drives

CORE-2: MODELING AND ANALYSIS OF ELECTRICAL MACHINES

Course Objectives:

Students will be able to:

To understand the operation of an electrical machine mathematically.

To understand how a machine can be represented as its mathematical equivalent.

To develop mathematical model of AC & DC machines and perform transient analysis on them.

Syllabus

Units	Content
	Principles of Electromagnetic Energy Conversion. General expression of stored magnetic energy. Co-energy and force/torque, example using single and doubly excited system. Basic Concepts of Rotating Machines-Calculation of air gap mmf and per phase machine inductance using physical machine data; Voltage and torque equation of dc machine.

Three phase symmetrical induction machine and salient pole synchronous machines in phase variable form
Application of reference frame theory to three phase symmetrical induction and synchronous machines
Dynamic direct and quadrature axis model in arbitrarily rotating reference frames.
Determination of Synchronous machine dynamic equivalent circuit parameters
Analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

Special Machines - Permanent magnet synchronous machine
Surface permanent magnet (square and sinusoidal back emf type) and interior permanent magnet machines
Construction and operating principle
Dynamic modelling and self-controlled operation.
Analysis of Switch Reluctance Motors.
Brushless D.C. Motor for space Applications
Recent trends.

Suggested reading

Charles Kingsle,Jr., A.E. Fitzgerald, Stephen D.Umans, "Electric Machinery", Tata Mcgraw Hill

R. Krishnan, "Electric Motor & Drives: Modeling, Analysis and Control", Prentice Hall of IndiaMiller,

T.J.E., "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press P.C.Krause

"Analysis of Electric Machine" Wiley IEEE Press 3rd Edition

Course Outcomes:

Students will be able to:
Knowledge about the dynamic behavior rotating machines. Able to understand equivalent circuit of synchronous machines.To understand various practical issues of different machines.

PE 1: ADVANCED POWER ELECTRONIC CIRCUITS

Course Objectives:

Students will be able to:

Understand the operation of advanced power electronic circuit topologies.

Understand the control strategies involved.

Learn few practical circuits, used in practice.

Syllabus

Units **Content**

Boost type APFC and control.

Three phase utility interphases and control-Buck, Boost, Buck-Boost SMPS Topologies.

Modes of operation –Push-Pull and Forward Converter Topologies - Voltage Mode Control.Half and Full Bridge Converters.Flyback Converter.

Introduction to Resonant Converters.

Load Resonant Converter. Zero Voltage Switching Clamped Voltage Topologies.
Resonant DC Link Inverters with Zero Voltage Switching.

High Frequency Link Integral Half Cycle Converter.

Modelling and design of DC-DC Converters for various renewable energy conversion.

Few power electronic circuits used in practice for controlling electric drives.

Suggested reading

Rashid "Power Electronics" Prentice Hall India 2007.

G.K.Dubey et.al "Thyristorised Power Controllers" Wiley Eastern Ltd., 2005, 06.

Dewan&Straughen "Power Semiconductor Circuits" John Wiley &Sons., 1975.

G.K. Dubey& C.R. Kasaravada "Power Electronics & Drives" Tata McGraw Hill., 1993Cyril W Lander "Power Electronics" McGraw Hill., 2005.

B. K Bose "Modern Power Electronics and AC Drives" Pearson Education (Asia)., 2007

Abraham I Pressman "Switching Power Supply Design" McGraw Hill Publishing Company.,2001.

Course Outcomes:

Students will be able to:

Knowledge about analysis and design of Load Commutated CSI and PWM CSILearn analysis and design of series Inverters.

Acquire knowledge about analysis and design of Switched Mode Rectifiers,APFC,DC-DC converters &Resonant converters

PE 2:POWER SEMICONDUCTOR DEVICES AND MODELING

Course Objectives:

Students will be able to:

Understand the concepts and basic operation of PWM converters, including basic circuit operation and design

Understand the steady-state and dynamic analysis of PWM converters along with theapplications like solid state drives and power quality

Units	Content
1.	Energy auditing: Types and objectives.Audit instruments- ECO assessment and Economic methods specificenergy analysis. Minimum energy paths-consumption models-Case study. Electric Motors-Energy efficient controls and starting Efficiency.Motor Efficiency and Load Analysis.Energy efficient /high efficient Motors Case study. Load Matching and selection of motors. Variable speed drives.Pumps and Fans-Efficient Control strategies.Optimal selection and sizing.Optimal operation and Storage: Casestudy. Transformer Loading/Efficiency analysis.Feeder/cable loss evaluation: Case study.Reactive PowerManagement.Capacitor Sizing-Degree ocompensation. Capacitor losses-Location-Placement Maintenance, Case study. Peak Demand controls MethodologiesTypes of Industrial loads Optimal LoadScheduling-case studyLighting- Energy efficient light sources. Energy conservation in Lighting Schemes. Electronic ballast-Power quality issues. Uminaries: case study Cogeneration-types and Schemes. Optimal operation of cogeneration plants-case study.Electric loads of Air conditioning &Refrigeration.Energy conservation measures. Cool storage. Types-optimal operation case study. Electric water heating, Gysers, Solar Water Heaters Power Consumption in Compressors. Energy conservation measures.

	Electrolytic Process. Computer Controls. Software-EMS.	

Suggested reading

Giovanni Petrecca,. "Industrial Energy Management: Principles and Applications", TheKluwerinternational series -207,1999

Anthony J. Pansini, Kenneth D. Smalling,. "Guide to Electric Load Management", Pennwell Pub;(1998)

Handbook on Energy Audit and Environment Management , Y P Abbi and Shashank Jain, TERI,2006

Handbook of Energy Audits Albert Thumann, William J. Younger, Terry Niehus, 2009.

Course Outcomes:

Students will be able to:

Acquire the background required for engineers to meet the role of energy managers and toacquirethe skills and techniques required to implement energy management.

Identify and quantify the energy intensive business activities in an organization.

Knowledge about standard methodologies for measuring energy in the workplace and energyaudit instruments.

Knowledge about energy efficient motors, load matching and selection of motors. Acquire knowledge about reactive power management, capacitor sizing and degree ofcompensation.

Research Methodology and IPR

Teaching Scheme

Lectures: 1hrs/week

Course Outcomes:

At the end of this course, students will be able to

Understand research problem formulation. Analyze research related information

Follow research ethics

Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and

---

social benefits.

Syllabus Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches,

analysisPlagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper

Developing a Research Proposal, Format of research proposal, a presentation andassessmentby a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Processof Patenting and Development: technological research, innovation, patenting, development.International Scenario: International cooperation on Intellectual Property. Procedure for grantsof patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditionalknowledge Case Studies,IPR and IITs.

References:

Stuart Melville and Wayne Goddard, "Research methodology: an introduction forscience &engineering students'"

Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.Mayall , "Industrial Design", McGraw Hill, 1992.Niebel , "Product Design", McGraw Hill, 1974.

Asimov , "Introduction to Design", Prentice Hall, 1962.

Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Propertyin NewTechnological Age", 2016.

T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

LAB 1- ELECTRICAL DRIVES LABORATORY

List of experiments:

Study of Thyristor controlled D.C Drive.Study of Chopper Fed DC Motor.Study of A.C single phase motor speed control using TRIAC.

PWM inverter fed three phase induction motor control using PSPICE/MATLAB/PSIMsoftware.VSI/CSI fed induction motor drive analysis using MATLAB/PSPICE/PSIM software.
Study of V/f control operation of three phase induction motor.
Study of permanent magnet synchronous motor drive fed by PWM inverter using software.Regenerative/ Dynamic breaking operatation for DC motor study using software.
Regenerative/ Dynamic breaking operatation for AC motor study using software.PC/PLC based AC/DC motor control operation.

Power Quality Lab

To study the effect of non linear loads on power quality.
To demonstrate the voltage and current distortions experimentally.To reduce the current harmonics with filters.To study the voltage sag due to starting of large induction motor.To study the capacitor switching transients.
To study the effect of balanced non linear load on neutral current , in a three phasecircuit

To study the effect of ground loop.To study the effect of voltage flicker . To calculate the distortion power factor.
Study the effect of harmonics on energy meter reading.To study effect of voltage sag on electrical

Select and implement the drives for Industrial Process
Implement various variable speed drives in Electrical Energy Conversion System

Code	Course Name	L-T-P	Cr.
AUD -101	English for Research Paper Writing	2-0-0	0

Course objectives: Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title

Syllabus- Content:

Unit No.	Content
1	Planning and Preparation, Word Order, Breaking up long sentences,Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and 4 Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.
4	key skills are needed when writing a Title, key skills are needed whenwriting an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature
5	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions useful phrases, how to ensure paper is as good as it could possibly be the 4 first- time submission.

Suggested Studies:

Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011