AISSMS
INSTITUTE OF INFORMATION TECHNOLOGY
(IOIT)
ADDING VALUE TO ENGINEERING
An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 5 UG Programmes

Program - Electrical Engineering

Structure and Detailed Curriculum

B. Tech with Honor Degree - Advanced Electrical Engineering

(With Effect from Academic Year 2024-25)

AISSMS INSTITUTE OF INFORMATION TECHNOLOGY
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BOS-ELECTRICAL ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Structure Honor Degree - Advanced Electrical Engineering

Sr. No.	Course Code	Course Name	Offered in Semester	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELHDT511	Advanced Power Electronics	V	3	--	--	**03**	40	60	--	--	--	**100**
2	ELHDT512	Advanced Power Electronics Lab @@	V	--	1	2	**02**	--	--	25	25	--	**50**
3	ELHDT611	Advanced Power System	VI	3	--	--	**03**	40	60	--	--	--	**100**
4	ELHDT612	Advanced Power System Lab	VI	--	--	2	**01**	--	--	--	--	25	**25**
5	ELHDT706	Advanced Control System	VII	3	--	--	**03**	40	60	--	--	--	**100**
6	ELHDT707	Advanced Control System Lab @@	VII	--	1	2	**02**	--	--	25	25	--	**50**
7	ELHDT802	Non-Conventional Energy Systems	VIII	3	--	--	**03**	40	60	--	--	--	**100**
8	ELHDT803	Non-Conventional Energy Systems Lab	VIII	--	--	2	**01**	--	--	--	--	25	**25**
Total				**12**	**02**	**08**	**18**	**160**	**240**	**50**	**50**	**50**	**550**

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B. TECH WITH HONORS			
Advanced Power Electronics (ELHDT511)			
Course Code :	ELHDT511	**Credit :**	03
Contact Hours :	3 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	40
2.	End-sem. Examination	External	60

Prerequisite:

1. Basic electronics engineering.
2. Basic Electrical Engineering.
3. Power Electronics

Course Objective:	
1	To impart knowledge of advanced converters like Resonant Converters, Resonant inverters, cyclo-converters.
2	To introduce concept of SMPS and its detailed analysis.
3	To explain Dynamics analysis of DC to DC converters.
4	To provide knowledge of different applications of power converters

Course Outcomes: Upon successful completion of this course, the students will be able to:	
ELHDT511.1	Reproduce the working principle of resonant converters.
ELHDT511.2	Design switched mode power supply.
ELHDT511.3	Reproduce the working principle of resonant inverters.
ELHDT511.4	Describe working of cyclo converters.
ELHDT511.5	Formulate dynamic equations of DC-to-DC converters.
ELHDT511.6	Use different converters for applications such as UPS, Electronic ballast etc.

Unit 01	:	**Resonant Converters**	**(06 Hrs)**
Introduction, need of resonant converters, Classification of resonant converters, Load resonant converters, Resonant switch converters, zero voltage switching dc-dc converters, zero current switching dc-dc converters, clamped voltage topologies.			
Unit 02	:	**Switch Mode Power Supply**	**(06 Hrs)**
Introduction, Linear power supplies, Overview of Switching power supplies, DC-DC Converters with electrical isolation, Control of Switch mode power supplies, Power supply protection. Design of SMPS.			

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Unit 03	:	**Resonant Inverters**	**(06 Hrs)**
Series and parallel resonant inverters - voltage control of resonant inverters – Class E resonant inverter – resonant DC – link inverters.			
Unit 04	:	**Cyclo-Converters**	**(06 Hrs)**
Review of Single phase and three phase cyclo-converters. Reduction in Output Harmonics. Power factor Control, Matrix Converter, output voltage control techniques, commutation methods. Power conditioners and UPS.			
Unit 05	:	**Dynamic Analysis of DC-DC Converters**	**(06 Hrs)**
Formulation of dynamic equation of buck and boost converters, averaged circuit models, linearization technique, small-signal model, and converter transfer functions.			
Unit 06	:	**Applications**	**(06 Hrs)**
Power line disturbances, EMI/EMC, power conditioners, Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS, Electronic ballast for fluorescent lighting, Active power filters.			

Textbooks:	
[T1]	"Power Electronics", MD Singh and K.B Khanchandani, McGraw Hill, third edition, 2008.
[T2]	"Power Electronics: Circuits Devices and Applications", M. H. Rashid, 3rd edition, Pearson/Prentice Hall Publications
[T3]	"Power Electronics Converters, Applications and Design", Ned Mohan, 3rd edition, Jonh Wiley, and Sons.
[T4]	"Power Electronics", M.S.Jamil Asghar, Prentice Hall of India private Ltd -2011.
[T5]	"Elements of Power Electronics", Philip T. krein, Oxford University Press – second edition, 2016.
Reference Books:	
[R1]	"Fundamentals of Power Electronics", R W Erickson and D Maksimovic, Springer, 2nd Edition, 2001.
[R2]	"Power Electronics – Concepts, applications and Design", Ned Mohan, Undeland and Riobbins, John Wiley and Sons, Singapore, 2000
[R3]	"Elements of Power Electronics" Philip T. Krein, Oxford University Press -2004.
[R4]	" Power Converters Circuits" William Shepherd and Li zhang, CRC Press, 2004.
[R5]	"Power- Switching Converters" Simon Ang and Alejandro Oliva, Taylor & Francis Group

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B. TECH WITH HONORS			
Advanced Power Electronics Lab (ELHDT512)			
Course Code :	ELHDT512	**Credit :**	02
Contact Hours :	1 Hr./Week (T) 2 Hrs./week (P)	**Type of Course :**	Tutorial/ Practical
Examination Scheme :	Term Work. Evaluation 25 Marks	Practical Examination 25 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	25
2.	Practical Examination	External	25

Prerequisite:

1. Basic electronics engineering.
2. Electrical circuit analysis
3. Knowledge of Power Electronics

Course Objective:

1	To impart knowledge of advanced converters like Resonant Converters, Resonant inverters, cyclo-converters.
2	To introduce concept of SMPS and its detailed analysis.
3	To explain Dynamic analysis of DC to DC converters.
4	To provide knowledge of different applications of power converters

Course Outcomes: Upon successful completion of this course, the students will be able to:

ELHDT512.1	Reproduce the working principle of resonant converters.
ELHDT512.2	Design switched mode power supply.
ELHDT512.3	Reproduce the working principle of resonant inverters.
ELHDT512.4	Describe working of cyclo converters.
ELHDT512.5	Formulate dynamic equations of DC-to-DC converters.
ELHDT512.6	Use different converters for applications such as UPS, Electronic ballast etc.

List of Tutorials: Any 8 of the following

1. Design of SMPS.
2. Power Quality problems produced due to Single phase-controlled Converter.
3. Power Quality problems produced due to Three phase-controlled Converter.
4. Design of three phase diode clamped multilevel inverter.
5. Design of three phase cascaded H-Bridge Multilevel inverter.
6. Numerical on single-phase series-resonant inverter.
7. Numerical on Cyclo-converters with R loads.
8. Numerical on Cyclo-converters with RL loads.
9. Numerical on Single Phase series inverter with R loads.
10. Numerical on Single Phase series inverter with RL loads.
11. Numerical on Single Phase Parallel inverter with R loads.
12. Numerical on Single Phase Parallel inverter with RL loads.

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List of Experiments:

Any eight experiments are to be performed.

1. Study and design of SMPS.
2. Power Quality Analysis (Harmonic and PF measurement) at AC side of Single-phase controlled Converter.
3. Power Quality Analysis (Harmonic and PF measurement) at AC side of Three phase-controlled Converter.
4. Performance analysis of three phase diode clamped multilevel inverter.
5. Performance analysis of three phase cascaded H-Bridge Multilevel inverter.
6. To study MOSFET/IGBT based single-phase series-resonant inverter.
7. To study Single Phase Cyclo converters with R and RL loads.
8. To study Single Phase series inverter with R and RL loads.
9. To study Single Phase Parallel inverter with R and RL loads.
10. To study resonant dc to dc converter.

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B. TECH WITH HONORS			
Advanced Power System (ELHDT611)			
Course Code :	ELHDT611	**Credit :**	03
Contact Hours :	3 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	40
2.	End-sem. Examination	External	60

Prerequisite:

1. Power System Engineering & Analysis

Course Objective:	
1	To explain different new trends in Power Systems
2	To explain advanced techniques in Power System operation and maintenance
3	To introduce concept of Artificial Intelligence

Course Outcomes: Upon successful completion of this course, the students will be able to:

ELHDT611.1	Understand operational issues and limitations of modern trends power systems.
ELHDT611.2	Understand the billing system for consumers of different utilities.
ELHDT611.3	Use the IoT for various application in power system.
ELHDT611.4	Use Artificial Intelligence in various application in power system.
ELHDT611.5	Use ANN in various application in power system.
ELHDT611.6	Use Data Analytics in each application.

Unit 01	:	**Modern Trends in Generation, Transmission and Distribution**	**(06 Hrs)**

Solar Power- Transparent Solar Photovoltaic cells, Flexible solar panels, High Temperature Low Sag (HTLS) Conductors and Optical Ground wire (OPGW) in transmission systems, One and half circuit breakers, Hybrid Switchgear, Numerical Bay in substation, Optical Current Transformer, Nitrogen Cooling System for transformer.

Unit 02	:	**kVAh billing systems**	**(06 Hrs)**

Need for kVAh billing system, Comparison with kWh billing systems, advantages, and constraints of kVAh billing system with respect to consumer and utility, kVAh billing tariff, Implementation of kVAh billing system in Maharashtra, Role of power factor improvement and reactive power compensation in kVAH billing systems, Power quality issues, Case study based on implementation of kWh billing system.

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Unit 03	:	**IoT based Power Systems**	**(06 Hrs)**
Concept of Internet of Things (IoT), Cloud computing, IoT based substation devices, On Line dissolve gas analysis, IoT based Protection systems, Virtual Energy Meters, Summation Meters			
Unit 04	:	**Artificial intelligence (AI) in Power Systems**	**(06 Hrs)**
Concept of AI, Advantages and scope, Types of AI- Expert systems, Fuzzy Logic systems, Robotics and neural networks Knowledge based systems at Substations, Fuzzy logic-based systems, Genetic Algorithms in Power Systems			
Unit 05	:	**Artificial Neural Networks (ANN) in Power Systems**	**(06 Hrs)**
ANN fundamentals: Biological neuron model, artificial neuron model, Static and dynamic artificial neuron models. ANN networks: Adaptive function estimators, weights, Inputs and bias. Activation functions. Single-layer ANN, Multi-layer ANN, Radial basis function neural network. Various ANNs and training strategies for different applications, Application of the error back propagation algorithm, Nodes, layers. Back propagation training and learning, ANN Applications in load frequency control in Power Systems, ANN based Electric drives			
Unit 06	:	**Data Analytics in Power Systems**	**(06 Hrs)**
Introduction to data analytics, central tendency- mean, mode, median and standard deviation, correlation and regression, clustering, decision tree analysis, Use of Data Analytics in Energy Management Systems			

Textbooks:	
[T1]	D. P. Kothari, I. J. Nagarath, "Modern Power System Analysis", McGraw Hill Publishing
[T2]	Turan Gonen, "Modern Power System Analysis", CRC Press
[T3]	Kosko B., "Neural Networks & Fuzzy Systems A dynamical systems approach to machine intelligence, Prentice Hall of India.
[T4]	Goldberg D.E. "Genetic Algorithms in Search Optimization & Machine Learning", Wesley Co., New York.
Reference Books:	
[R1]	Peter Vas, "Artificial-Intelligence-based Electrical Machines and Drives" Oxford University press, 2010
[R2]	Rajasekaran S. and Pai G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and applications, PHI New Delhi.
[R3]	John R. Neuenswander, "Modern Power Systems", International Textbook Company

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B. TECH WITH HONORS			
Advanced Power System Lab (ELHDT612)			
Course Code :	ELHDT612	**Credit :**	01
Contact Hours :	2 Hrs./week (P)	**Type of Course :**	Practical
Examination Scheme :	Oral Evaluation 25 Marks		

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Oral Examination	External	25

Prerequisite:
1. Power System Engineering & Analysis

Course Objective:	
1	To introduce different new trends in Power Systems
2	To explain advanced techniques in Power System operation and maintenance
3	To explain concept of Artificial Intelligence

Course Outcomes: Upon successful completion of this course, the students will be able to:	
ELHDT612.1	Understand operational issues and limitations of modern trends power systems.
ELHDT612.2	Understand the billing system for consumers of different utilities.
ELHDT612.3	Use the IoT for various application in power system.
ELHDT612.4	Use Artificial Intelligence in various application in power system.
ELHDT612.5	Use ANN in various application in power system.
ELHDT612.6	Use Data Analytics in each application.

List of Experiments:

Any eight experiments are to be performed from following list

1. Determination of efficiency of Solar PV cells at 100 KW Solar power plant at AISSMS, IOIT.
2. Computation of KVAH billed amount at AISSMS, Kennedy Road, Campus.
3. Study of one and half circuit breaker at 400 KV Substation.
4. Implementation of IoT based virtual energy meters.
5. Simulation of summation energy meters
6. Dissolve Gas Analysis using Kelman Kit.
7. Simulation and data analytics of substation data (Current, Voltage, Real Power and Energies)
8. Simulation of neural network for Power Flow in transmission network
9. Inspection of energy meters using Decision Tree approach.
10. Use of Data Analytics in Energy Management System.
11. Study of Nitrogen Injection System in Power Transformers.
12. Load Flow analysis using Machine Learning

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