

IV	<b>Unit IV</b> <b>THREE PHASE SYNCHRONOUS MOTORS</b> Review of Three phase Synchronous Motor and its performance, self controlled schemes, Variable frequency control of multiple synchronous motor, Permanent magnet AC motor drives, Brushless DC Motor Drives	9	Co4
V	<b>Unit V</b> <b>INDUSTRIAL APPLICATIONS</b> Electric traction, steel & cements plants, textile & paper mills, machine tool drive and CNC, electric cars. <b>SPECIAL DRIVES</b> Fundamentals of Switched reluctance motors, Stepper Motors, Permanent Magnet Motor, Digital control of drives.	9	CO5
Expert Lecture		1	
<b>Total Hours</b>		40	
<b>List of Experiments</b> <ol style="list-style-type: none"> <li>To study various types of load and selection of drive. (CO1)</li> <li>Dynamic Braking of D.C. shunt motor. (CO2)</li> <li>Dynamic Braking of 3 phase induction motor. (CO2)</li> <li>Counter current braking of D.C. shunt motor. (CO2)</li> <li>Counter current braking of 3 phase squirrel cage induction motor.(CO2)</li> <li>Speed control of D.C. motor using ward Leonard control method. (CO3)</li> <li>Speed control and direction control of separately excited dc motor using half controlled rectifier. (CO3)</li> <li>Speed Control of DC Motor using Chopper. (CO3)</li> <li>Vector Control method for three phase induction motor. (CO3)</li> <li>Study of Switch Reluctance Motor. (CO1).</li> <li>Three phase permanent magnet synchronous motor drive simulation using MATLAB (CO4).</li> <li>Three phase three level PWM converter simulation using MATLAB (CO4)</li> <li>Chopper fed DC motor drive simulation using MATLAB (CO4)</li> <li>Speed control DC Motor using BJT-H bridge simulation using MATLAB (CO4).</li> </ol>			
<b>TEXT BOOK:</b> <ol style="list-style-type: none"> <li>Dubey G. K. , "Fundamentals of Electrical Drives". Narosa Publishing House.</li> <li>Pillai S. K. "A first course on Electrical Drives", Second edition, Wiley Eastern.</li> </ol>			

**REFERENCE BOOKS:**

1. Bose B. K., "Power Electronics and AC Drives", Prentice-Hall.
2. Murphy M. D., and Tumbuli F., "Power Electronic Control of AC Motors", Pergamon Press, OxfordUniversity Press.
3. P.V. Rao, "Power semiconductor Drives", BS Publications
4. Krishnan, R, "Electric Motor Drives: Modeling, Analysis and Control " ,Prentice Hall of India, Second Edition , 2001.
5. Ned Mohan et al, "Power Electronics: Converters, Applications, and Design", John Wiley & Sons. Inc., 2nd Edition, 1995.
6. Werner Leonhard, "Control of electrical drives", Springer, 1995.
7. Dubey G. K., "Power Semiconductor Controlled Drives", Prentice-Hall, Englewood Cliffs!
8. De N.K., Sen P.K. "Electric Drives", Prentice Hall of India, Second Edition , 2001.

**Modes of Evaluation and Rubric**

Theory (60)	Midsem (20)	Assg (10)	Quiz (10)	Total (100)
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**List/Links of e-learning resource**

NPTEL/MOOCs

Recommendation by Board of studies on

Approval by Academic council on

Compiled and designed by

Sudhir Sharma

Subject handled by department

Electrical Engineering

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE  
(Engineering College), VIDISHA M.P.  
(An Autonomous Institute Affiliated to RGPV Bhopal)  
**Department of Electrical Engineering**



Semester/Year		V/III		Program			B.Tech				
Subject Category	DE	Subject Code:	EE- 602	Subject Name:			Power system Analysis & control				
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Quiz	Assig	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:			
Power system			
Course Objective:			
<ul style="list-style-type: none"> <li>To have an overview of interconnected power system problems and operations.</li> <li>To impart the knowledge of load flow study, numerical methods to solve the power flow problems.</li> <li>To study fault statistics in power system operative conditions.</li> <li>Evaluate the system performance based on stability, voltage, power, and frequency control.</li> </ul>			
Course Outcomes:			
<p>CO1. To have an overview of power system operations and control and restructured power system.</p> <p>CO2. To study load flow methods with their comparison, voltage Profile and VAR compensation.</p> <p>CO3. To analyse different types of faults in power system operations</p> <p>CO4. To enumerate stability analysis in power system and understand power system security.</p> <p>CO5. To understand power frequency dynamics and reactive power control.</p>			
UNITs	Descriptions	Hrs.	CO's
I	<b>General</b> - Problems associated with modern interconnected power systems, Need for operational studies, Load forecasting, Distributed generation, Power system restructuring, congestion, available transfer capacities.	6	CO1
II	<b>Power flow studies</b> – Bus classification, Bus admittance and impedance matrix, Formulation of static power flow equations and solutions using Gauss- Seidel, Newton Raphson and FDLF methods, comparison of these methods.	8	CO2
III	<b>Fault analysis</b> - Faults in power systems, single line diagram, equivalent impedance diagram, per unit reactances, Analysis (using matrices) of power systems by symmetrical components under: Three phase short circuit, LG fault, LL fault, LLG fault, sequence networks and their inter connections for different types of faults, effects of fault impedance.	10	CO3
IV	<b>Stability analysis</b> - Classification of power system stability, Swing equation , Swing curve , Power-Angle equation , Equal area criterion , Critical clearing angle and time, Classical step-by-step solution of the swing equation , modified Euler method, Power system security and security levels.	8	C04

V	<b>Load frequency and VAR control:</b> Basics of speed governing mechanism and modeling, speed - load characteristics, load sharing between two synchronous machines in parallel. Control area concept. Load Frequency Control of a single area and Two area system, Tie line control, Static and dynamic analysis of uncontrolled and controlled cases Basics of reactive power control, Methods of voltage control.	8	CO5
Expert Lecture		02	
<b>Total Hours</b>		40	
<b>Suggestive list of Experiments.</b>			
<ol style="list-style-type: none"> <li>To develop a program in Matlab for formation of Y-bus matrix for N bus system.</li> <li>Load flow solution for 3-bus system using Gauss- Seidel, Newton Raphson and FDLF methods up to 3 iteration.</li> <li>Load flow solution for IEEE 6-bus and 30-bus system in Matlab using Newton Raphson method.</li> <li>Assessment of transient stability of a single machine system.</li> <li>Effect of compensation on voltage profile of IEEE 6-bus system.</li> <li>Study of transient stability analysis using MATLAB/ETAP Software.</li> <li>Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the following cases: LG Fault, LLG Fault, LL Fault and 3-Phase Fault</li> <li>Study of any software tools (PSAT, EDSA, MY POWER, ETAP etc).</li> </ol>			
<b>Text Book:</b>			
<ol style="list-style-type: none"> <li>Modern Power System Analysis-by I.J. Nagrath &amp; D.P. Kothari, Tata McGraw Hill, fourth edition, 2015.</li> <li>Power System Analysis by Hadi Saadat – TMH Edition, 2009</li> <li>'Power System Analysis' by C.L. Wadhwa, New Age International- 6th Edition, 2010,</li> </ol>			
<b>Reference Books-</b>			
<ol style="list-style-type: none"> <li>Prabha Kundur, "Power system stability and control", Mc-Graw Hill Inc, New York.</li> <li>Taylor C.W., "Power System Voltage Stability", Mc-Graw Hill Inc, New York.</li> <li>Weedy B.M. "Electric Power System" John Wiley.</li> <li>D. Das "Electrical Power Systems", New Age International Publishers, 2006.</li> <li>J.J. Grainger and W.D Stevenson, "Power System Analysis", McGraw Hill, 2015.</li> <li>A Course In Power Systems - J.B. Gupta, edition 2021.</li> <li>Reactive power Control in Electric Systems-by T.J.E. Miller, John Wiley &amp; Sons.</li> <li>T.K. Nagsarkar, M.S. Sukhiza, "-Power System Analysis", Oxford University Press.</li> </ol>			
<b>Modes of Evaluation and Rubric</b>			

Theory (60)	Midsem (20)	Assg (10)	Quiz (10)	Total (100)
Practical (30)	Lab work (10)	Quiz (10)	-	Total (50)
<b>List/Links of e-learning resource</b>				
<a href="https://www.tutorialspoint.com/faults-in-electrical-power-systems-ndash-causes-and-effects">https://www.tutorialspoint.com/faults-in-electrical-power-systems-ndash-causes-and-effects</a> <a href="https://nptel.ac.in/courses/108106026">https://nptel.ac.in/courses/108106026</a> <a href="https://archive.nptel.ac.in/courses/108/101/108101040/">https://archive.nptel.ac.in/courses/108/101/108101040/</a> <a href="https://in.mathworks.com/matlabcentral/fileexchange/25307-power-system-stability-and-control">https://in.mathworks.com/matlabcentral/fileexchange/25307-power-system-stability-and-control</a> <a href="https://in.mathworks.com/matlabcentral/answers/465117-short-circuit-fault-newton-raphson-power-flow">https://in.mathworks.com/matlabcentral/answers/465117-short-circuit-fault-newton-raphson-power-flow</a>				
<b>NPTEL/Moocs</b>				
<a href="https://archive.nptel.ac.in/courses/108/105/108105067/">https://archive.nptel.ac.in/courses/108/105/108105067/</a> <a href="https://archive.nptel.ac.in/courses/108/106/108106026/">https://archive.nptel.ac.in/courses/108/106/108106026/</a> <a href="https://archive.nptel.ac.in/courses/108/105/108105104/">https://archive.nptel.ac.in/courses/108/105/108105104/</a>				
Recommendation by Board of studies on				
Approval by Academic council on				
Compiled and designed by		Dr. Shilpi Tomar		
Subject handled by department		Electrical Engineering		



 <b>SAMRAT ASHOK TECHNOLOGICAL INSTITUTE</b> (Engineering College), VIDISHA M.P. (An Autonomous Institute Affiliated to RGPV Bhopal) <b>Department of Electrical Engineering</b>									
Semester/Year		Program			B.Tech				
Subject Category	Subject Code:		Subject Name:		<b>PLC and Automation</b>				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	L	T	P	
End Sem	Mid-Sem	Quiz	End Sem	Lab-Work					
						3	1	-	4
<b>Prerequisites:</b>									
Basic Electrical Engineering, Electrical Machines, Power Electronics/Industrial Drives (preferred), Digital Electronics (for logic concepts)									
<b>Course Objective:</b>									
1. Understand fundamentals of industrial automation. 2. Study electrical control components (contactors, relays, timers, motors). 3. Learn PLC architecture, wiring. 4. Develop ladder logic programs using basic and advanced instructions. 5. Interface PLC with sensors, actuators, HMI and apply automation concepts to industrial systems.									
<b>Course Outcomes:</b>									
After successful completion, students will be able to:									
<b>CO1:</b> Describe electrical control components and basic automation systems.									
<b>CO2:</b> Explain PLC architecture, modules, and working principles.									
<b>CO3:</b> Develop ladder logic and PLC programs.									
<b>CO4:</b> Interface PLC with industrial equipment and understand communication protocols.									
<b>CO5:</b> Apply PLC and automation concepts to industrial applications.									
UNITS	Descriptions					Hrs.	CO's		
I	<b>Basics of Industrial Automation &amp; Control Components</b> Introduction to industrial automation, Types of automation, Contactors, Relays, Timers, Counters, Pushbuttons, Limit switches, Proximity sensors; Control circuits: NO/NC logic, interlocking, Motor control circuits: DOL starter, Forward–reverse, Star–Delta starter.					9	CO1		
II	<b>PLC Fundamentals</b> Introduction to PLC and its evolution, PLC architecture: CPU, Memory, Power supply, Digital and Analog I/O modules, PLC wiring, task execution, Types of PLCs, Advantages and Limitation, Applications. <b>Sequential Programming.</b>					9	CO2		
III	<b>PLC Programming Techniques (Ladder Logic)</b> IEC 61131-3 languages, Ladder diagram concepts: rungs, rails, contacts, coils; Basic instructions: NO/NC, output coils, latch/unlatch; Timers, Counters, Arithmetic, logical & comparison instructions, Programming examples: Motor start/stop, Interlock circuits.					9	CO3		
IV	<b>Advanced PLC Functions &amp; Interfacing</b> Analog signal handling (0–10V, 4–20mA), Sensor & actuator					9	CO4		



	interfacing, High-speed counters, Interrupts and special modules' PLC communication protocols: Modbus, Profibus, Ethernet/IP.		
V	<b>Industrial Automation Applications</b> SCADA: architecture, functions and components, VFD interfacing with PLC, Industrial robotics basics, Case studies: Bottle filling system, Conveyer sorting, Traffic light control, Temperature control.	9	CO5
Guest Lectures (if any)		1	
<b>Total Hours</b>		45	
Suggestive list of experiments:			
1. NA			
Text Book-			
<ul style="list-style-type: none"> <li>• Frank D. Petruzella — Programmable Logic Controllers, McGraw Hill</li> <li>• Hugh Jack — Automating Manufacturing Systems with PLCs</li> <li>• John W. Webb &amp; Ronald A. Reis — Programmable Logic Controllers</li> </ul>			
Reference Books-			
<ul style="list-style-type: none"> <li>• Gary Dunning — Introduction to PLCs</li> <li>• Madhuchhanda Mitra — Programmable Logic Controllers and Industrial Automation</li> <li>• Siemens / Allen-Bradley Manuals</li> </ul>			
Modes of Evaluation and Rubric			
List/Links of e-learning resource			
<ul style="list-style-type: none"> <li>• <a href="https://nptel.ac.in/courses/108105063">https://nptel.ac.in/courses/108105063</a></li> </ul>			
Recommendation by Board of studies on			
Approval by Academic council on			
Compiled and designed by		Prof. S. S. Thakur/ Dr. Jitendra Kumar Tandekar	
Subject handled by department		Electrical Engineering	

 <p style="text-align: center;"> <b>SAMRAT ASHOK TECHNOLOGICAL INSTITUTE</b>            (Engineering College), VIDISHA M.P.            (An Autonomous Institute Affiliated to RGPV Bhopal)  <b>Department of Electrical Engineering</b> </p>											
Semester/Year		VI/III		Program				B.Tech			
Subject Category	DC	Subject Code:		<b>EE-604</b>		Subject Name:		<b>Power Quality</b>			
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks	L	T	P	
ES	MS	Quiz	Assig	ES	LW	Quiz					
60	20	10	10	-	-	-	100	3	1	-	4
Prerequisites:											
Power System, power Electronics											
Course Objective:											
1. Outline of different loads in the system. 2. Mitigation & their occurrences 3. Different closed loop method for controlling 4. Active & passive filters											
Course outcome:											



At the end of this course, students will demonstrate the ability to

C01. Understand the fundamental concepts of power quality and voltage quality, Analyze the causes and effects of power quality problems.

C02. Recognize loads that cause power quality issues and explore the working principles, classification, and control strategies of passive and active compensation techniques, including DSTATCOM and active series compensators.

C03. Understand the role, classification, and operation of Unified Power Quality Compensators (UPQC) in addressing power quality issues and improving system performance.

C04. Learn to identify the causes and impacts of voltage sags, interruptions, and transient overvoltages, and understand the principles of protection, monitoring, and harmonic distortion in commercial and industrial environments.

C05. Develop an understanding of harmonic distortion evaluation, control principles, and the operation of active and passive filters for effective mitigation of harmonic issues in power systems.

UNITs	Descriptions	Hrs.	CO's
I	Introduction, power quality -voltage quality, power quality evaluations procedures term and definition: general classes of power quality problem, causes & effect of power quality disturbances.	8	CO1
II	Loads that cause power quality problems, State of art on Passive shunt and series compensation, Classification and working of passive shunt and series compensation, Classification, Principle and control of active shunt compensator: DSTATCOM and its control algorithm, Active series compensators, working and its control.	8	CO2
III	Introduction to unified power quality compensators, classification, working and operation of UPQC.	8	CO3
IV	Voltage sags and interruption: sources of sags and interruption, estimating voltages sag performance, fundamental principles of protection, monitoring sags. Transients over voltages: sources of transient over voltages, utility capacitor switching transients, fundamentals of harmonics and harmonics distortion, harmonics sources from commercial load and from industrial loads.	8	CO4
V	Applied harmonics: harmonics distortion evaluations, principles for controlling harmonics, harmonics studies devices for controlling harmonic distortion, Shunt active and passive filters, their operation and control.	8	CO5
Expert Lecture			

<b>Total Hours</b>		40	
Suggestive list of experiments:			
No Lab			
Text Book-			
<ol style="list-style-type: none"> <li>1. Power electronic converter harmonics –by Derek A. Paice</li> <li>2. Power quality problems and mitigation techniques: Bhimsingh, Amrish Chandra, Kamal Al-Haddad.</li> </ol>			
Reference Books-			
<ol style="list-style-type: none"> <li>1. Power Quality- by R.C. Duggan</li> <li>2. Power System harmonics –by A.J. Arrillga</li> </ol>			
Modes of Evaluation and Rubric			
Theory (60)	Attendance (10)	Midsem (10 + 10)	Performance (10) Total (100)
List/Links of e-learning resource			
Coursera -			
Recommendation by Board of studies on			
Approval by Academic council on			
Compiled and designed by		Deepti Jain	
Subject handled by department		Electrical Engg. Deptt.	

 <p style="text-align: center;"><b>SAMRAT ASHOK TECHNOLOGICAL INSTITUTE</b> (Engineering College), VIDISHA M.P. (An Autonomous Institute Affiliated to RGPV Bhopal) <b>Department of Electrical Engineering</b></p>											
Semester/Year			VI/III			Program			B.Tech		
Subject Category		OE	Subject Code:		EE- 605 (A)	Subject Name:		SCADA & PLC applications			
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Quiz	Assig	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	0	0	3
Prerequisites:											
Course Objective:											



<ul style="list-style-type: none"> <li>To understand SCADA systems, its components and architecture,</li> <li>To have overview of PLC and its Programming</li> <li>To analyze applications of SCADA and PLC in different sectors.</li> </ul>			
Course Outcomes:			
<p>CO6. To understand SCADA and its components &amp; configuration.  CO7. To demonstrate various SCADA architectures , SCADA interfacing.  CO8. To brief PLC parts, wiring and modules.  CO9. To focus on PLC programming.  CO10. To analyze SCADA and PLC applications.</p>			
UNITs	Descriptions	Hrs.	CO's
I	<b>Introduction to SCADA:</b> Introduction, Communication requirements, Desirable Properties of SCADA system, features, advantages, disadvantages of SCADA, SCADA components and communication.	8	CO1
II	<b>SCADA Architecture-</b> Various SCADA Architectures, advantages and disadvantages of each system, single unified standard architecture IEC 61850 SCADA / HMI Systems. SCADA configuration & Interfacing.	8	CO2
III	<b>Intoduction to PLC:</b> Overview of PLC systems, parts of PLC, Input/Output modules, power supplies and isolators, Fundamental PLC wiring diagram, relays, switches, transducers, sensors, seal-in circuits.	8	CO3
IV	<b>Programming of PLC:</b> Fundamentals of logic, PLC programming languages. Ladder diagrams, Ladder Diagram Instruction, Logic functions, Latching, Multiple outputs. Interfacing of PLC with various circuits.	8	C04
V	<b>SCADA &amp; PLC Applications:</b> SCADA system in petrol refining process, chemical plant, conventional electric power generation. PLC application in different sectors-bottle filling plant, elevator. Case studies and implementation.	8	CO5
Expert Lecture		02	
<b>Total Hours</b>		40	

**Text Book:**

1. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd Edition.
2. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition.

**Reference Books-**

- 1 Stuart A. Boyer: "SCADA- Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, The Instrumentation system and Automation Society, 4th Edition, 2010.
2. Gordon Clarke, Deon Reynders" Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes An imprint of Elsevier Publications, 1st Edition, 2004
3. Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition.
4. Gordan Clark, Deem Reynders, "Practical Modern SCADA Protocols", ELSEVIER.
5. P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications.
6. John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers.
7. L.A. Bryan, E. A. Bryan, "Programmable Controllers Theory and Implementation" Industrial Text Company Publication, Second Edition.
8. Stuart A Boyer, "SCADA supervisory control and data acquisition", ISA, 4th Revised edition

**Modes of Evaluation and Rubric**

Theory (60)	Midsem (20)	Assg (10)	Quiz (10)	Total (100)

**List/Links of e-learning resource**

[https://scadahacker.com/library/Documents/ICS\\_Basics/Automation](https://scadahacker.com/library/Documents/ICS_Basics/Automation)  
[https://cdn.eit.edu.au/cms/images/Webinar\\_Slides/03\\_SK\\_Chapter-01\\_r4.pdf](https://cdn.eit.edu.au/cms/images/Webinar_Slides/03_SK_Chapter-01_r4.pdf)  
<https://nptel.ac.in/courses/108105063>  
<https://www.youtube.com/watch?v=a0lCy5Q7n88>

**NPTEL/Moocs**

<https://www.youtube.com/watch?v=MS3qJq2jvu0>

Recommendation by Board of studies on

Approval by Academic council on

Compiled and designed by

Dr. Shilpi Tomar

Subject handled by department

Electrical Engineering

 <p style="text-align: center;">SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P. (An Autonomous Institute Affiliated to RGPV Bhopal) <b>Department of Electrical Engg.</b></p>											
Semester/Year		VI/III		Program				B.Tech			
Subject Category	Open Elective	Subject Code:	OE-605		Subject Name:		<b>Energy audit &amp; management</b>				
Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks	L	T	P	
ES	MS	Quiz	Assig	ES	LW	Quiz					L
60	20	10	10				100	3	1	0	4
<b>Prerequisites:</b>											
<b>Pre-requisites:</b> Non conventional energy source, thermodynamics and laws, energy utilization, Electric Machines.											
<b>Course Objective:</b>											
<b>Course Objective -</b>											
<ol style="list-style-type: none"> <li>To discuss energy problem and scope for conservation, energy audit and its types.</li> <li>To motivate the students of energy auditing instruments.</li> <li>To realize the importance of thermal insulation, waste heat, recovery techniques and co-generation.</li> <li>DSM and its program, payback period and cost benefit analysis.</li> <li>To explain the of energy efficient motors.</li> </ol>											
<b>Course Outcomes:</b>											
After successful completion of this course students will able to:											
<ol style="list-style-type: none"> <li>Able to calculate energy loss and understand energy patterns.</li> <li>Able to examine energy audit technique and instruments.</li> <li>Will be aware of thermodynamics laws, types of maintenance and energy conservation economic evaluations.</li> <li>Can understand energy efficient motors and drives</li> <li>Will understand cogeneration and energy conservation aspects in industries.</li> </ol>											
UNITs	Descriptions							Hrs.	CO's		



I	<b>UNIT-I</b> General energy problem: Energy use patterns and scope for conservation. Energy audit: Energy monitoring, Energy accounting and analysis, Auditing and targeting. Energy conservation policy, Energy management & audit, Energy audit, Types of energy audit, energy management (audit), qualities and function of energy managers, language of an energy manager, Questionnaire, Check list for top management, Loss of energy in material flow, energy performance, Maximizing system efficiency, Optimizing, input energy requirements, Energy auditing instruments, Material load energy balance diagram.	8	CO1
II	<b>Unit-II</b> Thermodynamics of Energy Conservation. Basic principle. Irreversibility and second law efficiency analysis of systems. Primary energy sources, optimum use of primemovers, energy efficient house keeping, energy recovery in thermal systems, waste heat recovery techniques, thermal insulation. Thermal energy audit in heating, ventilation and air conditioning. Maintenance and Predictive and preventive maintenance, lubrication and tribo-logical innovations.	10	CO2
III	<b>Unit-III</b> Load curve analysis & load management DSM, Energy storage for power systems (Mechanical, Thermal, Electrical & Magnetic) Restructuring of electric tariff from energy conservation consideration, Economic analysis depreciation method, time value of money, Evaluation method of projects, replacement analysis, special problems inflation risk analysis. Pay back period, Energy economics, Cost Benefit Risk analysis, Pay back period.	8	CO3
IV	<b>UNIT-IV</b> Energy efficient electric drives, Energy efficient motors V.S.D. power factor improvement in power system. Energy Conservation in transportation system especially in electric vehicle. Energy flow networks, Simulation & modeling, formulation & Objective & constraints, alternative option, Matrix chart.	7	CO4
V	<b>Unit-V</b> Energy conservation task before industry, Energy conservation equipments, Co-Generation, Energy conservation process, Industry Sugar, Textiles, Cement Industry etc Electrical Energy Conservation in building, heating and lighting. domestic gadgets	7	CO5
Expert Lecture			
<b>Total Hours</b>		40	



Suggestive list of experiments:				
NA				
Text Book-				
<ol style="list-style-type: none"> <li>1. Energy Management Head Book- W.C. Turner, John Wiley</li> <li>2. Energy conservation and management-Surah Kumar Soni, Manoj Nair, Edition 4, Satya Prakash</li> </ol>				
<ol style="list-style-type: none"> <li>1. Energy Management – W.R. Murphy &amp; G. Mckey Butler worths.</li> <li>2. Energy Management Principles- Craig B. Smith, Pergamon Press</li> <li>3. Energy Conservation- Paul O Callagan- Pergamon Press</li> <li>4. Design &amp; Management of energy conservation. Callaghan</li> <li>5. Elect, Energy Utilization &amp; Conservation. Dr. Tripathi S.C</li> </ol>				
Modes of Evaluation and Rubric				
Theory (60)	Midsem (20)	Assg (10)	Quiz (10)	Total (100)
List/Links of e-learning resource				
<ul style="list-style-type: none"> <li>● NPTEL</li> </ul>				
Recommendation by Board of studies on			20 <sup>th</sup> December 2024	
Approval by Academic council on				
Compiled and designed by			Prof. Sudhir Sharma	
Subject handled by department			Electrical Engg.	