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POORNIMA
COLLEGE OF ENGINEERING

COURSE FILE

- **Name of faculty:** Dr. Gaurav Jain
- **Class- Sem:** B.Tech – VI Sem
- **Branch:** Electrical Engineering
- **Course Code:** 6EE4-04
- **Course Name:** Electrical Energy Conservation & Auditing (EECA)
- **Session:** 2023-24

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

SYLLABUS

4nd Year - VI Semester: B. Tech. (Electrical Engg.)

6EE4-04:Electrical Energy Conservation & Auditing

Credit: 3 **Max. Marks: 100(IA:30, ETE:70)**

3L+0T+0P **End Term Exam: 3 Hours**

SYLLABUS

1 Introduction: Objective, scope and outcome of the course.

2 Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

3 Basics of Energy and its Various Forms: Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

4 Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

5 Energy Efficiency in Electrical Systems: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

6 Energy Efficiency in Industrial Systems: Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency

operating limits, solar PV and wind farm behaviour during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

7 Energy Efficient Technologies in Electrical Systems Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

Text Books

1 Energy management audit and conservation By Barun Kumar De
2 Energy Conservation and Audit By B.P. Patil

Reference Books

1 Non-Conventional Energy Source By G. D. Rai
2 Energy Management and Conservation By K.V. Sharma
3 Power System Engineering By J.B. Gupta
4 Efficiency Evaluation of Energy System By Mehmet Kanoglu

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

ABC Analysis

Course: B. Tech. **Class/Section: VI SEM** **Date: 19.2.2024**
Name of Faculty: DR. GAURAV JAIN **Name of Subject: EECA** **Subject Code: 6EE4-04**

Unit No.	CO	Category A	Category B	Category C
1	CO1	Energy pricing, energy sector reforms, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future	Final energy consumption, energy needs of growing economy, long term energy scenario, Energy Conservation Act-2001 and its features.	Commercial and Non-commercial energy, primary energy resources, commercial energy production, air pollution, climate change, energy and environment
2	CO2	Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives	Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity	Electricity tariff, load management and maximum demand control, power factor improvement
3	CO3	Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.	Bench marking, energy performance, matching energy use to requirement, Maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs
4	CO4	Energy saving opportunities with energy efficient motors, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses	Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues	Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit
5	CO5	Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation	voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances	Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

INSTITUTE VISION AND MISSION

VISION

To create knowledge based society with scientific temper, team spirit and dignity of labor to face the global competitive challenges.

MISSION

To evolve and develop skill based system for effective delivery of knowledge so as to equip young professionals with dedication & commitment to excellence in all spheres of life.

ELECTRICAL DEPARTMENT VISION AND MISSION

VISION

To be a model of excellence in Professional Education and Research by creating electrical engineers who are prepared for lifelong engagement in the rapidly changing fields and technologies with the ability to work in team.

MISSION

- To provide a dynamic environment of technical education wherein students learn in collaboration with others to develop knowledge of basic and engineering sciences.
- To identify and strengthen current thrust areas based upon informed perception of global societal issues in the electrical and allied branches.
- To develop human potential with intellectual capability who can become a good professional, researcher and lifelong learner.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

- **PEO 1**: Graduates will have the ability to formulate, analyze and apply design process using the basic knowledge of engineering and sciences to solve complex electrical engineering problems.
- **PEO 2**: Graduates will exhibit quality of leadership, teamwork, time management, with a commitment towards addressing societal issues of equity, public and environmental safety using modern engineering tools.
- **PEO 3**: Graduates will possess dynamic communication and have successful transition into a broad range of multi-disciplinary career options in industry, government and research as lifelong learner.

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

- **PSO1:** Graduate possesses the ability to apply fundamental knowledge of basic sciences, mathematics and computation to solve the problems in the field of electrical engineering for the benefit of society.
- **PSO2:** Graduate possesses the ability to professionally communicate and ethically solve complex electrical engineering problems using modern engineering tools.
- **PSO3:** Graduate possesses sound fundamental knowledge to be either employable or develop entrepreneurship in the emerging areas of renewable and green energy, electric and hybrid vehicles and smart grids and shall be susceptive to life- long learning.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF KEY PHRASES OF THE INSTITUTES MISSION STATEMENT WITH THE KEY PHRASES OF INSTITUTES VISION STATEMENT
(Institution Mission Vs Institute Vision)

Key Phrases of the Mission Statement of the Institute	**Key Phrases of the Vision Statement of the Institute**		
	IV_1: To create knowledge based society with scientific temper	**IV_2:** Team spirit	**IV_3:** To face the global competitive challenges
IM_1: Skill based systems for effective delivery of knowledge	**2**	**3**	**2**
IM_2: To equip young professionals with dedication		**1**	**1**
IM_3: Excellence in all spheres of life	**1**		**3**

MAPPING OF KEY PHRASES OF THE DEPARTMENTS VISION STATEMENT WITH THE KEY PHRASES OF INSTITUTES MISSION STATEMENT
(Department Vision Vs Institution Mission)

Key Phrases of the Vision Statement of the Department	**Key Phrases of the Mission Statement of the Institute**		
	IM_1: Skill based systems for effective delivery of knowledge	**IM_2:**To equip young professionals with dedication	**IM_3:** Excellence in all spheres of life
DV_1: To be a model of excellence in Professional Education	**3**	**3**	**3**
DV_2: Lifelong engagement in the rapidly changing fields	**3**		**3**
DV_3: The ability to work in team		**3**	**3**

MAPPING OF KEY PHRASES OF THE DEPARTMENTS MISSION STATEMENT WITH THE KEY PHRASES OF DEPARTMENTS VISION STATEMENT (Department Mission Vs Department Vision)

Key Phrases of the Mission Statement of the Department	Key Phrases of the Vision Statement of the Department		
	DV_1: To be a model of excellence in Professional Education	**DV_2:** Lifelong engagement in the rapidly changing fields	**DV_3:** The ability to work in team
DM_1: **D**ynamic environment of Technical Education, Collaborative learning	**3**	**2**	**2**
DM_2: Current thrust areas based on global societal needs	**3**	**2**	
DM_3: Good professional, researcher and lifelong learner	**2**	**2**	

MAPPING OF PEOS WITH KEY PHRASES OF DEPARTMENTS MISSION STATEMENT (PEO Vs Department Mission)

PEO Statements	Key Phrases of the Mission of the Department		
	DM1: Dynamic environment of Technical Education, Collaborative learning	**DM2:** Current thrust areas based on global societal needs	**DM3:** Good professional, researcher and lifelong learner
Graduates will have the ability to formulate, analyze and apply design process using the basic knowledge of engineering and sciences to solve complex electrical engineering problems.	**3**		**3**
Graduates will exhibit quality of leadership, teamwork, time management, with a commitment towards addressing societal issues of equity, public and environmental safety using modern engineering tools.	**3**	**2**	**2**
Graduates will possess dynamic communication and have successful transition into a broad range of multi-disciplinary career options in industry, government and research as lifelong learner.	**2**	**2**	**1**

MAPPING OF PSO WITH KEY PHRASES OF DEPARTMENTS MISSION STATEMENT

(PSO Vs Department Mission)

PSO Statements	Key Phrases of the Mission of the Department		
	DM1: Dynamic environment of Technical Education, Collaborative learning	**DM2:** Current thrust areas based on global societal needs	**DM3:** Good professional, researcher and lifelong learner
PSO1: Graduate possesses the ability to apply fundamental knowledge of basic sciences, mathematics and computation to solve the problems in the field of electrical engineering for the benefit of society.	**3**	**1**	
PSO2: Graduate possesses the ability to professionally communicate and ethically solve complex electrical engineering problems using modern engineering tools.	**1**	**2**	**2**
PSO3: Graduate possesses sound fundamental knowledge to be either employable or develop entrepreneurship in the emerging areas of renewable and green energy, electric and hybrid vehicles and smart grids and shall be susceptive to life- long learning.	**1**	**1**	**1**

MAPPING OF PEO WITH KEY PHRASES OF PO (PEO Vs PO)

PO/PEO	1. Engineering knowledge:	2. Problem analysis:	3. Design/development of solutions:	4. Conduct investigations of [illegible]:	5. Modern tool usage:	6. The engineer and society:	7. Environment and sustainability:	8. Ethics:	9. Individual and team work:	10. Communication:	11. Project management and [illegible]:	12. Life-long learning:
PEO 1: Graduates will have the ability to formulate, analyze and apply design process using the basic knowledge of engineering and sciences to solve complex electrical engineering problems.	**3**	**3**	**3**	**2**								**2**
PEO 2: Graduates will exhibit quality of leadership, teamwork, time management, with a commitment towards addressing societal issues of equity, public and environmental safety using modern engineering tools.					**3**	**3**	**3**	**2**	**3**		**3**	**2**
PEO 3: Graduates will possess dynamic communication and have successful transition into a broad range of multi-disciplinary career options in industry, government and research as lifelong learner.									**2**	**3**	**2**	**3**

MAPPING OF PSO WITH PEO (PSO Vs PEO)

PSO/PEO	PSO1: Graduate possesses the ability to apply fundamental knowledge of basic sciences, mathematics and computation to solve the problems in the field of electrical engineering for the benefit of society.	PSO2: Graduate possesses the ability to professionally communicate and ethically solve complex electrical engineering problems using modern engineering tools.	PSO3: Graduate possesses sound fundamental knowledge to be either employable or develop entrepreneurship in the emerging areas of renewable and green energy, electric and hybrid vehicles and smart grids and shall be susceptive to life-long learning.
PEO 1: Graduates will have the ability to formulate, analyze and apply design process using the basic knowledge of engineering and sciences to solve complex electrical engineering problems.	3		2
PEO 2: Graduates will exhibit quality of leadership, teamwork, time management, with a commitment towards addressing societal issues of equity, public and environmental safety using modern engineering tools.		3	1
PEO 3: Graduates will possess dynamic communication and have successful transition into a broad range of multi-disciplinary career options in industry, government and research as lifelong learner.		3	2

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engineering **Class/Section: 3rd Year/ Sec - A** **Date: 19.2.2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

COURSE OUTCOMES

After completion of course,

6EE4-04 (CO1) - Describe the energy scenario, energy strategy, energy laws, energy security and maximization of energy efficiency. [Apply]

6EE4-04 (CO2) - Identify energy conservation techniques and energy efficient technologies for developing electrical and industrial equipment. [Analyze]

6EE4-04(CO3) - Evaluate pricing, energy audit, energy management and energy balance of an industry or organization and its understanding.

6EE4-04 (CO4) - Develop methods of energy optimization, power factor improvement and fuel & energy substitution.

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DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engineering **Class/Section: 3rd Year/ Sec - A** **Date: 19 Feb 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

MAPPING OF CO WITH PO AND PSO

	After completion of course,	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1. Students will be able to describe the energy scenario in India.	3														
CO 2	2. Students will be able to apply energy conservation techniques for developing energy efficient equipment.	3														
CO 3	3. Students will be able to understand the develop methods of energy management.	3	3													
CO 4	4. Students will be able to prepare process flow of energy audit of an industry or organization.	2														

PO Strongly Mapped:

PO1: Engineering knowledge: Apply the knowledge of mathematics, Science, Engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO Moderately Mapped:

Nil

PO Low Mapped:

Nil

PSO Strongly Mapped:

Nil

PSO Moderately Mapped:

Nil

PSO Low Mapped:

Nil

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DEPARTMENT OF ELECTRICAL ENGINEERING

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Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

RULES FOR CO/LO ATTAINMENT LEVELS: (TARGETS)

Course Code	Level 3	Level 2	Level 1
6EE4-04	60 % of students getting > 60% marks	50-60 % of students getting > 60% marks	40-50 % of students getting > 60% marks

END TERM RTU COMPONENT: CO ATTAINMENT LEVELS

Course Code	Level 3	Level 2	Level 1
6EE4-04	50 % of students getting > 60% marks	40-50 % of students getting > 60% marks	30-40 % of students getting > 60% marks

S. No.	Course Type	Attainment Level=1	Attainment Level=2	Attainment Level=3
1	Mid Semester Exams	CO1, CO2, CO3, CO4	CO3, CO4	CO1, CO2, CO3, CO4
2	University Exam			
4	OBT	CO1, CO2	CO3	CO3, CO4
5	Assignment	CO2, CO4	CO2, CO3	CO1, CO2,
6	Quiz	CO1, CO4	Co3,CO4	CO1, CO2, CO4

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engineering **Class/Section: 3rd Year/ Sec- A** **Date: 19 Feb 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

CO WISE ASSESSMENT ACTIVITIES (AS MENTIONED IN SESSION PLAN)

CO	Assignment	Quiz 1	OBT	Mid 1	Mid 2
CO1	Y	Y	Y	Y	Y
CO2	Y	Y	Y	Y	Y
CO3	Y	Y	Y	Y	Y
CO4	Y	Y	Y	Y	Y

CO-PO/PSO MAPPING AND TARGETS SESSION 2023-24

CO	PO												Avg.	PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	CO Targets	PSO1	PSO2	PSO3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO 4	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engineering **Class/Section: 3rd Year/ Sec - A** **Date: 19 Feb 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

ACTIVITY WISE ASSESSMENT TOOLS SESSION 2023-24

Sr. No.	Activity	Assessment Method	Tools	Weightage Marks	Recommendation
1.	Class Test	Direct	Marks	20	For CO1-CO4
2.	Open Book Test	Direct	Marks	20	For CO1-CO4
3.	Quiz	Direct	Marks	20	For CO1-CO4
4.	Mid Term 1	Direct	Marks	60	For CO1-CO4
5.	Mid Term 2	Direct	Marks	60	For CO1-CO4

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engineering **Class/Section: 3rd Year/ Sec - A** **Date: 10 May 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

CO-GAP IDENTIFICATIONS

(SEC A)				
COs	CO 1	CO 2	CO 3	CO4
Target	**3**	**3**	**3**	**2**
Achieved	**-**	**2.85**	**2.85**	**1.97**
Gap	**-**	**0.15**	**0.15**	**0.03**

Gaps Identified:
1. Lack of basic engineering knowledge observed in students.
2. Inability to relate fundamental principles of engineering to the real problems
3. Technical communication was lacking among the students

OVERALL CO ATTAINMENT TABLE

COs	CO1	CO2	CO3	CO4
Attainment level as per rules	-	**2.85**	**2.85**	**1.97**
Average CO attainment through internal assessment	**2.56**			

Activities Decided to Bridge the Gap:

1. Imparting basic engineering knowledge through a practical approach needs to be focused more.
2. Video lectures and other resources for improving technical skills are to be shared on a common platform.
3. Language lab-related activities will be increased

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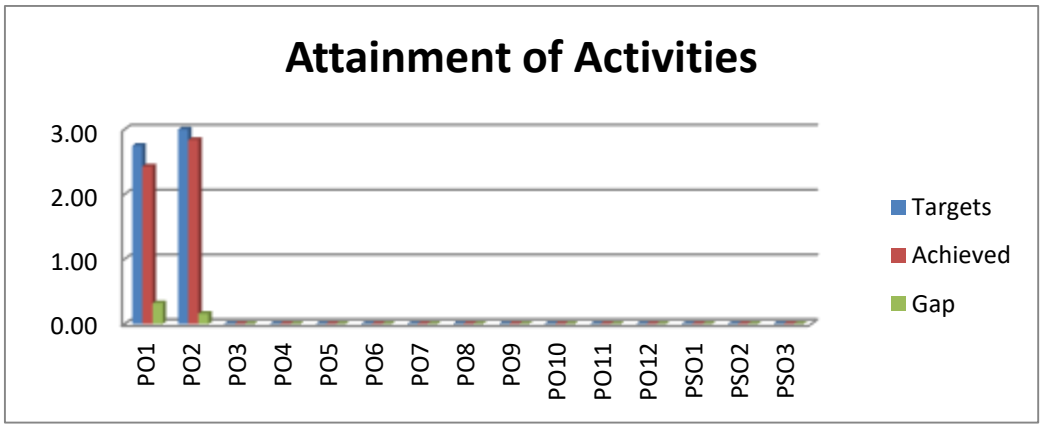
ATTAINMENT OF POS & PSO

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obtain Average-PO/PSO Targets	3	3													

PO GAP IDENTIFICATION (SEC A)

	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Targets	2.75	3.00	-	-	-	-	-	-	-	-	-	-	-	-	-
Achieved	2.43	2.84	-	-	-	-	-	-	-	-	-	-	-	-	-
Gap	0.32	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-



Gaps Identified:

Describe what the reasons for gap (for PO) are.

1. Some students showed less interest in application-based engineering because of a lack of imagination.
2. Problem-solving capability of students is not up to the Mark
3. Unable to relate theory to real-life problems.
4. Lack of awareness to the real-time problems of industry and process to design and develop the solution, considering public health & safety and cultural, societal and environmental considerations

Activities decided to Bridge the Gap:

1. Extra lectures on different types of problem analysis techniques need to be taken for improvement.
2. Practical will be performed on analysis-based topics.
3. Online course materials and lectures regarding modern tools will be focused on.
4. Interaction with professional bodies is to be increased.

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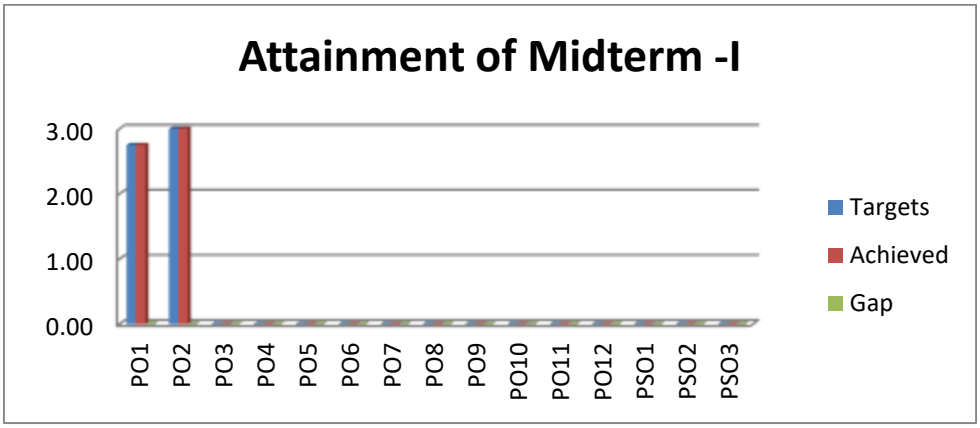
ATTAINMENT OF CO THROUGH MIDTERM -I COMPONENT

CO: 6EE4-04: EECA	
Target	**3.00**
Achieved	**2.99**
Gap	**0.01**

ATTAINMENT OF PO THROUGH CO (MIDTERM-I) COMPONENT

	Attainment of PO through CO(MIDTERM-I) Component														
6EE4-04	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Target	**2.75**	**3.00**	-	-	-	-	-	-	-	-	-	-	-	-	-
Achieved	**2.75**	**3.00**	-	-	-	-	-	-	-	-	-	-	-	-	-
Gap	**0.00**	**0.00**	-	-	-	-	-	-	-	-	-	-	-	-	-

Gaps in PO through CO from MIDTERM-I component: NA
Action to be taken: NA



Gaps for CO attainment through I Midterm Component:

1. Problem-solving capability of students is not up to the Mark
2. Lack of thorough approach of analysis observed.
3. Students did not realize the importance of the environment and its sustainability for the future generation.

Action to be taken:

1. Theory teaching will be focused more on complex problems.
2. Workshop and training programs will be arranged to improve the contribution of engineers to society.
3. Students were encouraged to actively participate in webinars, NPTEL online course

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ATTAINMENT OF CO THROUGH MIDTERM -II COMPONENT

CO: 6EE4-04: EECA	
Target	**3.00**
Achieved	**3.00**
Gap	**0.00**

Gaps for CO attainment through MIDTERM-II Component:

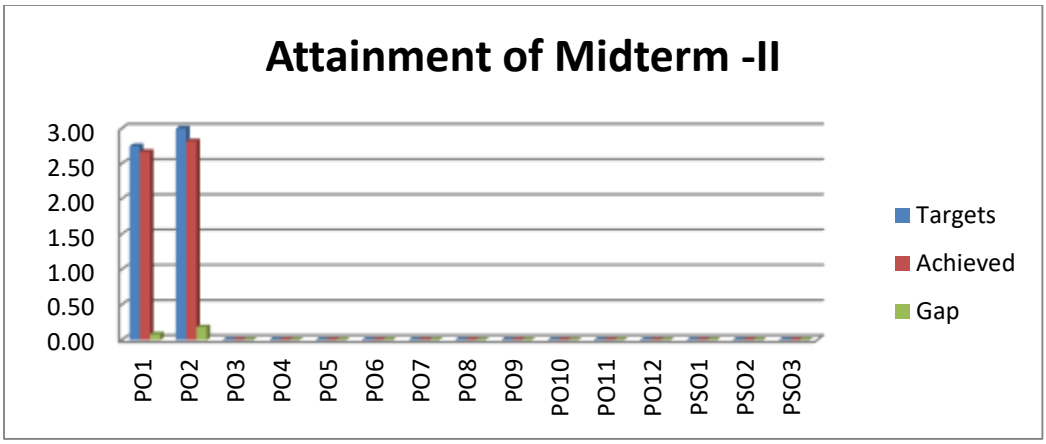
1. Problem-solving capability of students is not up to the Mark
2. Unable to relate theory to real-life problems.

Action to be taken:

1. Extra lectures on different types of problem analysis techniques need to be taken for improvement.

ATTAINMENT OF PO THROUGH CO (MIDTERM-II) COMPONENT

	Attainment of PO through CO(MIDTERM-II) Component														
6EE4-04	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Target	**2.75**	**3.00**	-	-	-	-	-	-	-	-	-	-	-	-	-
Achieved	**2.67**	**2.82**	-	-	-	-	-	-	-	-	-	-	-	-	-
Gap	**0.08**	**0.18**	-	-	-	-	-	-	-	-	-	-	-	-	-



Gaps Identified:

Describe what the reasons for gaps are

1. Students did not realize the importance of the environment and its sustainability for the future generation

<u>Activities decided to bridge the gap</u>

1. Students were encouraged to actively participate in webinars, NPTEL online course
2. Theory teaching will be focused more on complex problems

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engineering **Class/Section: 3rd Year/ Sec - A** **Date: 16 June 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

ATTAINMENT OF CO THROUGH RTU COMPONENT

CO: 6EE4-04: EECA	
Target	**3.00**
Achieved	**2.81**
Gap	**0.19**

Gaps for CO attainment through RTU Component:

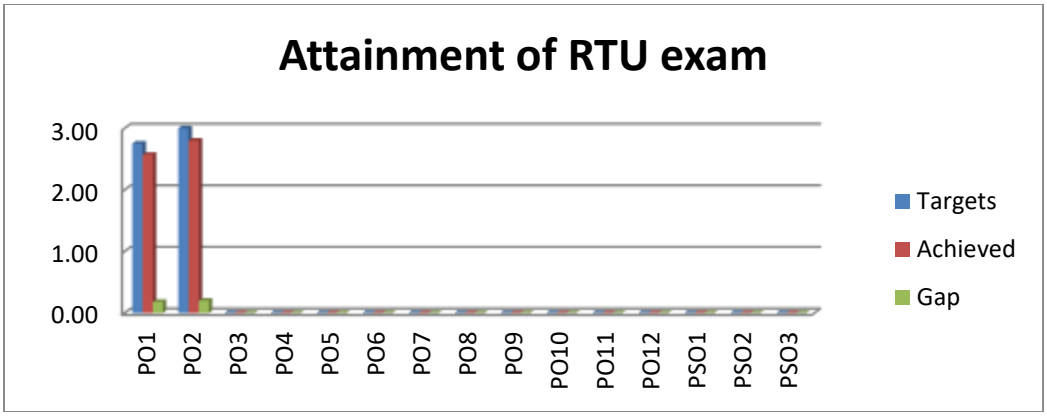
1. Problem-solving capability of students is not up to the Mark
2. Unable to relate theory to real-life problems.

Action to be taken:

1. Extra lectures on different types of problem analysis techniques need to be taken for improvement.

ATTAINMENT OF PO THROUGH CO (RTU) COMPONENT

	Attainment of PO through CO(RTU) Component														
6EE4-04	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Target	**2.75**	**3.00**	-	-	-	-	-	-	-	-	-	-	-	-	-
Achieved	**2.57**	**2.80**	-	-	-	-	-	-	-	-	-	-	-	-	-
Gap	**0.18**	**0.20**	-	-	-	-	-	-	-	-	-	-	-	-	-



Gaps Identified:
Describe what the reasons for gaps are
1. Problem-solving capability of students is not up to the Mark
2. Lack of thorough approach of analysis observed

Activities decided to bridge the gap

1. Students were encouraged to actively participate in webinars, NPTEL online course
2. Theory teaching will be focused more on complex problems

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engineering **Class/Section: 3rd Year/ Sec - A** **Date: 19 Feb 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

PERSONAL TIME TABLE

Poornima College of Engineering							
Department of Electrical Enginering							
Time Table(Dr. Gaurav Jain)							
Day/Time	**8:00-9:00**	**9:00-10:00**	**10:00-11:00**	**11:00-11:50**	**11.50-12.50**	**12.50-01.50**	**01.50-02.50**
Monday			6EE4-04,EECA (GJ)				
Tuesday							
Wednesday					6EE4-04,EECA (GJ)		
Thursday							6EE4-04,EECA (GJ)
Friday							
Saturday							

LUNCH

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: PCE Course: B.Tech.-EE Class/Section: 3rd year/ Sec-A Date: 19 Feb 2024
Name of Faculty: Dr. Gaurav Jain Name of Subject: EECA Code: 6EE4-04

COURSE PLAN –BLOWN UP

S. No.	Topic as per Syllabus	BLOWN UP TOPICS (Up to 10 TIMES SYLLABUS)
1.	**UNIT-I** **INTRODUCTION:** 1.1 Introduction	1.1.1 Introduction of Electrical Energy System 1.1.2 Scope of Energy Conservation 1.1.3 Overview of Auditing System
2.	**UNIT-II** **ENERGY SCENARIO:** 2.1 Commercial and Non-commercial energy, primary energy resources, commercial energy production	2.1.1 Introduction 2.1.2 Methods of Commercial and Non-commercial energy 2.1.3 Anvantage & Disadvantage of Commercial and Non-commercial energy 2.1.4 Types of Primary and Secondary energy sources 2.1.5 Introduction of Primary Energy source
	2.2 Energy needs of growing economy, long term energy scenario	2.2.1 Introduction of Energy Scenario 2.2.2 Energy factors for growing economy 2.2.3 Fundamental of long term energy system 2.2.4 General Mathematical Expression.
	2.3 Energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance	2.3.1 Define the Energy Pricing 2.3.2 Types of energy pricing 2.3.3 Effect of energy in the environment 2.3.4 Factor of Energy security 2.3.5 Introduction of energy conservation 2.3.6 Benefits of energy conservation
	2.4 Restructuring of the energy	2.4.1 Define Deregulation and Restructuring

	supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act	Market 2.4.2 Energy strategy for the future 2.4.3 Causes of air pollution 2.4.4 Reason of climate change 2.4.5 Electricity act 2003 2.4.7 Different Conservation Acts
3.	**UNIT-III** **Basics of Energy and its Various Forms** 3.1 Electricity tariff	3.1.1 Various Forms Of Energy • Potential Energy • Kinetic Energy • Energy Conversion • Grade of Energy 3.1.2 Nature and classification of Tariff • Calculation of Electricity bill for a company • Contract Demand • Maximum Demand • Time of Day Tariff
	3.2 Load management and maximum demand control	3.2.1 Prediction of Load • Load factor • Peak factor 3.2.2 Electrical Energy Basics for Load management and calculation
	3.3 Power factor improvement, selection & location of capacitors	3.3.1 Calculation of Power Factor 3.3.2 Methods of power factor improvement 3.3.2 Numarical of Power Factor
	3.4 Thermal Basics-fuels, thermal energy contents of fuel	3.4.1 Introduction 3.4.2 Contents of thermal fuels 3.4.3 Specific Heat
	3.5 Thermal Basics-Temperature & pressure, heat capacity, sensible and latent heat.	3.5.1 Temperature and Pressure 3.5.2 Heat, Units of Heat, Sensible Heat, Quantity of Heat 3.5.3 Phase change, Latent Heat, Humidity, Dew Point 3.5.4 Fuel Density, Viscosity, Calorific Value.
	3.6 Thermal Basics-evaporation, condensation, steam, moist air	3.6.1 Principle of operation. 3.6.2 Operating Design

	and humidity	3.6.3 Types of single effect evaporators 3.6.4 Multiple effect evaporators
	3.7 Heat transfer, units and conversion.	3.7.1 Conduction, convention and radiation 3.7.2 Electrical units and conversion
4.	**UNIT-IV** **Energy Management & Audit** 4.1 Definition, energy audit, need, types of energy audit	4.1.1 Types and Methodology of energy audit 4.1.2 Need for energy audit . 4.1.3 Types of energy audit.(Phase I,II,III)
	4.2 Energy management (audit) approach understanding energy costs, bench marking	4.2.1 Objective of energy management. 4.2.2 Detailed energy auditing 4.2.2.1 Pre audit Phase 4.2.2.2 Audit Phase. 4.2.2.3 Post audit phase. 4.2.3 Data Collection Hints 4.2.4 Bench marking and energy performance
	4.3 Energy performance, matching energy use to requirement, maximizing system efficiencies	4.3.1 Plant Energy Performance 4.3.1.1 Production Factor 4.3.1.2 Year equivalent Energy use 4.3.1.3 Monthly Energy Performance 4.3.2 Matching Energy usage to requirement 4.3.3 Study of maximize efficiency
	4.4 Optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	4.4.1 Optimization of Audit energy 4.4.2 Fuel Energy substitution 4.4.2.1 Case Study of fuel substitution 4.4.2.2 Types of fuel substitution 4.4.3 Energy Audit Instruments
	4.5 Material and Energy balance: Facility as an energy system	4.5.1 Basic principle of energy balance 4.5.2 The sankey diagram process
	4.6 Methods for preparing process flow	4.6.1 Continuous process 4.6.2 Blending process 4.6.3 Drying process
	4.7 Material and Energy balance diagrams.	4.7.1 Material balance. 4.7.1.1 Basics and Units 4.7.1.2 Total mass and composition 4.7.1.3 Numerical of material balance 4.7.2 Energy balance. 4.7.2.1 Heat balance

		4.7.2.2 Flow chart of energy balance 4.7.2.3 Facility as an Energy system 4.7.2.4 Cooling tower and cooling water supply system
5.	**UNIT-V** **Energy Efficiency in Electrical Systems** 5.1 Electrical system: Electricity billing.	5.1.1 Introduction 5.1.2. Energy Scenario 5.1.3. Electricity billing system. 5.1.3.1 Tariff structure 5.1.3.2 Temporary billing system 5.1.3.3 Prepaid electricity
	5.2 Electrical load management Maximum demand control, power factor improvement and its benefit.	5.2.1. Electrical load management Maximum demand control 5.2.1.1 Need of Electrical load management 5.2.1.2 Step by step approach of Maximum demand control 5.2.1.3 Rescheduling of load 5.2.1.4 Shedding of non-essential loads 5.2.1.5 Operation of capative generation and DG sets 5.2.1.6 Reactive power compensation
	5.3 Selection and location of capacitors, performance assessment of PF capacitors.	5.2.2. Power factor improvement and its benefit 5.2.2.1 Power factor basics 5.2.2.2 Improving power factor 5.2.2.3 Cost benefits of PF improvement 5.3.1 Direct relation for capacitor sizing 5.3.2 Capacitors for other loads 5.3.3 Performance assessment of power factor capacitor 5.3.3.1 Voltage Effect 5.3.3.2 Material of capacitor 5.3.3.3 Operational performance of capacitor
	5.4 Distribution and transformer losses.	5.4.1 Types of transformers 5.4.2 Rating of transformer 5.4.3 Location of transformer 5.4.4 Transformer losses and efficiency 5.4.5 Voltage fluctuation control 5.4.6 Parallel operation of transformer

		5.4.7 System distribution losses 5.4.8 Harmonics in transformers
	5.5 Electric motors: Types, losses in induction motors, motor efficiency	5.5.1 Introduction 5.5.2 Types of Motor 5.3.3.1 DC Motor 5.3.3.2 Induction motor 5.3.3.3 Synchronous motor 5.5.3 Motor Characteristics 5.5.4 Field test of Determining Efficiency 5.5.5 Pointers and Users 5.5.6 Motor Selection process
	5.6 Factors affecting motor performance, rewinding and motor replacement issues.	5.6.1 Factors affecting motor performance 5.6.1.1 Power supply quantity 5.6.1.2 Motor loading effect. 5.6.1.3 Reducing Under Loading 5.6.1.4 Sizing to variable load 5.6.1.5 Maintenance and age factor 5.6.2 Rewinding Effect on energy efficiency 5.6.3 Speed control of AC induction motor
	5.7 Energy saving opportunities with energy efficient motors.	5.7.1 Energy saving policies 5.7.2 Opportunities for saving the Energy system 5.7.3 Energy efficient motors. 5.7.3.1 Stator and Rotor I^2R losses 5.7.3.2 Core losses 5.7.3.3 Friction and windage losses 5.7.3.4 Stray load losses
6.	**UNIT-VI** **Energy Efficiency in Industrial Systems** 6.1 Overview of grid code technical requirements.	6.1.1 Introduction of grid code technical requirements. 6.1.1.1 Fault ride through wind farm 6.1.1.2 Regulate active and reactive power
	6.2 Voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances.	6.2.1 Voltage and frequency operating system 6.2.2 Solar hybrid power systems 6.2.3 Hybrid renewable energy systems 6.2.4 Solar PV behavior during grid disturbance 6.2.5 Wind farm behavior during grid disturbance
	6.3 Power quality issues.	6.3.1 Introduction of power quality

		6.3.2 Industrial energy efficiency technology 6.3.3 Static VAR generator and Active power filter technology 6.3.4 Peak shaving equipment 6.3.5 Power quality issue 6.3.6 Harmonics, transient and power factor
	6.4 Power system interconnection experiences in the world.	6.4.1 Introduction of interconnection world 6.4.2 Alternative current interconnection system 6.4.3 HVDC interconnection system
	6.5 Hybrid and isolated operations of solar PV and wind systems.	6.5.1 Hybrid AC/DC interconnection 6.5.2 Flexible AC Transmission system technology 6.5.3 Isolation technology in power system generation
7.	**UNIT-VII** **Energy Efficient Technologies in Electrical Systems**	
	7.1 Maximum demand controllers, automatic power factor controllers	7.1.1 Introduction of energy efficient technologies 7.1.2 Maximum demand controllers 7.1.2.1 Maximum demand controller 7.1.2.2 Need of Maximum demand controller in system 7.1.2.3 Working Concept 7.1.2.4 Calculation of maximum demand 7.1.2.5 Avoid maximum demand penalties on elect. Bill 7.1.2.6 Units used to control the maximum demand 7.1.3 Automatic power factor controllers 7.1.3.1 Voltage control controller 7.1.3.2 Kilover control controller 7.1.3.3 Automatic power factor control relay 7.1.3.4 Intelligent Power factor controller
	7.2 Energy efficient motors, soft starters with energy saver	7.2.1 Introduction of energy efficient Motors 7.2.1.1 Benefits of energy efficient Motors 7.2.1.2 Advantage of energy efficient Motors 7.2.2 Introduction of Soft starter 7.2.2.1 Types of soft starter 7.2.2.2 Choosing a soft starter
	7.3 Variable speed drives, energy	7.3.1 Variable speed drive 7.3.1.1 Speed control of induction motors

	efficient transformers.	7.3.1.2 Working of Variable frequency drive 7.3.1.3 Application of Variable frequency drive 7.3.2 Energy Efficient transformers
	7.4 Electronic ballast, occupancy sensors	7.4.1 Introduction of electronic ballast 7.4.1.1 Use of electronics Ballast 7.4.1.2 Working principle of an electronics Ballast 7.4.1.3 Electronic circuitry of an electronics Ballast 7.4.2 Introduction of HID ballast 7.4.2.1 Types of HID ballast 7.4.2.2 Working principle of an HID Ballast 7.4.3 Occupancy sensors 7.4.3.1 System Design and Components 7.4.3.2 Types of occupancy sensors 7.4.3.3 Working of occupancy sensors 7.4.3.4 Application of occupancy sensors
	7.5 Energy efficient lighting controls, energy saving potential of each technology.	7.5.1 Introduction of Energy efficient lighting control 7.5.1.1 Short return on investment 7.5.1.2 Lighting control methods 7.5.1.3 Motion sensing, manual switching, Lights 7.5.2 Introduction of energy saving potential

Dr. Gaurav Jain
Professor

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engg. **Class/Section: 3rd Year/ Section - A** **Date: 19 Feb 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

COURSE PLAN (Deployment)

S.No.	TOPIC AS PER BLOWNUP SYLLABUS	LECT. NO.	PLANNED DATE	ACTUAL DEL. DATE	CO/LO	REF. / TEXT BOOK WITH PAGE NO.
1.	**ZERO LECTURE** • Introduction • Basic knowledge about subject • Syllabus, REF. / TEXT BOOKS • RTU Question Paper • Conclusion	L-0			CO1	
2	**UNIT-I** **INTRODUCTION** **Lecture Introduction** 1.1.4 Introduction of Electrical Energy System 1.1.5 Scope of Energy Conservation 1.1.6 Overview of Auditing System **Lecture Conclusion**	L-1			CO1	Clive beggs
3	**UNIT-II** **ENERGY SCENARIO:** **Lecture Introduction** 2.1.6 Introduction 2.1.7 Methods of Commercial and Non-commercial energy 2.1.8 Advantage & Disadvantage of Commercial and Non-commercial energy 2.1.9 Types of Primary and Secondary energy sources 2.1.10 Introduction of Primary Energy	L -2			CO1	Clive beggs

	source **Lecture Conclusion**					
4.	**Lecture Introduction** 2.2.5 Introduction of Energy Scenario 2.2.6 Energy factors for growing economy 2.2.7 Fundamental of long term energy system General Mathematical Expression **Lecture Conclusion**	L-3			CO1	Clive beggs
5.	**Lecture Introduction** 2.3.1 Define the Energy Pricing 2.3.7 Types of energy pricing 2.3.8 Effect of energy in the environment 2.3.9 Factor of Energy security 2.3.10 Introduction of energy conservation 2.3.11 Benefits of energy conservation **Lecture Conclusion**	L-4			CO1	Clive beggs
6.	**Lecture Introduction** 2.4.1 Define Deregulation and Restructuring Market 2.4.2 Energy strategy for the future 2.4.3 Causes of air pollution 2.4.4 Reason of climate change 2.4.5 Electricity act 2003 2.4.6 Different Conservation Acts **Lecture Conclusion**	L-5			CO1	Clive beggs
7.	**Lecture Introduction** Numerical Problems **Lecture Conclusion**	L-6			CO1	Clive beggs
8.	**UNIT-III** **BASICS OF ENERGY AND ITS VARIOUS FORMS** **Lecture Introduction** 1.4.1 Various Forms Of Energy	L-7			CO1	K.V. Sharma

	• Potential Energy • Kinetic Energy • Energy Conversion • Grade of Energy 1.4.2 Nature and classification of Tariff • Calculation of Electricity bill for a company • Contract Demand • Maximum Demand • Time of Day Tariff **Lecture Conclusion**					
9.	**Lecture Introduction** 3.2.1 Prediction of Load • Load factor • Peak factor 3.2.2 Electrical Energy Basics for Load management and calculation **Lecture Conclusion**	L-8			CO1	K.V. Sharma
10.	**Lecture Introduction** 3.3.1 Calculation of Power Factor 3.3.2 Methods of power factor improvement 3.3.2 Numarical of Power Factor **Lecture Conclusion**	L-9			CO1	K.V. Sharma
11.	**Lecture Introduction** 3.4.1 Introduction of thermal Basics 3.4.2 Contents of thermal fuels 3.4.3 Specific Heat **Lecture Conclusion**	L-10			CO1	K.V. Sharma
12.	**Lecture Introduction** 3.5.1 Temperature and Pressure 3.5.2 Heat, Units of Heat, Sensible Heat, Quantity of Heat 3.5.3 Phase change, Latent Heat, Humidity, Dew Point 3.5.4 Fuel Density, Viscosity, Calorific Value. **Lecture Conclusion** **OBT I**	L-11			CO1	K.V. Sharma

13.	**Lecture Introduction** 3.6.1 Principle of operation. 3.6.2 Operating Design 3.6.3 Types of single effect evaporators 3.6.4 Multiple effect evaporators **Lecture Conclusion**	L-12			CO1	K.V. Sharma
14.	**Lecture Introduction** 3.7.1 Conduction, convention and radiation 3.7.2 Electrical units and conversion 3.7.3 Numericals **Lecture Conclusion**	L-13			CO1	K.V. Sharma
	UNIT-IV					
15.	**ENERGY MANAGEMENT & AUDIT LECTURE INTRODUCTION** **Lecture Introduction** 4.1.1 Types and Methodology of energy audit 4.1.2 Need for energy audit . 4.1.3 Types of energy audit.(Phase I,II,III) Method **Lecture Conclusion**	L-14			CO2	Barun Kumar De
16.	**Lecture Introduction** 4.2.1 Objective of energy management. 4.2.2 Detailed energy auditing 4.2.2.1 Pre audit Phase 4.2.2.2 Audit Phase. 4.2.2.3 Post audit phase. 4.2.3 Data Collection Hints 4.2.4 Bench marking and energy performance **Lecture Conclusion**	L-15			CO2	Barun Kumar De
17.	**Lecture Introduction** 4.3.1 Plant Energy Performance 4.3.1.1 Production Factor 4.3.1.2 Year equivalent Energy use 4.3.1.3 Monthly Energy Performance 4.3.2 Matching Energy usage to requirement 4.3.3 Study of maximize efficiency	L-16			CO2	Barun Kumar De

	Lecture Conclusion					
18.	**Lecture Introduction** 4.4.1 Optimization of Audit energy 4.4.2 Fuel Energy substitution 4.4.2.1 Case Study of fuel substitution 4.4.2.2 Types of fuel substitution 4.4.3 Energy Audit Instruments **Lecture Conclusion**	L-17			CO4	Barun Kumar De
19.	**Lecture Introduction** 4.5.1 Basic principle of energy balance 4.5.2 The sankey diagram process **Lecture Conclusion**	L-18			CO2	Barun Kumar De
20.	**Lecture Introduction** 4.6.1 Continuous process 4.6.2 Blending process 4.6.3 Drying process **Lecture Conclusion**	L-19			CO2	Barun Kumar De
21.	**Lecture Introduction** 4.7.1 Material balance. 4.7.1.1 Basics and Units 4.7.1.2 Total mass and composition 4.7.1.3 Numerical of material balance 4.7.2 Energy balance. 4.7.2.1 Heat balance 4.7.2.2 Flow chart of energy balance 4.7.2.3 Facility as an Energy system 4.7.2.4 Cooling tower and cooling water supply system **Lecture Conclusion**	L-20			CO3	Barun Kumar De
22.	**Lecture Introduction** Numerical Problems **Lecture Conclusion**	L-21			CO2	Barun Kumar De
23.	**UNIT-V** **ENERGY EFFICIENCY IN ELECTRICAL SYSTEM** **Lecture Introduction** 5.1.1 Introduction of Electrical System 5.1.2. Energy Scenario 5.1.3. Electricity billing system.	L-22			CO3	B.P. Patil.

	5.1.3.3 Tariff structure 5.1.3.4 Temporary billing system 5.1.3.3 Prepaid electricity **Lecture Conclusion**	L-23			CO3	B.P. Patil.
24.	**Lecture Introduction** 5.2.1. Electrical load management Maximum demand control 5.2.1.7 Need of Electrical load management 5.2.1.8 Step by step approach of Maximum demand control 5.2.1.9 Rescheduling of load 5.2.1.10 Shedding of non-essential loads 5.2.1.11 Operation of capative generation and DG sets 5.2.1.12 Reactive power compensation **Lecture Conclusion**	L-24			CO3	B.P. Patil.
25.	**Video Lecture** **Lecture Introduction** 5.2.2. Power factor improvement and its benefit 5.2.2.1 Power factor basics 5.2.2.2 Improving power factor 5.2.2.3 Cost benefits of PF improvement 5.3.1 Direct relation for capacitor sizing 5.3.2 Capacitors for other loads 5.3.3 Performance assessment of power factor capacitor 5.3.3.1 Voltage Effect 5.3.3.2 Material of capacitor 5.3.3.3 Operational performance of capacitor **Lecture Conclusion**	L-25			CO3	B.P. Patil.
26.	**Lecture Introduction** 5.4.1 Types of transformers 5.4.2 Rating of transformer 5.4.3 Location of transformer					

	5.4.4 Transformer losses and efficiency 5.4.5 Voltage fluctuation control 5.4.6 Parallel operation of transformer 5.4.7 System distribution losses 5.4.8 Harmonics in transformers **Lecture Conclusion**	L-26			CO3	.P. Patil.
27.	**Lecture Introduction** 5.5.1 Introduction 5.5.2 Types of Motor 5.3.3.1 DC Motor 5.3.3.2 Induction motor 5.3.3.3 Synchronous motor 5.5.3 Motor Characteristics 5.5.4 Field test of Determining Efficiency 5.5.5 Pointers and Users 5.5.6 Motor Selection process **Lecture Conclusion**	L-27			CO3	B.P. Patil.
28.	**Lecture Introduction** 5.6.1 Factors affecting motor performance 5.6.1.1 Power supply quantity 5.6.1.2 Motor loading effect. 5.6.1.3 Reducing Under Loading 5.6.1.4 Sizing to variable load 5.6.1.5 Maintenance and age factor 5.6.2 Rewinding Effect on energy efficiency 5.6.3 Speed control of AC induction motor **Lecture Conclusion**	L-28			CO3	B.P. Patil.
29.	**Lecture Introduction** 5.7.1 Energy saving policies 5.7.2 Opportunities for saving the Energy system 5.7.3 Energy efficient motors. 5.7.3.1 Stator and Rotor I^2R losses 5.7.3.2 Core losses 5.7.3.3 Friction and windage losses 5.7.3.4 Stray load losses **Lecture Conclusion**	L-29			CO3	K.V. Sharma

30.	**UNIT-VI** **ENERGY EFFICIENCY IN INDUSTRIAL SYSTEMS** **Lecture Introduction** 6.1.1 Introduction of grid code technical requirements. 6.1.1.1 Fault ride through wind farm 6.1.1.2 Regulate active and reactive power **Lecture Conclusion**	L-30			CO2	K.V. Sharma
31.	**Lecture Introduction** 6.2.1 Voltage and frequency operating system 6.2.2 Solar hybrid power systems 6.2.3 Hybrid renewable energy systems 6.2.4 Solar PV behavior during grid disturbance 6.2.5 Wind farm behavior during grid disturbance **Lecture Conclusion**	L-31			CO3	K.V. Sharma
32.	**Lecture Introduction** 6.3.1 Introduction of power quality 6.3.2 Industrial energy efficiency technology 6.3.3 Static VAR generator and Active power filter technology 6.3.4 Peak shaving equipment 6.3.5 Power quality issue 6.3.6 Harmonics, transient and power factor **Lecture Conclusion** **QUIZ**	L-32			CO2	K.V. Sharma
33.	**Lecture Introduction** 6.4.1 Introduction of interconnection world 6.4.2 Alternative current interconnection system 6.4.3 HVDC interconnection system **Lecture Conclusion**	L-33			CO3	K.V. Sharma

34.	**Lecture Introduction** 6.5.1 Hybrid AC/DC interconnection 6.5.2 Flexible AC Transmission system technology 6.5.3 Isolation technology in power system generation 6.5.4 Numaricals **Lecture Conclusion** **<u>UNIT-VII</u>** **ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS**	L-34			CO4	Barun Kumar De/ K.V. Sharma
35.	**Lecture Introduction** 7.1.1 Introduction of energy efficient technologies 7.1.2 Maximum demand controllers 7.1.2.1 Maximum demand controller 7.1.2.2 Need of Maximum demand controller in system 7.1.2.3 Working Concept 7.1.2.4 Calculation of maximum demand 7.1.2.5 Avoid maximum demand penalties on elect. Bill 7.1.2.6 Units used to control the maximum demand 7.1.3 Automatic power factor controllers 7.1.3.1 Voltage control controller 7.1.3.2 Kilover control controller 7.1.3.3 Automatic power factor 7.1.3.4 Intelligent Power factor controller **Lecture Conclusion**	L-35			CO4	Barun Kumar De/ K.V. Sharma
36.	**Lecture Introduction** 7.2.1 Introduction of energy efficient Motors 7.2.1.1 Benefits of energy eff.Motors 7.2.1.2 Advantage of energy efficient Motors 7.2.2 Introduction of Soft starter 7.2.2.1 Types of soft starter 7.2.2.2 Choosing a soft starter **Lecture Conclusion**	L-36			CO3	Barun Kumar De/ K.V. Sharma

37.	**Lecture Introduction** 7.3.1 Variable speed drive 7.3.1.1 Speed control of induction motors 7.3.1.2 Working of Variable frequency drive 7.3.1.3 Application of Variable frequency drive 7.3.2 Energy Efficient transformers **Lecture Conclusion**	L-37			CO3	Barun Kumar De/ K.V. Sharma
38.	**Lecture Introduction** 7.4.1 Introduction of electronic ballast 7.4.1.1 Use of electronics Ballast 7.4.1.2 Working principle of an electronics Ballast 7.4.1.3 Electronic circuitry of an electronics Ballast 7.4.2 Introduction of HID ballast 7.4.2.1 Types of HID ballast 7.4.2.2 Working principle of an HID Ballast 7.4.3 Occupancy sensors 7.4.3.1 System Design and Components 7.4.3.2 Types of occupancy sensors 7.4.3.3 Working of occupancy sensors 7.4.3.4 Application of occupancy sensors **Lecture Conclusion**	L-38			CO3	Barun Kumar De/ K.V. Sharma
39.	**Lecture Introduction** 7.5.1 Introduction of Energy efficient lighting control 7.5.1.1 Short return on investment 7.5.1.2 Lighting control methods 7.5.1.3 Motion sensing, manual switching, Lights 7.5.2 Introduction of energy saving potential **Lecture Conclusion**	L-39			CO3	Barun Kumar De/ K.V. Sharma
40.	**Lecture Introduction** Numarical Problem **Lecture Conclusion**					

	Class Test **SECOND ASSESSMENT**					

S. No.	Title of Book	Authors	Publisher	No. of books in Library
Text Books				
T1	Energy management audit and conservation	Barun Kumar De	Vrinda Publications Pvt Ltd Delhi	50
T2	Energy Conservation and Audit	B.P. Patil.	Nirali Prakshan PVT LTD	20
T3	Energy Management and Supply Conservation	Clive beggs	B & H Publishing House	20
T4	Energy Management and Conservation	K.V. Sharma	I.K. International Publication House Delhi	10

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engg. **Class/Section: 3rd Year/ Section - A** **Date: 19 Feb 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

Zero Lecture

1) **Name of Subject with Code**: **ELECTRICL ENERGY CONSERVATION & AUDITING (6EE4-04)**
Course Nature (Compulsory/Elective): Compulsory

2). **Self-Introduction**:

a). Name : Dr. Gaurav Jain
b). Qualification: B.Tech, M.Tech, MBA and Ph.D.
c). Designation: Associate Professor
d). Research Area: Power System
e). E-mail Id: gaurav Jain@poornima.org
f). Other details:

1. Areas of proficiency/expertise:
   - 1.1 Subjects taken:
     - 1.1.1 Power Systems
     - 1.1.2 Renewable Engineering
     - 1.1.3 Deregulation & Restructuring
   - 1.2 Laboratories Taken
     - 1.2.1 Basic Electrical and Electronics Lab
     - 1.2.2 MATLAB
     - 1.2.3 Power System Lab
   - 1.3 Academic Proficiency
     - 1.3.1 English
     - 1.3.2 Hindi
   - 1.4 Book Authored
     - 1.4.1 Electrical Machine Ashirwad Publications

b*). Records of students in 12th*

Sr. No.	Average result of 12th	Name of student scored highest marks	Marks 60% above (No. of students)	Marks between 40%-60% (No. of students)	English Medium Students (No.)	Hindi Medium Students (No.)	No. of Hostellers	No. of Day Scholar

c). Targets and Attainments

Academic Year	2021-22	2022-23	2023-24
Target	**3.00**	**3.00**	**3.00**
Attainment	**2.99**	**2.50**	**2.81**

d). Methods of Evaluation

(i) I & II Mid-Term Examination.
(ii) Assignment / Tutorials / Lab Records.
(iii) Quiz (Objective) / Viva-Voce
(iv) OBT
(v) OET
(vi) Google Classroom

4). Instructional Language: - 100 % English

a). Introduction to subject: - Electrical engineering is considered to deal with the problems associated with large-scale electrical building designing system such as power transmission design, owner plant design and green building design, whereas energy conservation and auditing deals with the study of large-scale designing systems including machine and integrated building circuits. Alternatively, conservation engineering are usually concerned with using electricity to transmit energy and analysis of energy used in the electrical world.

b). Relevance to Branch:

Renewable engineering is a branch of electrical engineering that deals with the non-conventional energy sources. The objective of conservation scheme is to keep the electrical design in stable, desirable condition. By knowing the energy auditing scheme we can say that green energy is suitable for every green energy design.

c). Relevance to Society:

Today's industrial and domestic building design are commonly used for energy saving. The development of energy design converters has made this possible by smooth speed control of both AC and DC motors/ generators which are employed for several applications in power plant design, Vehicles and renewable energy system. So we can say that it is directly relevant to the society.

d). Relevance to Self:

This course enables to develop the basics of electrical auditing and maintain different types of auditing methodology used to build the green building/industries. The competency in this area is highly required in engineering graduates working in most of the industries since these industries employ large number of electrical equipment and conservation/auditing report for operation and maintenance requires lot of competent man power. Thus this course is must for students who want to work in electrical design industries. Presently this is the sector which is touching energy green technology and this subject deals with electrical conservation/efficient technology. There are many projects in which students can work based on the concepts learnt in this subject.

e). Relation with lab:

The best way of learning things include the collaboration of theoretical and practical knowledge. The labs will prove to be helpful in correlating the theoretical fundamentals learnt in the class with the practical performed in the labs providing crystal clear concepts. This subject is directly connected with power system and power electronics lab in this semester.

f). Pre- Requisites (Connection with previous year): -

1. Power System-I (3EE5A)
2. Power system-II (4EE5A)
3. Power Restructuring –III (5EE1A)
4. Power Plant Generation (6EE4A)

In the previous year we had studied conventional electrical technology, machine and power electronics. Now we'll study further electric drives and their control.

5). Syllabus of Rajasthan Technical University, Kota

a). <u>ABC analysis (RGB method) of unit & topics</u>:

Unit No.	CO	Category A	Category B	Category C
1	CO1	Energy pricing, energy sector reforms, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future	Final energy consumption, energy needs of growing economy, long term energy scenario, Energy Conservation Act-2001 and its features.	Commercial and Non-commercial energy, primary energy resources, commercial energy production, air pollution, climate change, energy and environment
2	CO2	Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives	Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity	Electricity tariff, load management and maximum demand control, power factor improvement
3	CO3	Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.	Bench marking, energy performance, matching energy use to requirement, Maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs
4	CO4	Energy saving opportunities with energy efficient motors, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses	Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues	Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit

RED: HARD **BLUE: MODERATE** **GREEN: EASY**

b) Use of Keywords

Unit No.	Syllabus	Keywords
I	Objective, scope and outcome of the course.	Energy auditing, conservation system
II	Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution,	Non-conventional energy sources, Electrical energy acts, energy scenario, energy security

	climate change. Energy Conservation Act-2001 and its features.	
III	Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.	Traiffs, power factor, thermal energy, electrical load management
IV	Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.	Energy audit management, material balance, energy balance, bench marking
V	Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.	Induction motor, transformer losses, billing system in electrical energy, power factor factor improvement
VI	Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behaviour during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.	Grid system, real and reactive power network, grid disturbance, Power system interconnection
VII	Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.	Energy efficient technologies, controllers, Energy saving technologies, variable speed drive

ii) Recent Technologies & Publication:

Topic	Trends	Publication
Energy auditing	Electrical energy auditing used in green building	IEEE
Power factor	Improvement the power factor in industrial system	International Journal of Engineering Trends and Technology
Conservation system	Conservation system in electrical network system	IEEE
Energy demand	Energy demand in distributed generation system	IET Transmission Distribution and Generation

iii) Vocabulary Improvement

- Learning 10 New Words each day with their meanings. Sentence formation using these words.

iv) Current Affairs

- Discussion over 5 daily Current Affairs

v) Role Plays By Students on important topics.
vi) Group Discussion on a topic having different techniques.
vii) Feedback of every lecture by student
viii) Think-Pair-Share

6). Books/ Website/Journals & Handbooks/ Association & Institution:

a). Recommended Text & Reference Books and Websites:

S. No.	Title of Book	Authors	Publisher	No. of books in Library
Text Books				
T1	Energy management audit and conservation	Barun Kumar De	Vrinda Publications Pvt Ltd Delhi	50
T2	Energy Conservation and Audit	B.P. Patil.	Nirali Prakshan PVT LTD	20
Reference Books				
R1	Energy Management and Supply Conservation	Clive beggs	B & H Publishing House	20
R2	Energy Management and Conservation	K.V. Sharma	I.K. International Publication House Delhi	10
R3	Electrical energy conservation and auditing	Udit mamoditiya	Ashirwad Publication Jaipur	50

b). Journals & Handbooks: -

1. Journal of Scientific and Industrial Research
2. Indian Journal of Engineering and Material Science
3. Green Energy
4. Electrical energy demand
5. Science Competition Vision
6. Electrical India

c). Associations and Institutions:

1. Department Of Science and Technology(DST)
2. IEEE
3. MNIT & IIT

d). ***Websites related to subject:-***

1. www. nptel.iitm.ac.in
2. www.4shared.com
3. www.mit.com
4. www.electrical4u.com/electrical-drives/

7). Syllabus Deployment: -

a). Total weeks available for academics (excluding exams/ holidays) as per PGC calendar-

SEMESTER	IV
No. of Working Days Available (Approx.)	70
No. of Weeks(Approx.)	14

- Total weeks available for covering RTU syllabus- 11-12weeks (Approx.)
- Total weeks available for special activities (as mentioned below)- 02 weeks (Approx.)

b). Course Assesment Methods (Special Activities):

- Open Book Test
- Quiz (50% Technical & 50% Aptitude)- Once in a semester
- Revision classes:- 1 to 3 turn at the end of semester (Before II Mid Term Exam)
- Solving Important Question Bank- 1 Turn before I & II Mid Term Exam (each) - Total Two turn.
- I and II Midterms
- RTU University Examinations

c). Lecture schedule per week/ Contact Hours:

i). University scheme (L+T+P) = 3+1+0
ii). PGC scheme (L+T+P) = 5+0+0

Sr. No.	Name of Unit	No. of lectures	Broad Area	Degree of difficulty (High/Medium/Low)	No. of Question in RTU Exam.	Text/ Reference books
1.	Energy Scenario	5	Energy situation in the world	LOW	2	Electrical energy conservation and auditing
2.	Basics of Energy and its Various Forms	5	Concept of thermal energy in energy conservation	MEDIUM	2	Energy manag. audit and conservation
3.	Energy Management & Audit	7	Structure of energy auditing	HIGH	2	Energy Conserv. and Audit
4.	Energy Efficiency in Electrical Systems	12	Efficiency structure in electrical system	HIGH	2	Energy Management and Supply Conserv.
5.	Energy Efficiency in Industrial Systems	10	Efficiency structure in eindustrial system	MEDIUM	2	Electrical energy conservation and auditing
6.	Energy Efficient Technologies in Electrical Systems	10	Concept of electrical energy policies	MEDIUM	2	Electrical energy conservation and auditing

d). Introduction & Conclusion: Each subject, unit and topic shall start with introduction & close with conclusion. In case of the subject, it is Zero lecture.

e). Time Distribution in lecture class: - Time allotted: 60 min.

i. First 5 min. should be utilized for paying attention towards students who were absent for last lecture or continuously absent for many days + taking attendance by calling the names of the students and also sharing any new/relevant information.
ii. Actual lecture delivery should be of 50 min.

iii. Last 5 min. should be utilized by recapping/ conclusion of the topic. Providing brief introduction of the coming up lecture and suggesting portion to read.
iv. After completion of any Unit/Chapter a short quiz should be organized.
v. During lecture student should be encouraged to ask the question**.**

10). Home assignment: - An essential component of Teaching- Learning process in Professional Education.

Home assignment shall comprise of two parts:

Part (i) Minimum essential questions, which are to be solved and submitted by all with in specified due date.

Part (ii) Other important questions, which may also be solved and submitted for examining and guidance by teacher.

8). Examination System:

Sr. No.	**Name of the Exam**	**Max. Marks**	**% of passing marks**	**Nature of paper Theory + Numerical**	**Syllabus coverage (in %)**	**Conducted by**
1.	Ist Mid Term Exam	60	40%	T+N	60%	PCE
2.	IInd Mid Term Exam	60	40%	T+N	40%	PCE
3.	University (End) Term Exam	120	30%	T+N	100%	RTU

Place: **Jaipur**
Date:

Dr. Gaurav Jain
(Professor)

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engg. **Class/Section: 3rd Year/ Section - A** **Date: 11 Mar 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

DEPARTMENT OF ELECTRICAL ENGINEERING
OPEN BOOK TEST
Session 2023-24
B.Tech. III year VI sem Section:
Code: 6EE4-04 Subject Name–Electrical Energy Conservation and Auditing

Max. Time: 1 hr. **Max. Marks: 20**

Note: Attempt all questions.

Q.1	**CO 1**	**PO 2**	Define the following terms with three examples for each - Primary and Secondary Energy. Commercial and Non-commercial Energy.	**(5)**
Q.2	**CO 2**	**PO 2**	Name any three main provisions of the EC act, 2001 as applicable to the designated consumers	**(5)**
Q.3	**CO 3**	**PO 3**	Differentiate between energy conservation and energy efficiency	**(2.5)**
Q.4	**CO 4**	**PO 2**	What are the three modes of heat transfer? Explain with examples?	**(5)**
Q.5	**CO 4**	**PO 3**	A fluorescent tube light consumes 40 W for the tube and 10 W for choke. If the lamp operates for 8 hours a day for 300 days in a year, calculate the total energy cost per annum if the energy cost is Rs.3/- per kWh.	**(2.5)**

References:

S. No.	Title of the Book	Authors	Publication
1	Energy management audit and conservation	Barun Kumar De	Vrinda Publications Pvt Ltd Delhi
2	Energy Conservation and Audit	B.P. Patil.	Nirali Prakshan PVT LTD
3	Energy Management and Supply Conservation	Clive beggs	B & H Publishing House,Neew Delhi
4	Energy Management and Conservation	K.V. Sharma	I.K. International Publication House, New Delhi

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engg. **Class/Section: 3rd Year/ Section - A** **Date: 1 April 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

DEPARTMENT OF ELECTRICAL ENGINEERING
CLASS TEST
Session 2023-24
B.Tech. III year VI sem Section:
Code: 6EE4-04 Subject Name–Electrical Energy Conservation and Auditing

Max. Time: 1 hr. **Max. Marks: 20**

Note: Attempt all questions.

Q.1	**CO 1**	**PO 1**	Define the following terms with three examples for each - a) Primary and Secondary Energy. b) Commercial and Non-commercial Energy.	**(4)**
Q.2	**CO 2**	**PO 4**	List at least five States where coal deposits are concentrated in India	**(4)**
Q.3	**CO 3**	**PO 1**	Differentiate between energy conservation and energy efficiency	**(4)**
Q.4	**CO 4**	**PO 2**	What are the three modes of heat transfer? Explain with examples	**(4)**
Q.5	**CO 4**	**PO 2**	A fluorescent tube light consumes 40 W for the tube and 10 W for choke. If the lamp operates for 8 hours a day for 300 days in a year, calculate the total energy cost per annum if the energy cost is Rs.3/- per kWh.	**(4)**

References:

S. No.	Title of the Book	Authors	Publication
1	Energy management audit and conservation	Barun Kumar De	Vrinda Publications Pvt Ltd Delhi
2	Energy Conservation and Audit	B.P. Patil.	Nirali Prakshan PVT LTD
3	Energy Management and Supply Conservation	Clive beggs	B & H Publishing House,Neew Delhi
4	Energy Management and Conservation	K.V. Sharma	I.K. International Publication House, New Delhi

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engg. **Class/Section: 3rd Year/ Section - A** **Date: 15 May 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

DEPARTMENT OF ELECTRICAL ENGINEERING
QUIZ TEST
Session 2023-24
B.Tech. III year VI sem Section:
Code: 6EE4-04 Subject Name–Electrical Energy Conservation and Auditing

1. The main purpose of energy audit is [ ]
A) to increase the energy efficiency (B) reduce the energy related cost (C) both (D) None

2. The objective of energy audit is to [ ]
A) characterize and quantify energy usage B)implement conservation program
C) reduce losses D) none

3. PEA is done in [ ]
A) 10-20DAYS B) 10-30days C) 2-5days (D) 5-12days

4---------- offers a means to conserve the energy & quantify its consumption [ ]
A) working environment (B)measurement
C)energy consumption indices(D) none

5. One joule is---------- [ ]
A) $2.7855*10^{-7}$kwh (B) $2.7855*10^{-7}$ wh (C) $2.7855*10^{-5}$kwh (D) None

6. The ratio of energy consumption to the product output is ----- [ ]
A) cost index (B) energy index (C) both (D) None

7.------ is used to represent energy consumption in terms of bandwidth [ ]
A) sankey diagram (B) load profile (C) bar chart (D) None

8. Frequent implementation of new techniques & new technologies is needed in [ ]
A) longterm (B) short term (C) medium (D) None

9. The utility sponsored incentives came into existence as a result of [ ]

10. (A)EP Act1992 (B) EP Act2005(C) EP Act1998 (D) Energy security act2007

11. The ASHRAE standard 90.1 is specified for [ ]

12. (A)residential (B)commercial building (C) both A & B (D) none

13. The goal of Kyoto protocol is to [ ]
(A)stabilize green house gases(B) increase equipment efficiency
(C)increase profits for utilities (D)none

14. The standards and codes have impact on [ ]
(A) energy policy (B)energy usage
(C) building laws for corporate (D)all the above

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

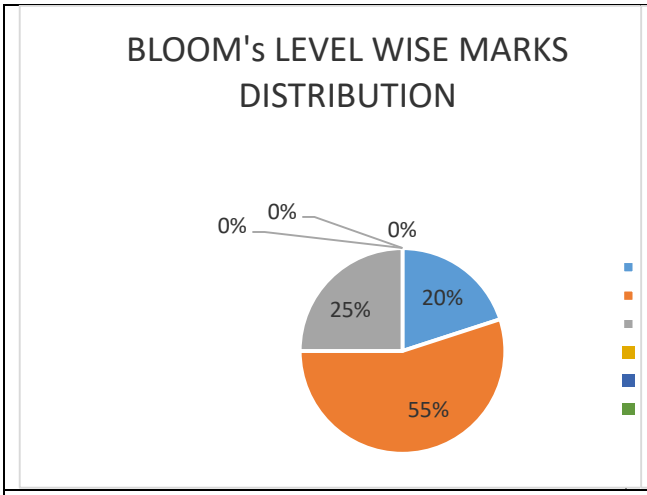
Campus: Poornima College of Engg. **Class/Section: 3rd Year/ Section - A** **Date: 22 Mar 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

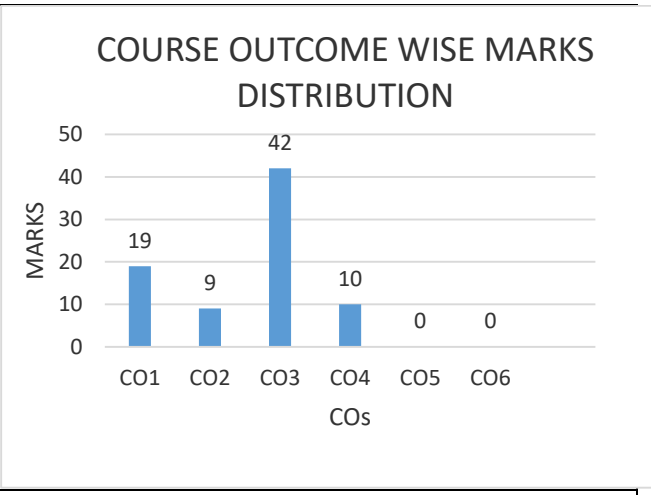
FIRST MID TERM EXAMINATION 2023-24
Code: 6EE4-04 Category: PCC Subject Name–Electrical Energy Conservation & Auditing
B.Tech. III year VI sem Section A
(BRANCH – Electrical Engineering)

Course Outcomes (CO):
At the end of the course the student should be able to:
CO1: Describe the energy scenario, energy strategy, energy law's, energy security and maximization of energy efficiency. [Apply]
CO2: Identify energy conservation techniques and energy efficient technologies for developing electrical and industrial equipment.[Analyze]
CO3: Evaluate pricing, energy audit, energy management and energy balance of an industry or organization.
CO4: Develop methods of energy optimization, power factor improvement and fuel & energy substitution.

PART - A: (All questions are compulsory) Max. Marks (10)						
Q. No.	**Questions**	**Marks**	**CO**	**BL**	**PO**	**PI**
Q.1	Define commercial and Non-commercial energy sources.	**2**	**1**	**1**	**1**	**1.2.1**
Q.2	What are the various steps in the implementation of energy management in an organization?	**2**	**3**	**2**	**1**	**1.2.1**
Q.3	Define Facility as an Energy System using plant energy system.	**2**	**2**	**2**	**1**	**1.2.1**
Q.4	Describe the Greenhouse effect in detail.	**2**	**1**	**1**	**1**	**1.2.1**
Q.5	Enlist energy instruments used in electrical engineering.	**2**	**1**	**1**	**1**	**1.2.1**
PART - B: (Attempt 4 questions out of 6) Max. Marks (20)						
Q.6	What is energy conservation? Explain it importance.	**5**	**2**	**1**	**1**	**1.3.1**
Q.7	Explain the energy strategy for the future requirement.	**5**	**1**	**2**	**1**	**1.2.1**
Q.8	Explain the methodology for Primary Energy Audit Process.	**5**	**3**	**2**	**1**	**1.2.1**
Q.9	Describe the Material and Energy balance system in detail.	**5**	**3**	**2**	**1**	**1.3.2**
Q.10	If air consists of 77% by weight of nitrogen and 23% by weight of oxygen calculate: (a) the mean molecular weight of air, (b) the mole fraction of oxygen, (c) the concentration of oxygen in mole/m3 and kg/m3 if the total pressure is 1.5 atmospheres and	**5**	**3**	**2**	**2**	**2.1.1**

	the temperature is 25 °C.					
Q.11	What are the benefits of benchmarking energy consumption?	**5**	**3**	**1**	**1**	**1.3.1**
PART - C: (Attempt 3 questions out of 4) Max. Marks (30)						
Q.12	Explain the Energy Conservation Act, 2001 and its Features in detail.	**10**	**1**	**2**	**1**	**1.3.1**
Q.13	A three phase, 10 kW motor has the name plate details as 415 V, 18.2 amps and 0.9 PF. Actual input measurement shows 415 V, 12 amps and 0.7 PF, which was measured with power analyser during motor running. Calculate Motor loading?	**10**	**4**	**3**	**2**	**2.1.1**
Q.14	Explain the thermal Energy by using their following terms: Temperature, pressure, specific heat, humidity, dew point, calorific value, heat transfer, evaporation and condensation.	**10**	**3**	**2**	**1**	**1.4.1**
Q. 15	Explain the methodology for detailed Energy Audit Process.	**10**	**3**	**3**	**1**	**1.2.1**





BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 –Analyzing, 5 – Evaluating, 6 - Creating)
CO – Course Outcomes; PO – Program Outcomes

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engg. **Class/Section: 3rd Year/ Section - A** **Date: 27 May 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

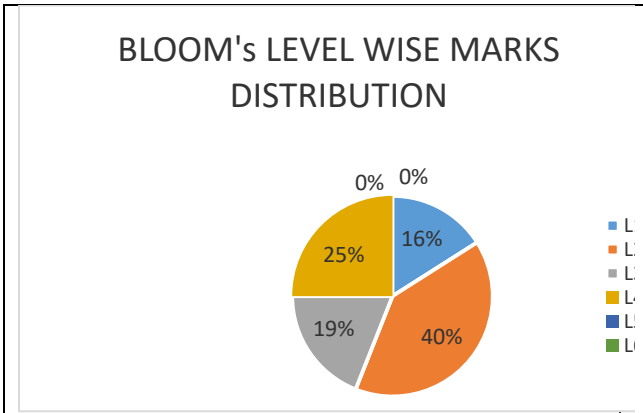
SECOND MID TERM EXAMINATION 2023-24
Code: 6EE4-04 Category: PCC Subject Name–Electrical Energy Conservation & Auditing
B.Tech. III year VI sem Section A
(BRANCH – Electrical Engineering)

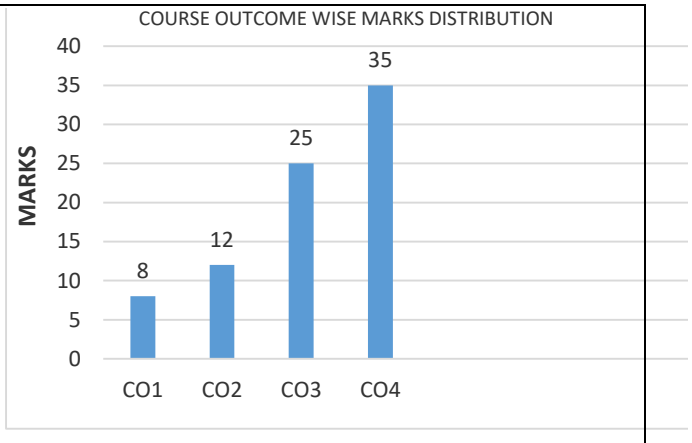
Course Outcomes (CO):
At the end of the course the student should be able to:

CO1: Describe the energy scenario, energy strategy, energy law's, energy security and maximization of energy efficiency. [Apply]
CO2: Identify energy conservation techniques and energy efficient technologies for developing electrical and industrial equipment.[Analyze]
CO3: Evaluate pricing, energy audit, energy management and energy balance of an industry or organization.
CO4: Develop methods of energy optimization, power factor improvement and fuel & energy substitution.

PART - A: (All questions are compulsory) Max. Marks (10)						
Q. No.	**Questions**	**Marks**	**CO**	**BL**	**PO**	**PI Code**
Q. 1	Define the Cascade efficiency in electrical power supply system.	**2**	1	1	1	**1.2.1**
Q. 2	Which is the best location for capacitor for power factor improvement from energy conservation point of view.	**2**	1	1	1	**1.3.1**
Q. 3	Categorize how many grid code technical requirement are used in the industry.	**2**	2	2	2	**2.1.1**
Q. 4	Name three types of motors in industrial practice.	**2**	1	1	1	**1.2.1**
Q. 5	What are the advantages of energy efficient motors?	**2**	1	1	1	**1.3.1**
PART - B: (Attempt 4 questions out of 6) Max. Marks (20)						
Q. 6	Explain the Electricity billing using different tariff structure.	**5**	3	1	1	**1.2.1**
Q. 7	Define distribution and transformer losses in detail.	**5**	2	2	1	**1.3.1**
Q. 8	A process plant consumes of 12500 kWh per month at 0.9 Power Factor (PF). What is the percentage reduction in	**5**	3	2	2	**2.2.3**

	distribution losses per month if PF is improved up to 0.96 at load end.					
Q. 9	Discuss about analysis of Energy Efficient Lighting Control system in detail.	**5**	3	2	2	**2.1.1**
Q. 10	Explain the working of a soft starter and its advantage over other conventional starters.	**5**	2	2	1	**1.2.1**
Q. 11	Categorize the Power quality issue in the grid network system and what is the use of static VAR generator to improve the power quality issue.	**5**	4	3	2	**2.1.2**
PART - C: (Attempt 3 questions out of 4) Max. Marks (30)						
Q. 12	Design the algorithm for demand side management and the various technique used for DSM. What are the benefits of DCM to customers and distribution companies?	**10**	3	4	3	**3.2.1**
Q. 13	Discuss about the variable speed drive in analyzing energy efficient technologies using following terms a) variable frequency drive b) Variable Torque vs Constant Torque c) Tighter process control with variable speed drives d) Eddy Current Drives.	**10**	4	3	2	**2.1.2**
Q. 14	Discuss about the Hybrid and isolated operations of solar PV and wind systems. (A comparative analysis is accepted.)	**10**	4	2	2	**2.1.3**
Q. 15	A 3-phase, 415 V, 100 kW induction motor is drawing 50 kW at a 0.75 PF Calculate the capacitor rating requirements at motor terminals for improving PF to 0.95. Also calculate the reduction in current drawn and kVA reduction, from the point of installation back to the generated side due to the improved PF.	**10**	4	4	2	**2.2.3**





BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 –Analyzing, 5 – Evaluating, 6 - Creating) CO – Course Outcomes; PO – Program Outcomes

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF ELECTRICAL ENGINEERING

Campus: Poornima College of Engg. **Class/Section: 3rd Year/ Section - A** **Date: 19 Feb 2024**
Course: B.Tech.
Name of Faculty: Dr. Gaurav Jain **Name of Subject: EECA** **Code: 6EE4-04**

Assignment 1

1. Define the following terms with three examples for each -

   a) Primary and Secondary Energy.
   b) Commercial and Non-commercial Energy.
   c) Renewable and Non-renewable Energy

2. In terms of coal reserve India's position in the world is

   (a) 10^{th} (b) 17^{th} (c) 4^{th} (d) 26^{th}

3. How is economic growth linked to energy consumption?
4. What do you think of strategies required for long-term management of energy in India?
5. Discuss the subsidies and cross subsidies in oil sector in India.
6. Write in few words about the various reforms in the energy sector.
7. Though Plant Respiration and Decomposition release more than ten times CO_2 released by human activities, explain why CO_2 is regarded as a potential threat to the planet.
8. The contribution of CO_2 to the green house gases is

   (a) 23% (b) 95% (c) 54% (d) 0%

9. What are the implications of Global warming?
10. Describe the Greenhouse effect.
11. The excess of which gas in the atmosphere is the main cause for greenhouse effect?
12. Name three greenhouse gases. Which one of them produces the maximum green house effect?
13. What are the major pollutants in burning fossil fuels?
14. Differentiate between energy conservation and energy efficiency.

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Assignment 2

1. Discuss one energy conversion activity with various losses occurring stage wise.
2. The reactive power is represented by
   (a) kVA (b) kW (c) kVAr (d) PF
3. A fluorescent tube light consumes 40 W for the tube and 10 W for choke. If the lamp operates for 8 hours a day for 300 days in a year, calculate the total energy cost per annum if the energy cost is Rs.3/- per kWh
4. Power factor is the ratio of
   (a) kW / kVA (b) kVA / kW (c) kVA / kVAr (d) kVAr / kV
5. Define the term load factor.
6. What do you understand by the term calorific value?
7. What are the three modes of heat transfer? Explain with examples?
8. Explain why steam is used commonly in industries?
9. If an electric heater consumes 4 kWh, what will be the equivalent kilocalories?
10. Why a cube of ice at $0^{o}C$ is more effective in cooling a drink than the same quantity of water at $0^{o}C$?
11. 10 kg of steam at $100^{o}C$ with latent heat of vapourisation 2260 kJ is cooled to $50^{o}C$. If the specific heat of water is 4200 J/kg^{o}C, find the quantity of heat given out.

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Assignment 3

1. List down the objective of energy management..
2. What are the managerial functions involved in energy management?
3. Explain why managerial skills are as important as technical skills in energy management?
4. What are the various steps in the implementation of energy management in an organization?
5. State the importance of energy policy for industries.
6. Explain the role of training and awareness in energy management programme?
7. What is an energy audit?
8. Explain briefly the difference between preliminary and detailed energy audits?
9. What is the significance of knowing the energy costs?
10. What are the benefits of benchmarking energy consumption?
11. Explain the implications of part load operation of energy equipment with examples?
12. What do you understand by the term fuel substitution? Give examples.

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RTU PAPER

6E7144

Total No. of Questions : 22 Total No. of Pages : 04
Roll No. : 21EPKEE016

6E7144

B.Tech. VI-Sem. (Main/Back) Exam. - 2024
ELECTRICAL ENGINEERING
6EE4-04/Electrical Energy Conversion and Auditing
Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :
Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.
Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.
Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A [10×2=20]
(Answer should be given up to 25 words only)
All questions are compulsory

Q.1. What is final energy consumption?
Q.2 What are the primary energy resources?

Q.3. Discuss bench marking while studying energy audit.

Q.4. What do you mean by power factor improvement?

Q.5. Discuss different losses in induction motors in very short.

Q.6. What do you mean by energy performance?

Q.7. What is heat capacity?

Q.8. Discuss energy security.

Q.9. How we calculate motor efficiency?

Q.10. What are the voltage and frequency operating limits of wind farms?

PART-B **[5×4=20]**

(Analytical/Problem solving questions)

Attempt any five questions

Q.1. What is the need of energy audit? Explain different types of energy audit.

Q.2. Briefly discuss the electrical load management and maximum demand control.

Q.3. Define the Energy Conservation Act,2001 and its features.

Q.4. Explain energy pricing with its features.

Q.5. Discuss energy balance diagrams in detail.

Q.6. What is long term energy scenario? Discuss the energy conservation and its importance.

Q.7 Describe the power system interconnection experiences in the different part of the word.

PART-C **[3×10=30]**

(Descriptive/Analytical/Problem Solving/ questions)

Attempt any three questions

Q.1. (a) Deliberate the solar PV and wind farm behavior during grid disturbances.

(b) Describe the energy saving opportunities with energy efficient motors.

Q.2. (a) What are the evaporation and condensation?

(b) How moist air and humidity affects the thermal energy?

Q.3. (a) Elaborate the automatic power factor controllers.

(b) Discuss the different methods for preparing process flow for energy system.

Q.4. (a) Explain the distribution and transformer losses.

(b) Discuss briefly the instruments uses for energy audit.

Q.5. (a) How and why selection and location of capacitors in electrical system performed?

(b) What do understand by energy efficient motors and soft starters with energy saver?