Department of Electrical Electronics Engineering
Academic Year 2023 – 2024 (Odd Semester)

Degree, Semester & Branch: B.E/V/EEE
Course Code & Title: EE3032/Energy Storage Systems
Name of the Faculty member (s): Mrs G.Sivapriya

Innovative Practice Description

- **Unit / Topic: Unit I /** Types of Energy Storage Systems
- **Course Outcome:** CO 1
- **Topic Learning Outcome:** TLO2
- **Activity Chosen:** One Minute Paper
- **Justification:**

  The basics of Energy storage Systems are discussed. After teaching this topic, I thought of this activity for making to have clarity about the various types of energy storage systems .I can judge the understanding level of the students .

Time Allotted for the Activity: 5 Minutes

- **Details of the Implementation:**

  After teaching the concept, I gave students one or two minutes to think about the topic without writing anything.

  Total Strength :64
  Reporter: Myself
  At the end of the Class (Last 5 minutes)

  I asked the students to think various types of energy storage systems concept for 3 minutes.

  Then I told them to write as much as they can within a short period of time (1 minute)

  Finally, I collected the papers from each column

- **CO – PO / PSO mapping:**

CO	PO1	PO5	PO6	PO7	PO8	PO9	PO10	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	1	3	3	2	2	1	1

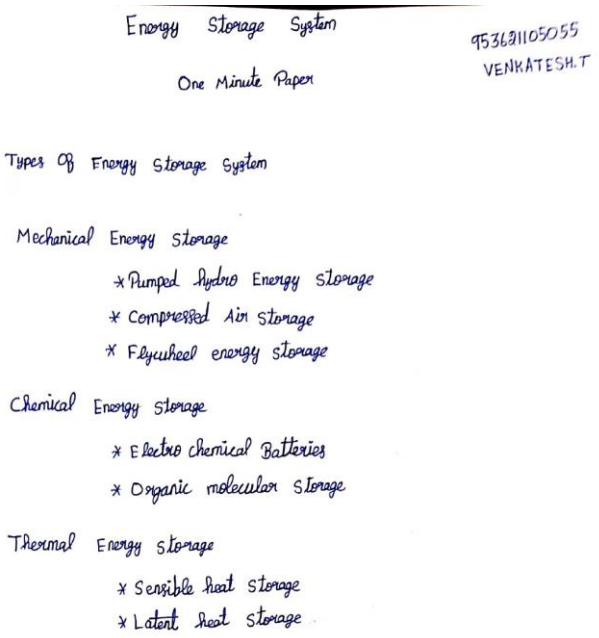
(1 – Low 2 – Moderate 3 – High)

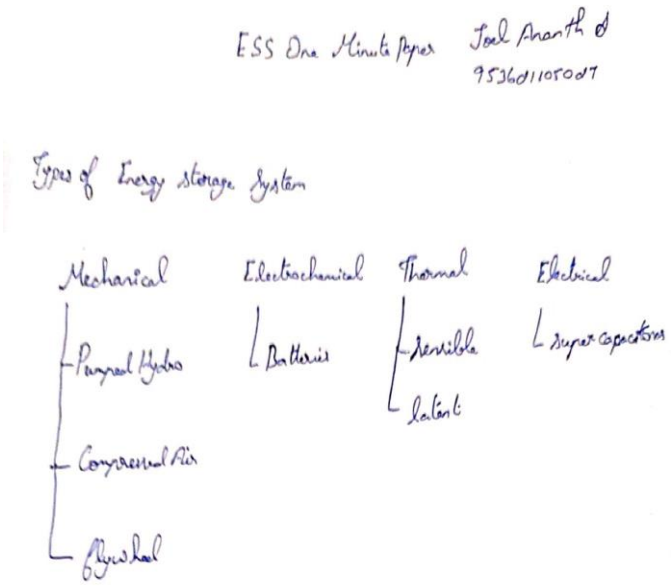
- **PO / PSO mapped:**

Innovative practice	PO1	PO6	PO7	PO8	PO9	PO10	PO12
	2	3	3	1	3	3	2
Justification for correlation	The basics and limitations of renewable	As role of engineering in protecting	The impact of energy Storage Systems in	Consequences of unethical environmental practice &	The students will be given group	The students will be given group assignment /	For preparing the assignment,

	energy sources are discussed for understanding the need of energy storage as an engineering problems.	the globe is discussed	environmental sustainability will be taught to the students	method to overcome the same is briefly explained	assignment / presentation	presentation. They will prepare a report on the same	students need to comprehend few technical contents

- **Images / Screenshot of the practice:**





- **Reflective Critique:**
  - ❖ ***Feedback of practice from students and other stakeholders:***
  - The assessment of effectiveness of the activity was felt when told most of the points.
  - While conducting the activity, I understood that the students will be able to explain the basics of Energy storage Systems and its various types.
  - The success of the activity was evaluated by asking the same question in Internal Assessment test I – Around 90% of students answered.

Benefit of the practice:

- Students were able to attend the question even in the questions are in indirect form.
- Students were able to explain the concepts in examination without any confusion.

❖ ***Challenges faced in implementation:***

- In the class mostly few students hesitate to answer the questions.
- Time utilization for conducting activity.

References:

1.Ibrahim Dincer and Mark A. Rosen, 'Thermal Energy Storage Systems and Applications', John Wiley & Sons, 3rd Edition, 2021.
2. Ru-shi Liu, Lei Zhang and Xueliang sun, 'Electrochemical technologies for energy storage and conversion', Wiley publications, 2nd Volume set, 2012.
3. James Larminie and Andrew Dicks, 'Fuel cell systems Explained', Wiley publications, 3rd Edition, 2018.

Signature of Faculty Member **HOD**

Department of Electrical and Electronics Engineering
Academic Year 2023 – 2024 (Odd Semester)

Degree, Semester & Branch: V Semester B.E. EEE
Course Code & Title: EE3032/ Energy Storage Systems
Name of the Faculty member (s): Mrs.G.Sivapriya

Innovative Practice Description

- **Unit / Topic:** Unit II / Thermal storage System , Solar Thermal Collector, Evacuated Type Flat plate collectors**,** Solar PV Panel
- **Course Outcome:** CO 2
- **Topic Learning Outcome: 2a(TLO 4)**
- **Activity Chosen:** Field Visit, Demonstration
- **Justification:**

Solar Photovoltaic (PV) is a technology that converts sunlight (solar radiation) into direct current electricity by using semiconductors. When the sun hits the semiconductor within the PV cell, electrons are freed and form an electric current. Solar PV technology is generally employed on a panel (hence solar panels). After teaching the constructional, I thought of conducting this as field visit for making the students to give overview of PV panel which enhance the learning level and as a teacher I can judge the understanding level of the students.

Solar thermal energy storage system in which thermal energy from solar radiation is absorbed by using solar collector and it is transferred to the fluid, finally the heated water is taken from the solar water heater. In this type of storage system, the thermal energy is directly utilised.

- **Time Allotted for the Activity:** 50 minutes
- **Details of the Implementation:**

After teaching the concept, give students one or two minutes to think about the topic without writing anything.

Total Strength is 64,

Photographer: one student – Mr. S. Dineshkumar (interested in photography)

Reporter: Myself

At the end the Class (Last 15 minutes)

- ✓ I asked the students to think about solar PV system operation and solar thermal storage system for 2 minutes.

- ✓ Then I told them to Pair with their neighbours and discuss about the operation of solar photovoltaic energy conversion system and solar thermal storage system for another 1 minute.
- ✓ Finally, I randomly asked students about the operation of solar photovoltaic energy conversion system and solar thermal storage system. (2 minutes).

- **CO – PO / PSO mapping:**

CO	PO 1	PO 2	PO 3	PO 5	PO6	PO 7	PO 8	PO 9	PO 10	PO12	PSO1	PSO2	PSO3
CO 2	2	1	1	2	1	2	1	3	3	2	2	1	1

(1 – Low 2 – Moderate 3 – High)

- **PO / PSO mapped:**

Innovative practice	PO 7
	2
Justification for correlation	The basic applications of solar energy in an environmental context are taught to the students, hence it is moderately correlated (level 2).

- **Images / Screenshot of the practice:**

Reflective Critique:

- ***Feedback of practice from students and other stakeholders:***

Students were satisfied with the field visit demonstration class on Solar PV system and solar water heater(thermal energy storage system,) also they said, it increases our curiosity to explore more about the topic.

- ***Benefit of the practice:***

1. Students are able to understand the impact of engineering solution on society
2. Students understood the concept which was reflected from their answers for the questions I have asked during discussion session of field visit.
3. The success of the activity was evaluated by asking the same question during IAT-II – **Around 88% of students answered.**
4. Students are able to explain the concept of thermal energy storage system in examination without any confusion.

- ***Challenges faced in implementation:***

1. Time utilization for conducting activity became more than planned.

References:

1. D.P.Kothari, K.C Singal, RakeshRanjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013
2. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016

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Course Code & Title: EE3032 Energy Storage Systems
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Innovative Practice Description

- **Unit / Topic:** Unit IV / Fuel Cell
- **Course Outcome:** CO4
- **Topic Learning Outcome:** TLO15
- **Activity Chosen:** Ungraded Quiz
- **Justification:**

I explained the working principle of fuel cell, types of fuel cell and the components of fuel cell. After teaching this topic, I thought of this activity for making to have clarity about the Fuel cell. So I can judge the level of understanding.

- **Time Allotted for the Activity:** 10 Minutes
- **Details of the Implementation:**
  - After teaching the concept, I gave students one or two minutes to think about the topic without writing anything.
  - Total Strength :64
  - Reporter: Myself
  - At the end of the Class (Last 10 minutes)
  - I asked the students to recall about the fuel cell working principle, the components of fuel cell and types of fuel cell for 2 minutes.
  - Then I told them to write to attend the quiz which is ungraded (8 minutes)
  - Finally, I collected the responses of each student in canvas.

- **CO – PO / PSO mapping:**

CO	PO1	PO2	PO5	PO6	PO7	PO8	PO9	PO10	PO12	PSO1	PSO2
CO2	2	1	2	1	2	1	3	3	2	2	1

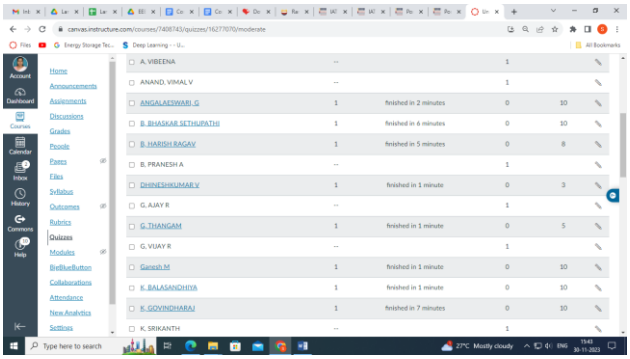
(1 – Low 2 – Moderate 3 – High)

- **PO / PSO mapped:**

Innovative practice	PO1	PO2	PO5	PO7	PO8	PO9	PO10	PO12	PSO1	PSO2
	2	1	3	2	1	3	3	2	2	1

Justification for correlation	Students The basics of fuel cells are discussed for understanding the need of energy storage as an engineering problems	Suitable mathematical and engineering knowledge will be applied by the students to solve basic problems	Students will Suitable mathematical and engineering knowledge will be applied by the students to solve basic problems	The basic role of fuel cell in environmental sustainability is taught to the students	Students follow basic ethical practice to prepare the assignment	Presentation / Assignment will be submitted by the students on fuel cell	Assignments will ure the missio of a hnical rt with ctured low	Through assignment, students will explain the minimal and basic change in trends while designing wind farms for given locat**:** Through assignment, students will explain the minimal and basic change in trends while designing fuel cell for energy storage systems for given location. ion.	Analyze the performance of energy Storage Systems using Matlab software packages	will be able to design and develop the hardware and software with fuel cell skills required for industrial automation

- **Images / Screenshot of the practice:**



- **Reflective Critique:**
  - ❖ ***Feedback of practice from students and other stakeholders:***

I preferred this activity because it will help me to evaluate what types of questions I am asking students and what level they are working at.

Benefit of the practice: (E.g.: Outcome attainment would have increased due to innovative practice over conventional practice)

The students can understand their knowledge in that particular topic.

- ❖ ***Challenges faced in implementation:***
- Since it is conducted online ,it is very tough to make all students to attend.
- It is difficult to access whether student have attended the quiz properly or not.

References:

- ❖ https://www.nactateachers.org/images/The_Student-Developed_Quiz_or_Exam-__Scaffolding_Higher-Order_Thinking.pdf.
- ❖ James Larminie and Andrew Dicks, 'Fuel cell systems Explained', Wiley publications, 3rd Edition, 2018.
- ❖ .https://www.netl.doe.gov/sites/default/files/netl-file/FCHandbook7.pdf Fuel Cell Handbook

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Department of Electrical and Electronics Engineering
Academic Year 2023 – 2024 (Odd Semester)

Degree, Semester & Branch: V Semester B.E. EEE
Course Code & Title: EE3032 Energy Storage Systems
Name of the Faculty member: Mrs. G. Sivapriya, AP/EEE

Innovative Practice Description

- **Unit / Topic:** Unit V / Types of alternate Energy Storage Technologies
- **Course Outcome:** CO 5
- **Topic Learning Outcome:** TLO18
- **Activity Chosen: Mind - map**
- **Justification:**
  - Explain the different tpes of alternate Energy Storage Technologies
  - After teaching the concept, I thought of conducting this activity for making the students to give the difference between the 3 types of Energy Storage Technologies which enhance the learning level and as a teacher I can judge the understanding level of the students.

Time Allotted for the Activity: 6 Minutes

After teaching the concept, the students were made to pair with their neighbors

Photographer: Myself

Reporter: Myself

At the end the Class (Last 6 minutes)

- ✓ I asked the students to think about types of Energy Storage Technologies concept for 2 minute.
- ✓ Then I told them to Pair with their neighbors and discuss about the concepts for another 1 minute.
- ✓ Finally I told them to design mind-map and submit within 3 minutes.

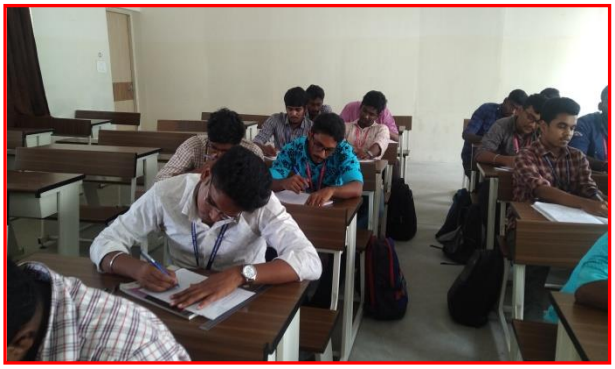
- **CO – PO / PSO mapping:**

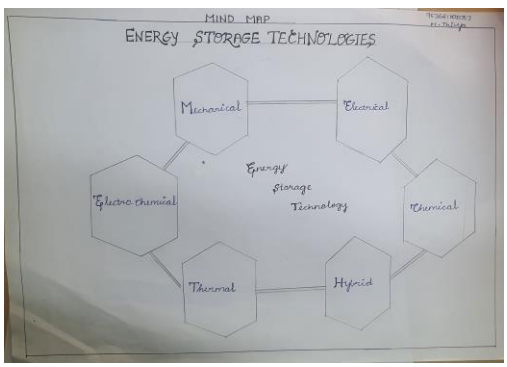
CO	PO1	PO2	PO3	PO5	PO6	PO7	PO8	PO9	PO10	PO12	PSO1	PSO2	PSO3
C215.2	3	2	3	2	1	2	1	2	2	2	2	1	1

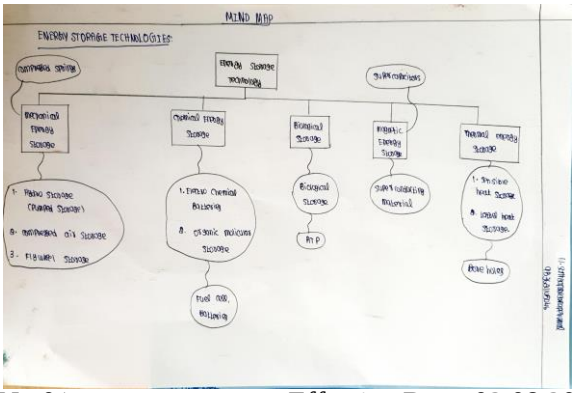
- **PO / PSO mapped:**

Innovative practice	PO1	PO2	PO3	PO5	PO6	PO7	PSO1	PSO3
	3	2	3	1	2	2	2	2
Justification for correlation	The basics of alternative technologies for energy storage are discussed for understanding the need of energy storage as an engineering problems.	Suitable mathematical and engineering knowledge will be applied by the students to solve basic problems	Students will determine the design objectives and functional requirements of the alternative energy Storage Systems.	Students will be using Matlab Software and gains proficiency on the same	As role of engineering in protecting the globe is discussed.	The basic role of alternative energy Storage Systems in environmental sustainability.	Analyze the performance of alternative energy Storage Systems using Matlab software packages	Students will be able to design and develop the hardware and software with alternative energy Storage Systems skills required for industrial automation systems

- **Images / Screenshot of the practice:**







Reflective Critique:

1. ***Pre-implementation Reflection:***

I preferred this Activity because they types of Energy Storage Technologies separately.

Challenges anticipated:

- In the class few boys hesitate to answer to the questions.
- Time utilization for conducting activity.

Steps taken:

- The boys are sitting in 2 columns – I planned to choose more pairs from boys to involve them in the activity.

2. ***Post implementation Reflection:***

Benefits:

- Students understood the concept which was reflected from their answers forthe questions I have asked during discussion session.

Challenges:

- Slow learners were not able to understand some topics during discussion hours.

❖ *Benefit of the practice**:*** (E.g.: Outcome attainment would have increased due to innovative practice over conventional practice)

✓ The assessment of effectiveness of the activity was felt when told most of the points.

✓ While conducting the activity, I understood that the students will be able to explain the concepts of types of Energy Storage Technologies.

✓ The success of the activity was evaluated by asking the same question in Internal Assessment test II – Around 85% of students answered.

References:

1. https://omerad.msu.edu/teaching/teaching-strategies/active-learning-strategies/27-teaching/184-visual-modeling-mini-maps

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