NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

Department of Mechanical Engineering

COURSE OUTLINE TEMPLATE			
Course Title	ENERGY STORAGE TECHNOLOGY		
Course Code	MEOE18	No. of Credits	3
Department	MECHANICAL ENGINEERING	Faculty	Dr. S. SURESH
Pre-requisites Course Code	-NIL-		
Course Coordinator(s) (if, applicable)	Dr. S. SURESH		
Other Course Teacher(s)/Tutor(s), E-mail	ssuresh@nitt.edu	Telephone No.	04312503422
Course Type	☐ Core course	■ Open Elective course	

COURSE OVERVIEW

It is planned to teach the course interactively, rather than by a strict lecture format. The class will cover the fundamentals of energy storage technology. This course is designed to introduce a basic study of modelling and application of different energy storage techniques. The methodologies for solving a wide variety of practical engineering problems and useful information concerning the analysis of energy storage will be discussed.

SYLLABUS

Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Applications

Thermal storage – Types – Modelling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units - Modelling using porous medium approach, Use of Transys

Fundamental concept of batteries – measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide and modern batteries for example (i) zinc - Air (ii) Nickel Hydride, (iii) Lithium Battery

Fuel Cell – History of Fuel cell, Principles of Electrochemical storage – Types – Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis – advantage and drawback of each type.

Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications

COURSE OBJECTIVE

1. To develop the ability to understand / analyse the various types of energy storage.
2. To study the various applications of energy storage systems

COURSE OUTCOMES (CO)	
Upon the completion of the course, the students will be able	Aligned Programme Outcomes (PO)
Explain about applications of energy storage systems	1,2,5,6,7
Analyse different energy storage technology	2,3,11
Explore the real time applications of energy storage techniques	2,3,4,5,6
Model thermal energy storage systems	3,5,6

COURSE TEACHING AND LEARNING ACTIVITIES

Sl.No.	Week	Topics	Mode of Delivery
1	1st week	Necessity of energy storage – types of energy storage –	Chalk & Talk: Document camera
2	2nd week	comparison of energy storage technologies– Applications	Chalk & Talk: Document camera
3	3rd week	Thermal storage – Types – Modelling of thermal storage units – Simple water and rock bed storage system –	Chalk & Talk; Document camera
4	4th week	pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units -	Chalk & Talk; Document camera
5	5th week	Modelling using porous medium approach, Use of Transys	Chalk & Talk; Multimedia
6	6th week	Fundamental concept of batteries – measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues.	Chalk & Talk: Document camera

7	7th week	Types of batteries – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide and modern batteries	Chalk & Talk: Document camera
8	8th week	(i) zinc - Air (ii) Nickel Hydride, (iii) Lithium Battery	Chalk & Talk: Document camera
9	9th week	Fuel Cell – History of Fuel cell, Principles of Electrochemical storage –	Chalk & Talk: Document camera
10	10th week	Types – Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell,	Chalk & Talk: Document camera
11	11th week	detailed analysis – advantage and drawback of each type.	Chalk & Talk: Document camera
12	12th week	Flywheel, Super capacitors, Principles & Methods – Applications	Chalk & Talk; Multimedia
13	13th week	Compressed air Energy storage, Concept of Hybrid Storage – Applications	Chalk & Talk: Document camera
14	14th week	Revision and repeat class for particular topics	Chalk & Talk: Document camera

COURSE ASSESSMENT METHODS

Sl.No.	Mode of Assessment	Week/Date	Duration	% Weightage (marks)
1.	Cycle Test - 1	After 6th week	1 hour	20
2.	Cycle Test – 2	12th-13th week	1 hour	20
3.	Assignment & Seminars	Two Assignments & One Seminar	-----	10
4.	End Semester Examination	At the end of semester	3 hours	50
			Total	100

ESSENTIAL READINGS: Textbooks and Data book

1. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002
2. Fuel cell systems Explained, James Larminie and Andrew Dicks, Wiley publications, 2003.
3. Electrochemical technologies for energy storage and conversion, Ru-shiliu, Leizhang, Xueliang sun, Wiley publications, 2012

COURSE EXIT SURVEY

1. Students can meet the faculty at any stage in the course duration in case he/she finds difficulty in understanding the concept.
2. Feedback from the students during the class committee meeting.
3. End semester feedback on Course Outcomes.

COURSE POLICY (Attendance, Assessment, academic honesty, etc.)

CORRESPONDENCE

All the correspondence will be done through their class representative (**CR**).

ATTENDANCE

1. Attendance will be taken by the faculty in all contact hours.
2. The minimum attendance for appearing for the end semester examination is 75%.
3. Any student, who fails to maintain 75 % attendance, but above 60% in a subject, shall attend mandatory classes before the semester examinations to qualify to write the semester exam.
4. The students who are having attendance less than 60% has to redo the course in the next semester.

EXAMINATION / ASSESSMENT

Attending all the assessments is **MANDATORY** for every student.

If any student is not able to attend any of the continuous assessments (CTs: 1&2) due to genuine reason, the Retest examination shall be conducted for 20 marks comprising the syllabus of both the cycle tests.

Students should submit the assignments before the last date of submission. In case if a student fails to submit the assignments within the last date of submission, he/she will be awarded zero marks for that particular assignment.

The passing minimum should be 33 marks or 50% of the class average.

ACADEMIC HONESTY & PLAGIARISM

All the students are expected to be genuine during the course work. Taking of information by means of copying assignments, looking or attempting to look at another student's paper or bringing and using study material in any form for copying during any assessments is considered dishonest.

Preventing or hampering other students from pursing their academic activities is also considered as academic dishonesty.

FOR SENATE'S CONSIDERATION

Course Faculty _____ CC-Chairperson _____ HOD _____ 06/02/2020