



SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE
www.sathyabama.ac.in**

Department of Electrical and Electronics

New course introduced

SL. NO.	COURSE CODE	COURSE OFFERED
1	SEE3013	ENERGY STORAGE SYSTEMS

SEE3013	ENERGY STORAGE SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To develop the ability to understand / analyze the various types of energy storage.
- To study the various applications of energy storage systems.
- To analyze various types of energy storage devices and perform the selection based on techno-economic view point.

UNIT 1 INTRODUCTION

8 Hrs.

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

UNIT 2 ELECTRICAL ENERGY STORAGE

10 Hrs.

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 zinc-Air, Nickel Hydride, Lithium Battery.

UNIT 3 FUEL CELL

9 Hrs.

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.

UNIT 4 THERMAL STORAGE SYSTEM

9 Hrs.

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

UNIT 5 ALTERNATE ENERGY STORAGE TECHNOLOGIES

9 Hrs.

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

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the different energy storage technology
- CO2 - Analyze the technical aspects of battery storage system
- CO3 - Examine the performance of fuel cell storage system
- CO4 - Evaluate the performance of different thermal storage system
- CO5 - Criticize the different alternate energy storage technology
- CO6 - Select suitable alternate energy storage technology for real world application

TEXT / REFERENCE BOOKS

1. Ibrahim Dincer and Mark A. Rosen, "Thermal Energy Storage Systems and Applications", John Wiley & Sons 2002.
2. James Larminie and Andrew Dicks, "Fuel cell systems Explained", Wiley publications, 2003.
3. Lunardini.V.J, Heat Transfer in Cold Climates, John Wiley and Sons 1981..
4. Ru-shiliu, Leizhang and Xueliang sun, "Electrochemical technologies for energy storage and conversion", Wiley publications, 2012.
5. Schmidt.F.W and Willmott.A.J, Thermal Storage and Regeneration, Hemisphere Publishing Corporation, 1981.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration: 3 Hrs.

PART A: 10 Question of 2 marks each – No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks