

## Syllabus for B.Tech – Energy Engineering

<b>Course Number &amp; Title:</b> EN304 Energy Storage Systems	
<b>L-T-P-C:</b> 3-0-0-6	
<b>Offered in</b> (Odd/ Even / Any): Semester V	
<b>Pre-Requisite:</b> Nil	
Preamble / Objectives (Optional): This course introduces the basic principles of several energy storage techniques and new emerging techniques in energy storage. The main focus for energy storage systems will be on addressing the energy demand in electric vehicles, and renewable energy storage in ESS.	
Course Content/ Syllabus: Energy demand, need for energy storage, types of energy storage: electrochemical, thermal, hydrogen storage, mechanical, electrical; electrochemical storage, primary and secondary batteries, thermodynamics and kinetics of storage, Li-ion battery, redox-flow battery, Na-S battery, thermal storage: sensible and latent heat, thermo-chemical storage, and Underground storage, Mechanical: flywheels, compressed air storage, pumped-hydro, H <sub>2</sub> storage: compressed storage, liquid/solid state storage, materials for H <sub>2</sub> storage, electrical: classification, difference between batteries and capacitors, superconducting magnetic storage, applications: storage for renewable energy systems, electric vehicles, and electrical energy storage systems, hybrid storage systems	
Books (In case UG compulsory courses, please give it as “Text books” and “Reference books”. Otherwise give it as “References”.	
Text Books: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	R Huggins, <i>Energy Storage</i> , 10 <sup>th</sup> Edition, Springer, 2014.
2.	I Dinçer, and M A Rosen, <i>Thermal Energy Storage: Systems and Applications</i> , 3 <sup>rd</sup> Edition, Wiley, 2021.
Reference Books: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	T B Reddy, <i>Linden’s Handbook of Batteries</i> , 4th Edition, McGraw-Hill Education, 2011.
2.	A F Zobaa, <i>Energy Storage - Technologies and Applications</i> , Intechopen, 2013.
3.	M Hirscher, Katsuhiko Hirose, <i>Handbook of Hydrogen Storage</i> , Wiley-VCN, 2010.