

# International Summer School Manipal University Jaipur [ISSMUJ]-2022

[Hybrid Mode]

## Course Overview

**Name of Course: Advanced Functional Materials for Energy Engineering**

Name of instructors: Dr. Ravi Kumar Sharma (MUJ) and Dr. Mohammad Khalid  
(Sunway University, Malaysia)

Session: June-July 2022

Language of instruction: English

Number of contact hours: 36

Credit awarded: 03

### Objective of Course

- Broad scope preparation in selecting and using materials for applications in energy engineering
- learning basics principles and how to use instruments, including: testing materials durability (e.g., microhardness, mechanical fatigue), modifying materials (e.g., by shot-peening), characterizing materials properties (e.g., residual stress by XRD and Hole Drilling methods)
- Principles of applications of these materials.

### Syllabus

Materials for solar cells: semi-conductors. Battery materials : Li-batteries, metal-hybrid-batteries. Materials for hydrogen technology: production (electrolysis), storage (hydrids), fuel cells. Materials used in connection with gas power (catalysts, microporous materials, membranes); Materials for thermal energy storage; Aging, damage and failure of materials in exercise (e.g. creep, mechanical fatigue, cavitation, wear and corrosion).

### Organization of course

Total contact hrs 36		
1st week:	8 hrs (classes)	4 hrs (self-study/ discussion/tutorial)

2nd week:	8 hrs (classes)	4 hrs (mid term exam/assessment/discussion/tutorial)
3rd week:	8 hrs (classes)	4 hrs (end term exam/presentation/report)

**Mode of lectures:** Offline Lectures; Tutorial Sessions; Discussion.

### Course Plan

Lecture no.	Topic	Lecture mode	Instructor(s)
L: 1-6	Introduction to energy materials	Offline Lectures; Tutorial Sessions; Discussion	Dr. Ravi Kumar Sharma Dr. Mohammad Khalid
L: 7-12	Materials for semiconductors and hydrogen store	Offline Lectures; Tutorial Sessions; Discussion	Dr. Ravi Kumar Sharma Dr. Mohammad Khalid
L: 13-18	Fuel cells, photovoltaic, microporous materials	Offline Lectures; Tutorial Sessions; Discussion	Dr. Mohammad Khalid
L: 19-24	Thermal energy storage	Offline Lectures; Tutorial Sessions; Discussion	Dr. Ravi Kumar Sharma
L: 25-30	Aging, damage and failure of materials	Offline Lectures; Tutorial Sessions; Discussion	Dr. Ravi Kumar Sharma Dr. Mohammad Khalid
L: 31-36	Project Presentation; Report/Paper Writing; Evaluation.	Tutorial Sessions; Discussion	Dr. Ravi Kumar Sharma Dr. Mohammad Khalid

### Brief profile of the instructors

**Dr. Ravi Kumar Sharma**, Associate Professor, Mechanical Engineering  
B.E. (Mechanical Engineering) – RGPV Bhopal, India  
Ph.D. (Thermal Energy Storage) – University of Malaya, Malaysia  
Academic & Research Experience: 14 years



**Dr. Mohammad Khalid**, Professor and Head, Graphene and Advanced 2D  
Materials Research Group School of Engineering  
and Technology  
B.E. (Chemical Engineering) –VTU, India  
Ph.D. (Chemical Engineering) – International Islamic University, Malaysia  
Academic & Research Experience: 15 Years

