Syllabus for B.Tech – Energy Engineering

Course Number & Title: EN313 Energy Materials and Device Fabrication Laboratory

L-T-P-C: 0-0-3-3

Offered in (Odd/ Even / Any): Semester VI

Pre-Requisite: Nil

Preamble / Objectives (Optional): This course provides the basic principles and hands on lab experience of device fabrication and lithography techniques focusing on Energy relevant materials with current advancements.

Course Content/ Syllabus: Introduction and overview of semiconductor device fabrication, Fabrication operations: Oxidation, doping, printing and lithography, Fabrication processes: etching and growth. Process evaluation, Process yield, clean room design, and packaging

- 3D Printing for designing surfaces, circuits, electrodes,
- Fabrication and assembly of solar lantern
- Fabrication of nano materials for solar cells, battery, capacitors, electrolyzer
- Fabrication of Li-ion battery (coin-cell) and study the kinetics and performance
- Fabrication of super capacitors (coin-cell) and study the performance
- H_2 evolution studies and study the thermodynamics and kinetics
- Photo electrochemical studies for alternate fuels
- Thin film deposition for solar-cells
- Fabrication of 500 W PEM fuel-cell and study the kinetics and thermodynamics
- Fabrication of microbial fuel-cell
- Fabrication of airfoil
- Fabrication of form stable Phase change materials
- Assembly and study of electrolyzer
- Battery management systems (BMS)
- Thermal management systems for Fuel-cell
- Study of P (Proportional) I (Integral) D (Differential), PI, PD, and PID controllers
- Study of the PLC controller

(selected 10 experiments will be studied)

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Text Books: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1. C Tong, *Introduction to Materials for Advanced Energy Systems*, Springer, 2019.
2. K Y Cheong, L C Chen, *Sustainable Materials for Next Generation Energy Devices,* Elsevier Science, 2020.

Reference Books: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1. P Swaminathan *Semiconductor Materials, Devices and Fabrication, Wiley India, 2017.*