U.S. Pakistan Center For Advanced Studies In Energy (USPCAS-E)

National University of Sciences & Technology

Course Title: Modelling of Energy system

Course Code ESE-809

Course Objectives:

The aim of this course are to familiarize students with practical applications of software used to model various aspects of energy systems ranging from energy planning strategies, carbon mitigation technologies, energy production & life cycle cost, evaluate supply & demand, depicting all possible flows to energy from resource extraction, through energy transformation and end-use devices, to demand for useful energy services.

The students will learn a multiple of software platforms leading to first order estimates to critical questions arising in the production and use of energy. This is considered universally as the preface to fabrication of experimental energy gadgets, which provides saving of time and costs.

Recommended books.

Detailed Contents:

- **Introduction to Modeling and simulation**
- **Energy Management in Buildings**
  a. Energy Audit
     Software: Design Builder TRNSYS RETSCREEN
  b. Modeling of Energy usage in Buildings RETSCREEN
     Software: Design Builder TRNSYS
  c. Modelling of geothermal systems for heating and cooling of buildings in domestic and commercial sectors
     Green House Gas (GHG) Reduction analysis
- **Solar Energy**
  a. PV (Application sided)
  b. Modeling of PV systems for off grid, on grid and isolated grid (Domestic, commercial and industrial scale) for different locations of Pakistan
     i. Software: Polysun, TRNSYS, PV sol, Metonorm RETSCREEN
     ii. Software: GeoT*SOL
     iii. Software: HOMER
  c. Solar Thermal systems modeling including solar cooling, heating
     Software: Polysun, TRNSYS, T*SOL, RETSCREEN

d. Solar power generation system modeling for parabolic trough, concentrators and solar chimney etc.

Software: ASAP PRO: optical analysis software and TRNSYS

e. Green House Gas (GHG) Reduction analysis

- **Wind Energy**

  Modeling of wind energy systems for off grid/ on grid power generation systems

  Software: HOMER Energy systems, TRNSYS

- **Energy Economics modeling**

  Software: RETScreen, Energy Costing Tool, LEAP, INVIVO and SPSS

- **Carbon Mitigation Technologies**

Text/Ref Books:

1 Design and optimization of thermal systems Yogesh Jaluria

2 Economy-Energy-Environment Simulation- Beyond the Kyoto Protocol. Kimio Uno

3 Energy, simulation-training, Brain J. Thomson

4 Handbook of Energy Audits Albert Thumann, William J. Younger, Terry Niehus

5 The Performance of Photovoltaic (PV) Systems: Modelling, Measurement and Assessment (2017) N. Pearsall

6 Weather Modeling and Forecasting of PV Systems Operation. M. Paulescu, E. Paulescu, P. Gravila, V. Badescu

7 Modeling and Optimization of Renewable Energy Systems. Arzu Sencan Sahin.