SOLAR ENERGY ENGINEERING AND TECHNOLOGY

PROF. PANKAJ KALITA
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IIT Guwahati

PRE-REQUISITES : Basic knowledge of heat transfer, thermodynamics and fundamentals of physics

INTENDED AUDIENCE : UG, PG and Doctorate students

INDUSTRIES APPLICABLE TO : This course will be very much effective for the engineres working in the solar industries.

COURSE OUTLINE :

The course content is designed to provide comprehensive knowledge on solar radiation, analysis of solar radiation data, fundamentals of the solar thermal and photovoltaic system along with storage of energy required for effective design of efficient solar energy conversion devices. The concepts will be illustrated with practical examples, schematics and block diagrams wherever required. A sufficient number of numerical problems with solutions will be discussed in the course. This course is specifically designed for undergraduate and postgraduate students of Energy Engineering and Technology. Further, the course will be very much useful for students and researchers from varied academic backgrounds for the synthesis of novel energy conversion devices and processes.

ABOUT INSTRUCTOR :

Prof. Pankaj Kalita is Associate Professor in the School of Energy Science and Engineering, Indian Institute of Technology Guwahati. He has completed his master degree in Mechanical Engineering (specialization: Fluids and Thermal Engineering) and PhD in Energy from IIT Guwahati. He worked as Assistant Professor in the Department of Energy at Tezpur University, Assam before joining at IIT Guwahati. He has more than 10 years of teaching and 16 years of research experience in various field of renewable energy. He has published more than 100 articles in various peer reviewed journals and conferences. He has also contributed one book and 16 book chapters in different books. He is a recipient of India Distinguished Visiting Fellow awarded by the University of Nottingham, United Kingdom in the year 2010. He has guided many PhD and master students. He has successfully implemented eight research projects and several consultancy projects funded by different government and private agencies in the fields of energy generation, energy management, energy modelling, solar power plant design, engine testing etc. At present three research projects are in progress in the areas of clean energy technologies for power generation, and hybrid (biomass and solar) drying technologies. His current areas of research include solar energy conversion, thermochemical and biochemical conversion, energy management, energy storage (li-ion and thermal energy) and integration of renewable energy for remote electrification.

COURSE PLAN :

Week 1: Energy Scenario, overview of solar energy conversion devices and applications, physics of propagation of solar radiation from the sun to earth

Week 2: Sun-Earth Geometry, Extra-Terrestrial and Terrestrial Radiation, Solar energy measuring instruments

Week 3: Estimation of solar radiation under different climatic conditions, Estimation of total radiation

Week 4: Fundamentals of solar PV cells, principles and performance analysis, modules, arrays, theoretical maximum power generation from PV cells.

Week 5:PV standalone system components, Standalone PV-system design.

Week 6: Components of grid-connected PV system, solar power plant design and performance analysis.

Week 7: Fundamentals of solar collectors, Snails law, Bougers law, Physical significance of Transmissivity – absorptivity product.

Week 8: Performance anlaysis of Liquid flat plate collectors and testing

Week 9: Performance anlaysis of Solar Air heaters and testing

Week 10: Solar thermal power generation (Solar concentrators).

Week 11: Thermal Energy Storage (sensible, latent and thermochemical) and solar pond

Week 12: Applications: Solar Refrigeration, Passive architecture,solar distillation, and ermeging technologies.