

# Controls for Renewable Energy and Microgrids

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## Overview of the course:

The power generated from renewable energy sources (RES) is fluctuating in nature. The fluctuating power from RES possess a great threat to grid stability and reliability. It is also very difficult to achieve specified voltage and frequency in isolation mode of operation of these types of sources and some additional storage devices or conventional DG set is required to mitigate these power fluctuations. Further, the growing energy crisis arising due to the mismatch in demand and supply of electricity is a major hindrance to sustain the current socio-economic growth of developing country like India. The integration of renewable energy sources like wind and solar have shown their effectiveness in achieving the aforesaid targets within their limits with the adoption and development of more advanced technology and have shown road map for their prospective growth. The geographical map of India provides us tremendous potential to tap the wind energy available along the long coast line and solar energy is almost uniformly available in most of the parts of the northern India. The initiatives taken by the Ministry of New and Renewable Energy (MNRE) in achieving the target of 160000 MW grid connected wind and solar photovoltaic systems by 2022 provides a huge opportunity to all the stakeholders working in this area. Above mentioned technologies find wide range of applications in grid-connected power systems specially serving rural and suburban areas, dedicated industrial or large commercial customers, and mini-grids serving rural or urban areas. Micro-grid incorporate information and communication technology into every aspect of electricity generation, delivery and consumption in order to minimize environmental impact, enhance markets, improve reliability and service, and reduce costs and improve efficiency. These technologies can be implemented at every level, from generation technologies to consumer appliances. As a result, smart micro grid can play a crucial role in the transition to a sustainable energy future in several ways: facilitating smooth integration of high shares of variable renewable, supporting the decentralized production of power; creating new business models through enhanced information flows, consumer engagement and improved system control; and providing flexibility on the demand side. However, the controls of renewable energy based micro grids is a challenging task. Therefore in the proposed course control aspects of integration of solar and wind system with microgrids will be covered followed by tutorials and simulation studies.

<b>Modules</b>	<b>This course consists of one module only.</b> <b>May 30–June 4, 2016</b> <b>Number of participants for the course will be limited to fifty.</b>
<b>You Should Attend If You are</b>	<ul style="list-style-type: none"><li>▪ Student of B. Tech, M. Tech, Ph. D. scholars and faculty from reputed academic institutions and technical institutions.</li><li>▪ Executives, engineers and researchers from manufacturing, service and government organizations including R&amp;D laboratories.</li></ul>
<b>Fees</b>	The participation fees for taking the course is as follows: <b>Participants from abroad : US \$200</b> <b>Industry/ Research Organizations: Rs. 5000</b> <b>Academic Institutions: Rs. 2000</b> <b>Research Scholars/students: Rs. 1000</b> The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, free internet facility.

## The Faculty



**Dr. Adel Nasiri** is presently a Professor in the Department of Electrical Engineering and Computer Science at the University of Wisconsin-Milwaukee, where he is the director of power electronics and electric motor drives laboratory. His research interests are renewable energy systems including wind and solar energy, and energy storage.

Dr. Nasiri has published numerous technical journal and conference papers on related topics. He also holds four patent disclosures. He is a co-author of the book Uninterruptible Power Supplies and Active Filters, CRC Press, Boca Raton, FL.

Dr. Nasiri is currently an Editor of IEEE Transactions on Smart Grid, Associate Editor of IEEE Transactions on Industry Applications, Associate Editor of the International Journal of Power Electronics, and Associate Editor of Journal of Power Components and Systems. He is also a member of IEEE Industry Applications, Industrial Electronics, Power Electronics, Power and Energy, and Vehicular Technologies Societies. He has also been a member of organizing committee for ECCE and IECON conferences.



**Dr. Majid Jamil** is a professor and head, Department of Electrical Engineering, Jamia Millia Islamia, New Delhi. Dr Jamil has more than 24 years research and teaching experience. He joined Jamia as a Lecturer in 1992 and became professor in 2010. He has also served as an Asst Professor at BITS Pilani Dubai Campus during 2003-2006.

Dr Jamil has published more than 80 research papers in international refereed journals and conferences. Dr Jamil has guided 8 Ph Ds and supervising 6 PhDs at present. He has also received grant of Rs. 203 lacs under FIST programme of DST, Govt of India. He has received grant of more than Rs 40 lacs from AICTE and DST, Govt of India for research projects. He has Edited 2 books and has written book chapters also. Dr. Jamil has also received the best paper award from University of California, Berkley, USA in 2009, Prof. Jamil was the organizing chair of IEEE International Conference- 12<sup>th</sup> INDICON 2015 held at Jamia Millia Islamia during 17-20<sup>th</sup> December 2015. He also organized a national conference ETEEE-2015 during 2-3<sup>rd</sup> Feb 2015.

Prof. Jamil is the senior member of IEEE and life member of ISTE, ICTP and Institutes of Engineering. His areas of interest are power systems, power protection, and renewable energy, energy auditing and intelligent techniques.

## Course Coordinator

**Prof. Majid Jamil**

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**For Registration:**

<http://www.gian.iitkgp.ac.in/GREGN/index>

# Controls for Renewable Energy and Microgrids

## TENTATIVE SCHEDULE

**May 30, 2016 (Monday)**

Registration: 9:00 AM to 9:30 AM

Inauguration Ceremony: 9:30 AM to 10:00 AM

### **May 30 Monday**

Lecture 1 : 10.00AM to 11:00 AM - Overview of Renewable Energy Sources

Tea Break

Lecture 2: 11:30 AM to 12:30PM - Solar Photovoltaic Technology

Lunch Break

Tutorial 1. 2:00 to 4:00 PM - Solar cells, solar modules, design and installation of solar photovoltaic systems etc.

### **May 31 Tuesday**

Lecture 3 : 10.00 AM to 11:00 AM - Wind Energy Conversion Systems

Tea Break

Lecture 4: 11:30 AM to 12:30 PM - Energy Storage Systems

Lunch Break

Tutorial 2. 2:00 PM to 4:00 PM - Wind power plants, energy storage systems etc.

### **June 1 Wednesday**

Lecture 5 : 10.00 AM to 11:00 AM - MPPT Controllers for solar photovoltaic and wind systems

Tea Break

Lecture 6: 11:30 AM to 12:30 PM - Converter Topologies for solar photovoltaic and wind systems

Lunch Break

Tutorial 3. 2:00 PM to 4:00 PM - MPPT algorithms, converter design etc.

### **June 2 Thursday**

Lecture 7 : 10.00 AM to 11:00 AM - Microgrid components, energy storage modelling

Tea Break

Lecture 8: 11:30 AM to 12:30 PM - Controls for storage inverter and generator

Lunch Break

Tutorial 4. 2:00 PM to 4:00 PM - Design and development of microgrid, inverter control etc.

### **June 3 Friday**

Lecture 9 : 10.00 AM to 11:00 AM - Controls for renewable in various modes

Tea Break

Lecture 10: 11:30 AM to 12:30 PM - Power management strategies in microgrid

Lunch Break

Tutorial 5: 2:00 PM to 4:00 PM - Modelling hybrid renewable energy system for microgrid

### **June 4 Saturday**

Lecture 11 : 10.00 AM to 11:00 AM - Simulation on controls of renewable energy with case studies

Tea Break

Lecture 12: 11:30 AM to 12:30 PM - Exposure to softwares for controls of renewable energy

Lunch Break

Lecture 11: 2:00 PM to 4:00 PM - Hands on practice on PV Syst, MATLAB software

Valedictory Function: 4:00 PM to 5: 00 PM