



A Six Day GIAN Course
on
Advanced Process Control

December 12 - 17, 2016

Call for Registration and Participation

About GIAN

MHRD, Govt. of India has launched an innovative program titled “Global Initiative of Academic Networks (GIAN)” in higher Education, in order to garner the best international experience. As part of this, internationally renowned Academicians and Scientists are invited to augment the Country’s academic resources, accelerate the pace of quality reforms and elevate India’s scientific and technological capacity to global excellence.

Overview of the Course

The need for high-performance advanced control systems has accelerated over the past decade. Economic pressure, increased environmental and safety concerns and a tighter integration of process units have all contributed towards this demand. The complex nature of manufacturing processes coupled with the large investments in assets by operating companies in the process industries make the need for automated process control greater than ever. At the same time, because of the increased efficiency of process computers, to demand for robust and accurate control of non-linear industrial processes can now be achieved by advanced process control (APC) strategies. APC is a proven technology that reduces process variability and inefficiency, improves product consistency, increases throughput by allowing operations to push constraints to the limits and achieve higher return on assets. Over the years, APC has decisively demonstrated its value as a best practice by increasing throughput and improving yield, energy usage, raw material usage, product quality, safety, and responsiveness.

The current economic crisis, the biggest in almost 100 years, further emphasizes the need for more cost- and resource-efficient production processes. APC is explicitly mentioned in several economic studies as a tool for facing the challenges related to globalization, sustainable development, economic demand, and changing consumer demand. The benefits of using advanced process control strategies include a more consistent product quality, the production of less off-spec material, a significant reduction in energy requirements, making product with less raw materials, increasing the production capacity of existing installations.

The main aim of the proposed course is to develop a quantitative understanding of the various complex techniques that underpin advanced (and modern) process control strategies, and an appreciation of how and when to apply them.

Leading international academics and researchers with extensively recognized expert, and demonstrable ability in teaching, consultancy, research, and training in the field of advanced process control will deliver lectures and discuss industrially relevant case studies in the course.

Course Contents:

- i) Dynamic models, linearization and state-space formulations. Synthesis, analysis and design of advanced SISO control structures.
- ii) Multi-input multi-output (MIMO) system analysis and multivariate control design.
- iii) State estimation using Kalman filtering. Estimator structure. Luenberger observer and Kalman gain. Sources of noise and filter formulation. Discrete time Kalman filter design. Realization and implementation issues. Extended Kalman Filter, Unscented Kalman filter, Ensemble Kalman Filter.
- iv) Linear model predictive control design. Moving and shrinking horizon philosophy and state-space formulation of MPC.
- v) Design and implementation aspects of nonlinear model predictive control approaches. Optimization approaches for NMPC, sequential-quadratic programming, single and multiple shooting techniques, simultaneous and sequential optimization approaches.
- vi) Examples of MPC and NMPC implementations and analysis of examples to Fluid catalysis cracking, bioreactors, batch and continuous processes, continuous pharmaceutical manufacturing
- vii) Hands-on simulation studies on filtering, linear and nonlinear MPC using simulation tools.

Resource Persons:



Prof. Zoltan K Nagy, Professor, School of Chemical Engineering, Purdue University, USA is the international resource person. He has over 20 years of experience in advanced process control, process analytical technologies and crystallization modeling & control approaches with applications in the pharmaceutical, food and fine chemical industries. His current research focuses on the application of systems approaches & tools in the design & robust control of batch & continuous crystallization systems. He has authored more than 120 archival journal papers and the co-author of 4 books. He graduated 15 PhD students and currently supervises or co-supervises 20 in the UK and Purdue.

For more details: <https://engineering.purdue.edu/ChE/people/ptProfile?id=79574>



Dr. Niket Kaisare, Associate Professor, Department of Chemical Engineering, IIT Madras is the national resource person. He worked about three years in Industrial R&D, with General Motors and ABB Corporate Research. He authored 35 papers in peer-reviewed international journals and is a co-inventor on five patent submissions. He was awarded IIT-M Young Faculty Recognition Award for Research and Teaching in 2010, and INAE Young Engineer Award in 2011. His specific research interest include model-based control, optimisation, multi-scale modelling, combustion in micro-reactors and fuel processing and storage.

For more details: <http://www.che.iitm.ac.in/~nkaisare/members/nkaisare.html>

Who can Participate?

- ❖ Faculty members/research scientist in chemical/Instrumentation/Control/Electrical/Electronics/relevant engineering discipline interested in modeling, simulation and advanced control.
- ❖ Professional engineers interested or working in optimization and process control in industries.
- ❖ UG/PG students or research scholars interested in learning advanced process control concepts.

How to Register?

Stage-1: Web Portal Registration: Visit <http://www.gian.iitkgp.ac.in/GREGN/index>

and create login User ID and Password. Fill up the blank registration form and do web registration by paying Rs. 500/- online through Net Banking/Debit/Credit card. This provides the user with life time registration to enroll in any number of GIAN courses offered.

Stage-2: Course Registration: Login to the GIAN portal with the user ID and Password already created in Step 1. Click on Course Registration option at the top of Registration form. Select the Course titled "**Advanced Process Control**" from the list and click on Save option. Confirm your registration by clicking on Confirm Course.

Registration Fee:

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|---|----------------------------|
| Faculty | Rs. 4,000/- |
| Participants from Industry /Research Organizations | Rs. 10,000/- |
| Students & Research Scholars <ul style="list-style-type: none">• Without award of Grade• With award of Grade | Rs. 1,000/- Rs. 2,000/- |
| Students from abroad | US \$ 300 |

The Registration fee includes instructional materials, tutorials, laboratory and computer use and free internet facility. Subjected to availability, the participants from academic/research institutes and Industry will be provided with boarding and lodging on additional payment of Rs. 4,000/- in Visitors Block on sharing basis. Students & Research Scholars will be provided with boarding and lodging in Institute Hostels on additional payment of Rs. 2,000/-. **Limited accommodation is available in the campus. Candidates registering and paying early will be given preference in short listing process and in providing accommodation.**

Selection and Mode of Payment: Selected candidates will be intimated through e-mail. They have to remit the necessary course fee to the Bank as per the details given below.

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| Account Name | GIAN NITW |
| Account No. | 62447453600 |
| Bank | State Bank of Hyderabad |
| Branch | REC Warangal (NIT Campus) |
| Branch Code | 20149 |
| IFSC | SBHY0020149 |
| MICR Code | 506004011 |
| SWIFT Code | SBHYINBB018 |

About the Institute and Warangal: National Institute of Technology, Warangal (NITW) formerly known as RECW is the first among seventeen RECs set up in 1959. Over the years, the Institute has established itself as a premier Institution in imparting technical education of a very high standard, leading to B.Tech, M.Tech and Ph.D. programmes in various specializations of Science and Engineering streams. Warangal is known for its rich historical and cultural heritage. It is situated at a distance of 140 km from Hyderabad. Warangal is well connected by rail and road. National Institute of Technology, Warangal campus is 2 km away from Kazipet railway station and 12 km away from Warangal railway station.

About the Department: The Department of Chemical Engineering was established in the year 1964 and celebrated Golden Jubilee year in 2014. The Department offers B.Tech in Chemical Engineering, two M.Tech programmes (each in Chemical Engineering and Process Control) and Ph.D programs. Currently, the Department has 16 faculty members with different research expertise. The Department has good research facilities for both experimental as well as simulation based research.

For any queries regarding registration of the course, please contact the National Coordinators:

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