
GIAN
GLOBAL INITIATIVE OF ACADEMIC NETWORKS

Global Initiative of Academic Networks (GIAN)

Govt. of India approved a new program titled Global Initiative of Academic Networks (GIAN) in Higher Education aimed at tapping the talent pool of scientists and entrepreneurs, internationally to encourage their engagement with the institutes of Higher Education in India so as to augment the country's existing academic resources, accelerate the pace of quality reform, and elevate India's scientific and technological capacity to global excellence, adopt newer methods of pedagogy, infuse creativity & innovation driven learning, boost research in cutting-edge technologies, and to build stronger academic networks between both countries in niche areas.

In order to garner the best international experience into our systems of education, enable interaction of students and faculty with the best academic and industry experts from all over the world and also share their experiences and expertise to motivate people to work on Indian problems, there is a need for a Scheme of International Summer and Winter Term. During the 'Retreat' of IITs with Minister of Human Resource Development Smt. Smriti Zubin Irani on 29th June, 2014 at Goa, it was decided that "A system of Guest Lectures by internationally and nationally renowned experts would be evolved along with a comprehensive Faculty Development Programme not only for new IITs, IIMs, IISERs but also other institutions in the country.

IIT Guwahati developed 36 nos. of courses from 2016 to 2020 in various topics. In GIAN Phase-I
15 nos. of courses are developed, where 5 nos. of courses are 2 weeks and 10 nos. of courses are 1 week. In Phase-II 21 nos. of courses are developed, where 3 nos. of courses are 2 weeks and 18 nos. of courses are 1 week.

IIT Guwahati contribution
Phase-I (2016 - 2017)


Optimization Methods to Groundwater Resources Management

Prof. Manish Kumar Goyal
Civil Engineering, IITG

Prof. Konstantinos Katsifarakis,
Aristotle University of Thessaloniki, GREECE

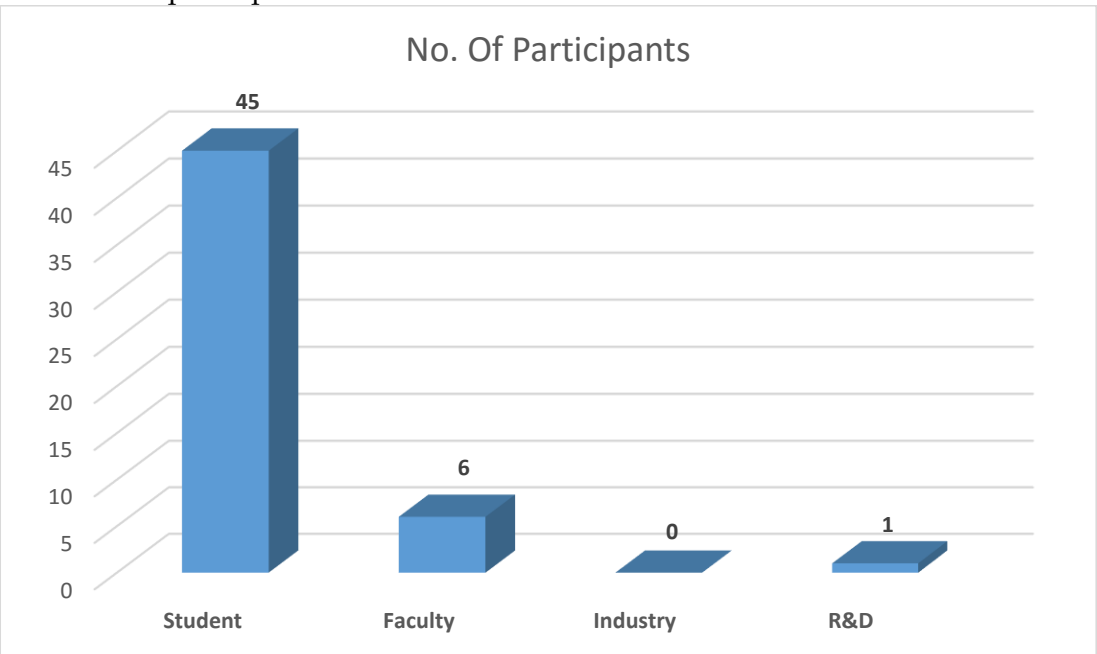
Duration: 07 March 2016 to 11 March 2016 (1 week)

Course Overview:
Groundwater is a component of the hydrological cycle interacting with all other components at various temporal and spatial scales. In several parts of world, burgeoning population and the socioeconomic development is causing depletion of ground water resources, seawater intrusion, reduction in base flows in rivers etc. Climate change, affecting total annual rainfall depth and precipitation pattern, may aggravate the problems.

In order to satisfy the several environmental and hydrologic requirements, optimization approaches should be used to develop a systematic method of determining optimum water supply strategies. This resource management problem requires the use of optimization techniques, quite often combined with ground water flow and mass transport simulation, in order to identify desirable scenarios of resource allocation; otherwise, resources may not be used in the most effective and efficient manner.

Internationally acclaimed academics and researcher with proven knowledge, experience, and demonstrable ability in teaching, research, and training in the field of optimization and ground water resources management will deliver lectures and discuss cases in the course. The course will be planned and offered as per the norms set by IIT Guwahati.

Total nos. of participants: 52




Optimization Methods for Engineering Planning and Design

Prof. Rajib Kumar Bhattacharjee
Civil Engineering, IITG

Prof. Fouad Bennis
FRANCE

Duration: 04 May 2016 to 08 May 2016 (1 week)

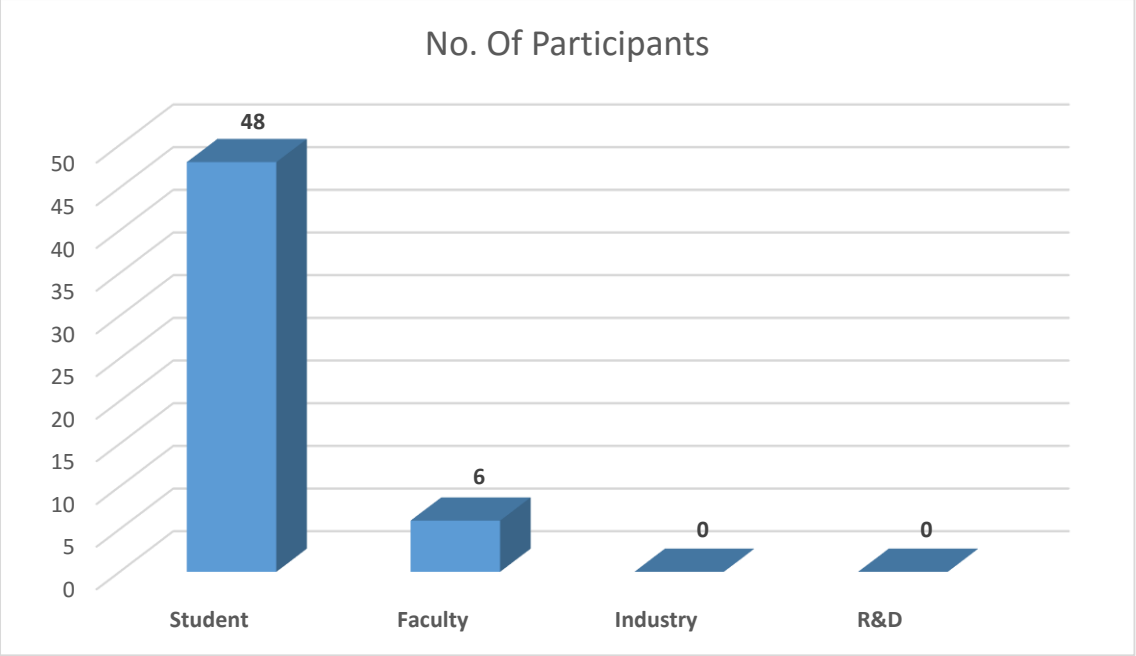
Course Overview:

Optimization is a powerful technique to obtain the best possible solution of various engineering planning and design problems. The techniques are in extensive use in engineering planning and design since long back. However, with the availability of high end computing facilities, it becomes more and more popular and is an important tool for finding the cost effective solution of various engineering problems. The current optimization methods and tools are sufficiently mature to be applied in industrial applications. As such, the applications of optimization techniques are increasing day by day in all branches of engineering and technology.

The objective of the course is to present the classical and non-classical optimization methods used in engineering planning and design problems. It will address some of the common real world problems in engineering design and planning of different engineering disciplines vis-it-vis Civil Engineering, Mechanical Engineering, Chemical Engineering, Electrical Engineering, etc. The initial lectures will cover the basics of the engineering optimization problems with their classical solution techniques and finally focuses will be given on the recent development in stochastic optimization techniques such as, Evolutionary Optimization, Simulated Annealing, Particle Swarm Optimization, Differential Evolution, Direct Search methods, etc. lt is intended to describe the systematic approach of optimization, which includes problem definition, its mathematical formulation, selection of a suitable optimization method, and a detailed analysis of the obtained optimal solution(s). Emphasis will also be given to enable the participants to formulate and optimize engineering problems with minimal programming skills. Practical works and projects will deal with optimal dimensioning of technical objects using MATLAB software.

The course lectures will be delivered by internationally acclaimed academician with proven knowledge and experience in teaching and research in the field of engineering optimization and design. It is expected that the course will be helpful to the academicians, engineers and scientists in enhancing their knowledge on optimization methods and its application to engineering planning and design.

Total nos. of participants: 54


No. Of Participants
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Student
Faculty
Industry
R&D


Campaigns, Media & Influence

Prof. Pahi Saikia
Department of Humanities and Social Science, IITG

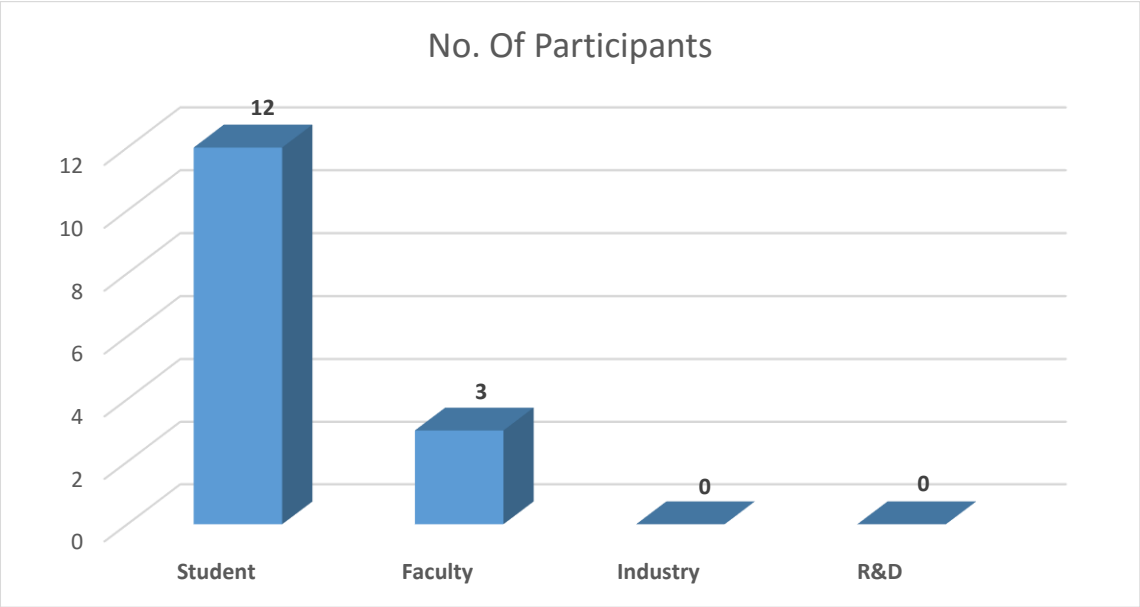
Prof. Holli A. Semetko
USA

Duration: 16 May 2016 to 20 May 2016 (1 week)

Course Overview:
Modern campaigning has been upended over the past decade by advances in media technology on a magnitude not seen since the arrival of television in the mid-20th century. Campaigns of all sorts are impacted by new mobile technology - political, governmental, NGO and corporate. This course focuses on the challenges and opportunities for election campaign research with examples from country and institutional contexts in the Americas, Europe and India. This graduate-level course provides an overview of key concepts, research designs, and methods used to advance research on influence in past, present and likely future campaign contexts. Students will receive an extensive bibliography of key readings on election campaign research, some of which will be assigned. Students will complete the course having learned about the evolution of:

- Country and institutional contexts for campaign research: media and political systems. Cases and examples from the Americas, Europe & India
- Media effects research in election campaigns from early modern (post-World War II) to the present day
- Research designs to investigate key concepts in media effects research: agenda-setting, priming, framing
- Research designs and methods used to investigate key concepts in election research: public opinion, information content, campaign mobilization and party support
- Country cases and examples from the Americas, Europe, India

Total nos. of participants: 15





Boiling Heat Transfer

Prof. Gautam Biswas
Department of Mechanical Engineering, IITG

Prof. Amaresh Dalal
Department of Mechanical Engineering, IITG

Prof. Vijay Dhir
University of California, USA

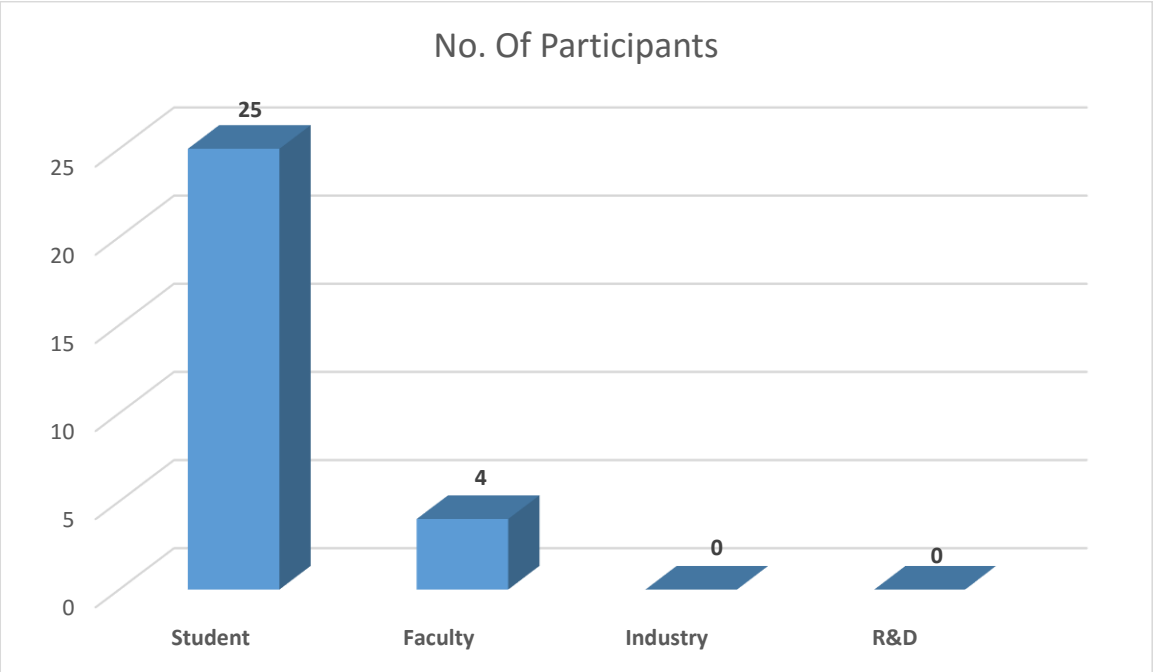
Duration: 23 May 2016 to 03 Jun 2016 (2 weeks)

Course Overview:

Many engineering applications involve phase change i.e., condensation or boiling. Boiling is the most effective heat transfer method as it shows high performance due to latent heat transport. It allows to reduce size, weight and volume of heat exchange devices and improve the thermal performance of components for the process industry and power plants. Hence, boiling heat transfer plays a very important role fora wide number of applications in many technological and industrial areas, including energy production. In addition, very compact heat exchangers can be manufactured due to the high heat transfer rate obtained with boiling heat transfer. Also, steam generators can be better designed if the boiling heat transfer is known in detail. Rate of boiling heat transfer is influenced by the magnitude of gravity through bubble dynamics and associate sub processes. Boiling is a very efficient way to cool engineering components and systems used in the extreme environments of space.

Internationally acclaimed academics and researchers with proven knowledge, experience, and demonstrable ability in teaching, research, and training in the field of Engineering will deliver lectures and discuss cases in the course. The course will be offered as 2 credit course with Jan- Apr semester course ME 522 Convective Heat and Mass Transfer as per the norms set by IIT Guwahati.

Total nos. of participants: 29




Green Material Forming and Joining

Prof. R. Ganesh Narayanan
Department of Mechanical Engineering, IITG

Prof. Jay S. Gunasekera
Ohio University, USA

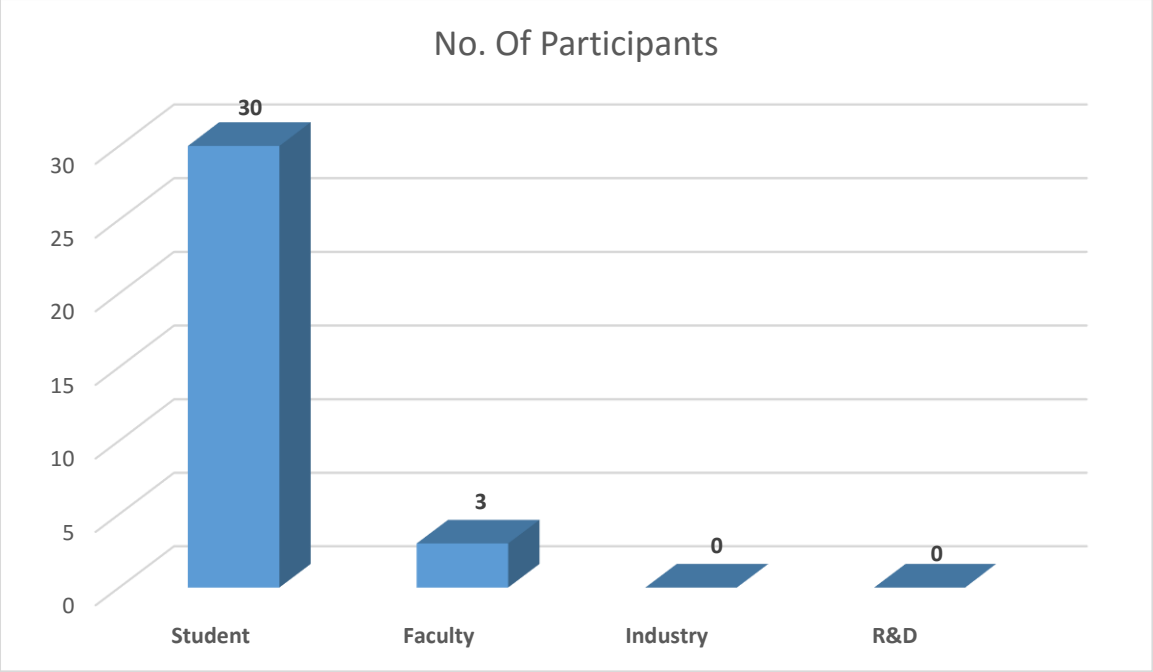
Duration: 06 Jun 2016 to 11 Jun 2016 (1 week)

Course Overview:

Since the first industrial revolution, manufacturing processes conventionally addressed environmental concerns as other's problem. Hence the development of the manufacturing processes and materials and its allied computerization did not take into account the sustainability and green issues during process development. The process includes the raw material consumed, the waste (type and volume including emissions), and the energy consumed. A good indicator of sustainability is the greenhouse emissions during the life-cycle of a product. The first three processes that contribute to the total CO2 emissions are, (a) Electricity and heat production, (b) Transport, and (c) industry. Some of the approaches towards sustainable and green manufacturing are, Enhanced use of renewable energy, Establishment of green buildings, Reduction of specific consumption of energy and water and materials, Reduction in specific emissions of wastes, effluents, Maximize recycling of wastes and water etc.

For instance, to tackle the sustainability issues in the transport sector, there is a growing synergy between the steel producers and the vehicle manufacturers. This effort started with the Ultra-Low Steel for Automotive Bodies (ULSAB) in the mid-1990s and the present version is the Future Steel Vehicle (FSV) program. The main motive is to reduce the carbon footprint throughout the lifecycle of the vehicle. Several technologies, for example, development of high strength steels, novel joining techniques like Friction Stir Welding, Laser Welding, forming techniques like Hot Forming, Incremental forming, and Extrusion have been developed. In order to make the sustainability and green concepts possible in day-to-day life, computations are inevitable. In this course, the concept of green and sustainability issues towards efficient material forming and joining will be highlighted. Attempts will be made to discuss the basics of such processes and their relationship with green and sustainable environment.

Total nos. of participants: 33


No. Of Participants
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Student
Faculty
Industry
R&D


Distributed Network Algorithms

Prof. Partha Sarathi Mandal
Department of Mathematics, IITG

Prof. Stefan Schmid
Aalborg University, DENMARK

Duration: 27 Jun 2016 to 01 July 2016 (1 week)

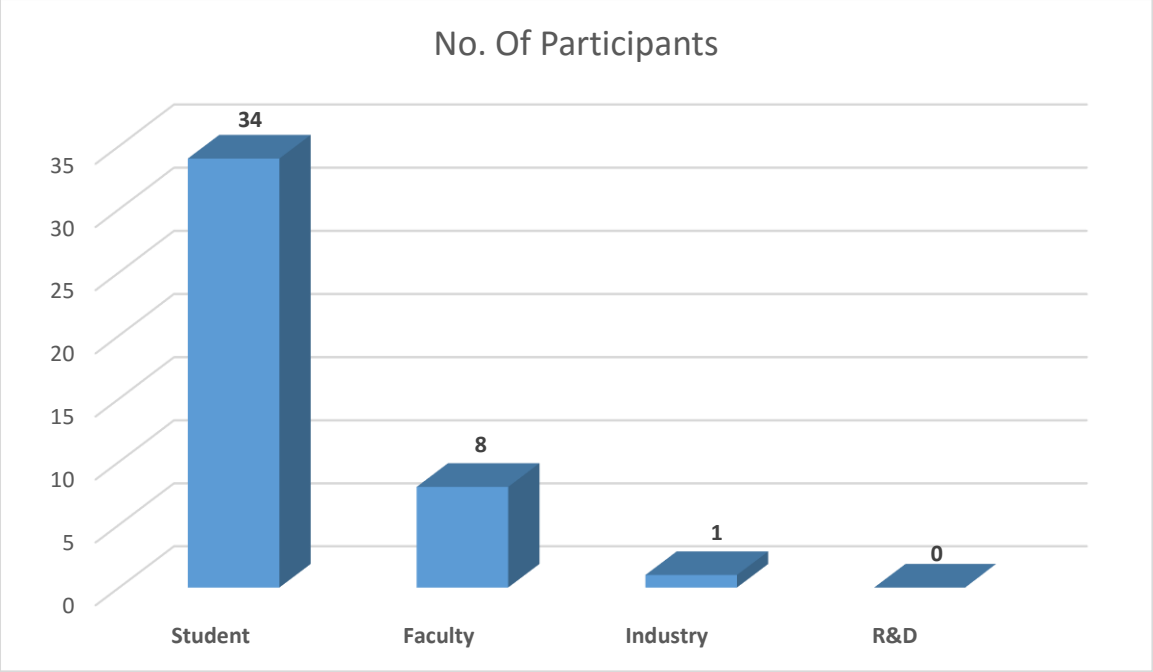
Course Overview:

Distributed network algorithms play a major role in many networked systems, ranging from computer networks (such as sensor networks, peer-to-peer networks, software-defined networks, datacenter networks, networks on chip) to social and even biological networks. Over the last decades, researchers have started developing a formal framework to reason about the fundamental mechanisms underlying distributed network algorithms, and to devise efficient distributed protocols. However, today, many basic distributed graph problems such as the distributed construction of spanners continue to puzzle researchers. Moreover, new applications like distributed graph analytics or new constraints introduced by wireless, power line or software-defined networks, continue raising fundamental research challenges. The goal of this course is two-fold: - First, we will introduce the fundamental formal models and methods used to reason about the correctness and performance of distributed network algorithms. In particular, we will teach essential algorithmic and analytic techniques which, after the course, are a useful toolbox and allow the students to develop and study their own distributed network algorithms. - Second, we complement the theoretical lectures with practical case studies, which show the various application domains of distributed network algorithms.

In particular students will learn about mathematical tools such as randomization, approximation techniques, graph theory etc., from a distributed computing lens. This active field of research also offers a wide range of research questions.

Internationally acclaimed academics, researchers and practitioners with proven knowledge, experience, and demonstrable ability in teaching, consultancy, research, and training in the field of Distributed Computing will deliver lectures and discuss potential research problems in the course. The course is planned as per the norms set by Global Initiative of Academic Networks (GIAN), an initiative by Govt. of India for Higher Education.

Total nos. of participants: 43


No. Of Participants
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Student
Faculty
Industry
R&D


Infrastructure Projects Planning and Modelling

Prof. L. Boeing Singh
Civil Engineering,
IITG

Prof. Hemanta Doloi
University of Melbourne,
AUSTRALIA

Duration: 27 Jun 2016 to 01 July 2016 (1 week)

Course Overview:

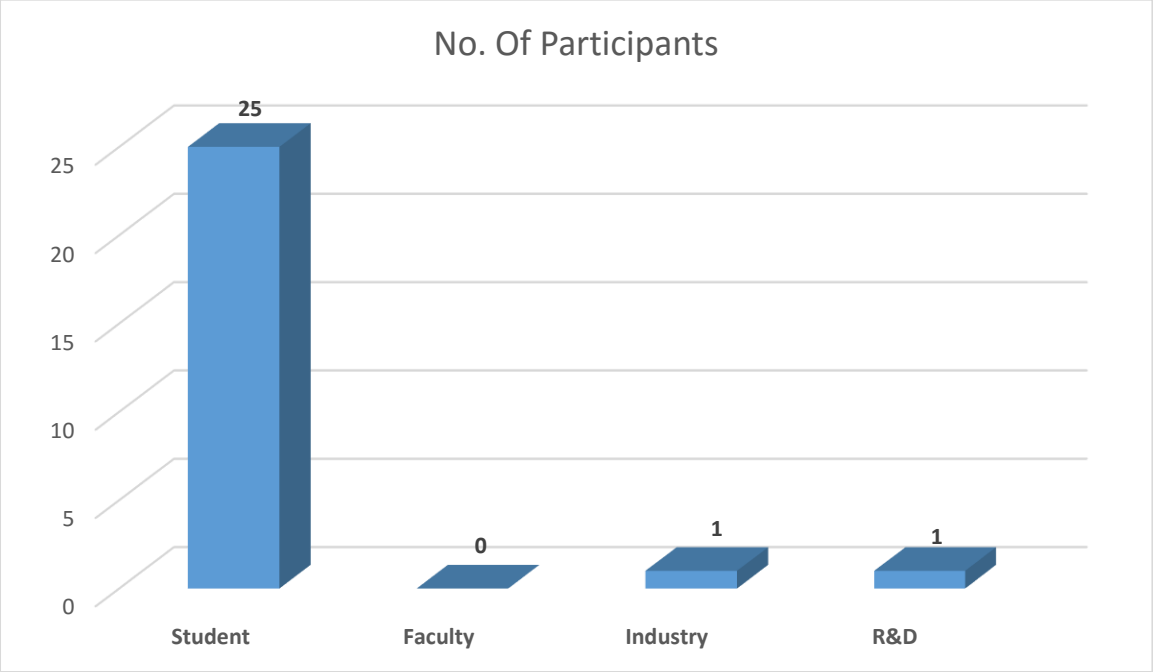
The economic growth of a nation is strongly influenced by the quality of infrastructure services provided to drive the various sectors and industries driving the country's economy. Good quality infrastructure leads to reduction in cost of production, improving the competitiveness of a region, generation of more employment opportunities, development of more inaccessible regions and enhancing the competitiveness of region at international level. In order to realize the spillover effects of infrastructure, it is very important to meticulously plan the development of infrastructure projects. Infrastructure planning therefore involves steps wherein the projects are assessing for economic and financial feasibility, limit the adverse impacts on the environment, and minimize the social impacts of the project. Various methods, tools and techniques, and frameworks have been developed to assist the planning process of infrastructure projects and it is very essential that the organizations, which are involved in infrastructure planning, should adopt a consistent approach to planning and management of infrastructure projects.

Ensuring the economic and financial viability of the infrastructure projects is very essential and guaranteed return on investment is considered as one of the key criteria for evaluating the infrastructure projects across most countries. However, there has been numerous evidence of failure of infrastructure projects despite being validated financially. Involvement of multitude of stakeholders in modern infrastructure projects demands projects being socially inclusive and the social value created by the projects meets the expectation of the wider community. Thus the questions, such as how much investment is enough, why such investment should be made, where the fund should come from and when should invest and how much social value is created over short and long terms etc., can easily be answered only if one has the right set of competency to deal with in a project context. Overall 'go/no-go' decisions do not always depend on financial principles but subjective judgments across the issues such as environmental performance, stakeholders' acceptance of product and usage, political situation etc. prevails. Unfortunately, when juggling with conflicting criteria across range of issues, solutions to one may not necessarily to guarantee a positive impact on others. Exercising a balanced approach for an appropriate 'trade-off is critical in making investment decisions in projects.

In the advent of Global Financial Crisis, accurate understanding of influencing parameters and their impact on projects' cash flow is highly crucial. Highly developed competency in Front-End analysis of project cash flow is the key for long term sustainability in the business. Responding to the above issues, this course aims to develop fundamental knowledge in project financial modelling and evaluation by taking a broad view on business viability analysis of public and private sector projects besides building expertise on the basics of planning of major infrastructure projects. Topic covered include fundamentals and basic concepts of infrastructure planning, tools and techniques for economic viability assessment, cost estimation and baseline planning, capital formation, role of interest rates, assessing financial feasibility and the investment decision, project financing and financing instruments,

profitability, socio-economic impact of projects, cost-benefit analysis, and revision of forecasts and financial decisions during project implementation.

Total nos. of participants: 27




Advances in Ultra-Precision Machining Processes

Prof. Shrikrishna N. Joshi,
Department of Mechanical Engineering, IITG

Prof. Saurav Goel,
Queen's University, Belfast, UK

Duration: 4 Jul 2016 to 15 Jul 2016 (2 weeks)

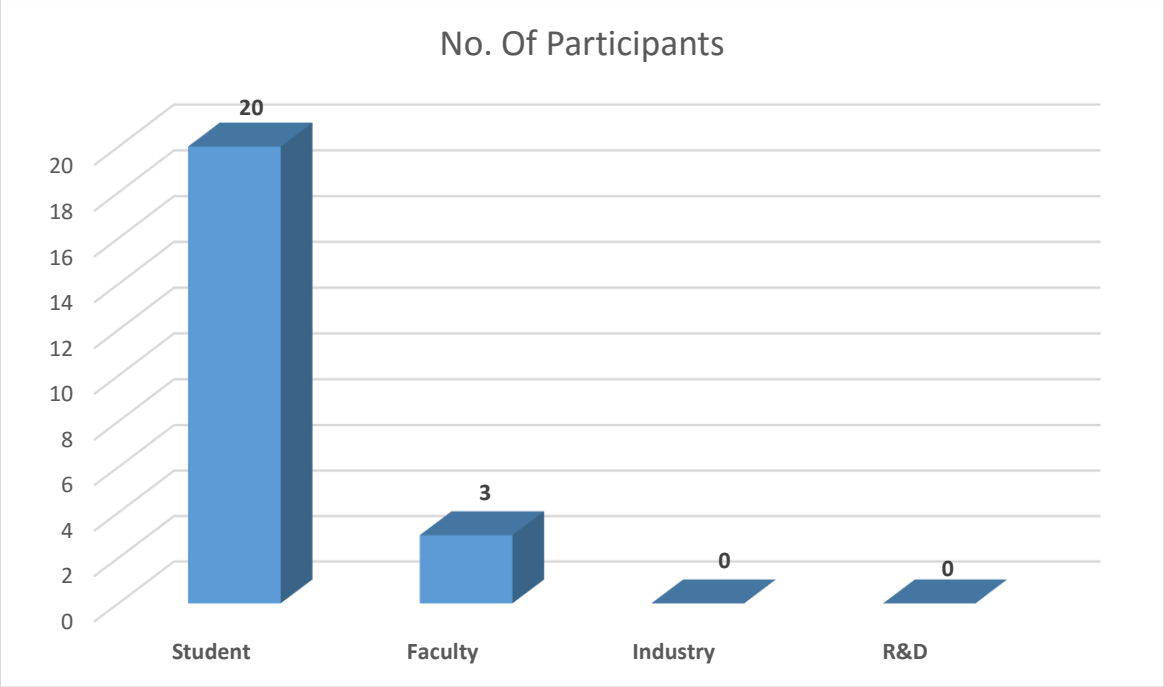
Course Overview:

Today the demand for micro devices and components is growing at a rapid pace in various areas such as aerospace, energy, optical, electronics and bio-medical industries. Miniaturization has pushed manufacturing improvements related to attainable accuracies and tolerances to the sub-micron range. This can be achieved by employing ultra-precision manufacturing processes such as single point diamond turning. Various ultra-precision material removal processes can be classified into mechanical, physical, or chemical processes. while physical and chemical machining processes are restricted to specific materials and applications, machining by mechanical means is considered to be almost universal in its applicability to almost all the materials. However, one of the formidable challenges to analyze and improve the mechanical based ultra-precision machining processes is that the mode of material removal at fine precision level changes from continuous to discrete. An accurate understanding of this phenomena is important.

In view of this, a 2-credits two weeks (20 lecturing hours) course on "Advances in ultra-precision machining processes, is organized at state-of-the-art E-classroom developed at the center for Education Technology (CET), llT Guwahati during July 4th to July 1.5th 2016. The course will be conducted by Dr. Saurav Goel (Queens University, U K) and Dr. Shrikrishna N. Joshi (llT Guwahati).

The course has two modules. First module focuses on fundamentals of ultra-precision machining processes such as classification of ultra-precision machining processes, size effects, differences between macro, micro and Nano machining, scaling issues, differences between mechanical, physical and chemical machining processes. In the second module, the course participants will learn the topics viz. molecular dynamics and its application to ultra-precision machining processes, latest developments in diamond machining and hybrid micromachining processes, newer approaches of micro-laser assisted machining, surface defect machining and vibration assisted machining. course participants will learn these topics through lectures and assignments. Also case studies will be shared to stimulate research motivation of participants.

Total nos. of participants: 23


No. Of Participants
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Student
Faculty
Industry
R&D


Reservoir Simulation – Mathematical Techniques in Oil and Gas Recovery

Prof. Anugrah Singh
Department of Chemical Engineering, IITG

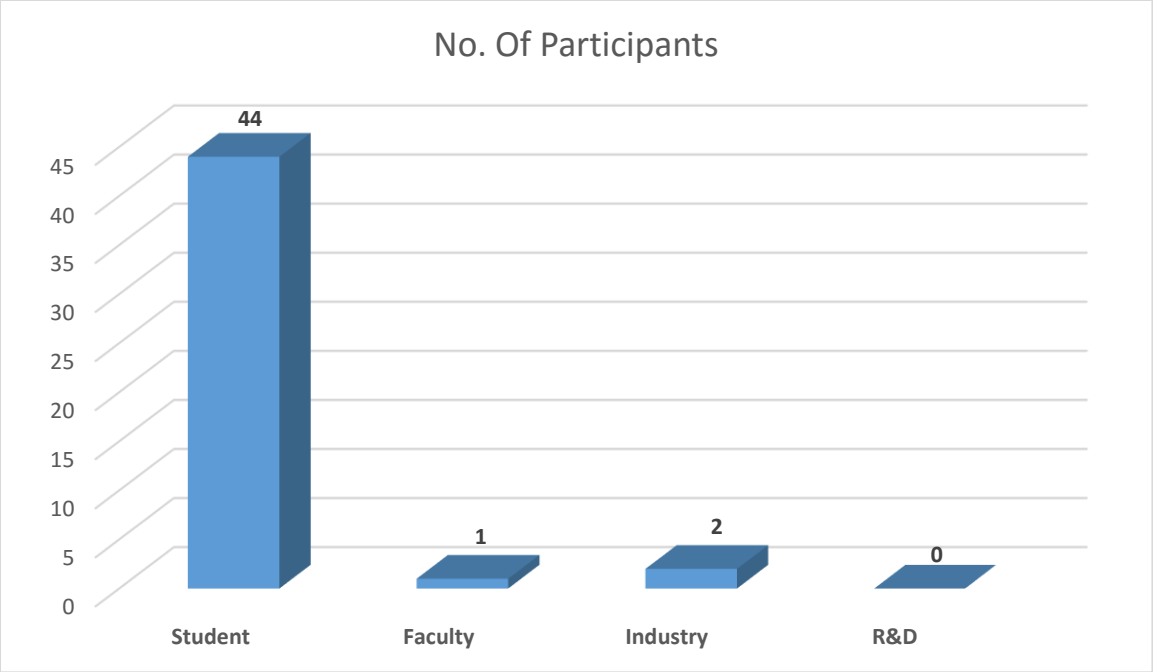
Prof. Prof. Mayank Tyagi
Louisiana State University, USA

Duration: 18 Jul 2016 to 29 Jul 2016 (2 weeks)

Course Overview:

Reservoir simulation has become a necessary tool for the petroleum engineers, geologists, and subsurface modelers to understand the recovery of hydrocarbon (or other fluids) in an efficient manner. With the advances in computing capabilities and the numerical methods, the complex geological systems and mixture of fluids can be tracked and visualized using the scientific computations. Insights from these simulations are expected to help in managing the reservoir assets and making reliable predictions about production rates. In this course the fundamental governing equations as well as the numerical techniques to discretize them will be covered. Simple linear algebra solvers will also be presented to enable building a Simulator that can provide the hands-on implementation of ideas in reservoir management. The students from petroleum, chemical, mechanical and civil engineering, and industry personnels working in petroleum sectors are expected to greatly benefit from this course. The course will be offered jointly by Prof. Mayank Tyagi of department of Petroleum Engineering, Lousiana State University, USA and Prof. Anugrah Singh of department of Chemical Engineering, IIT Guwahati, India.

Total nos. of participants: 47




Electricity Systems and Future Scenarios

Prof. Pinakeswar Mahanta
Department of Mechanical Engineering, IITG

Prof. Richard Blanchard
Loughborough University, UK

Duration: 6 Nov 2016 to 11 Nov 2016 (1 week)

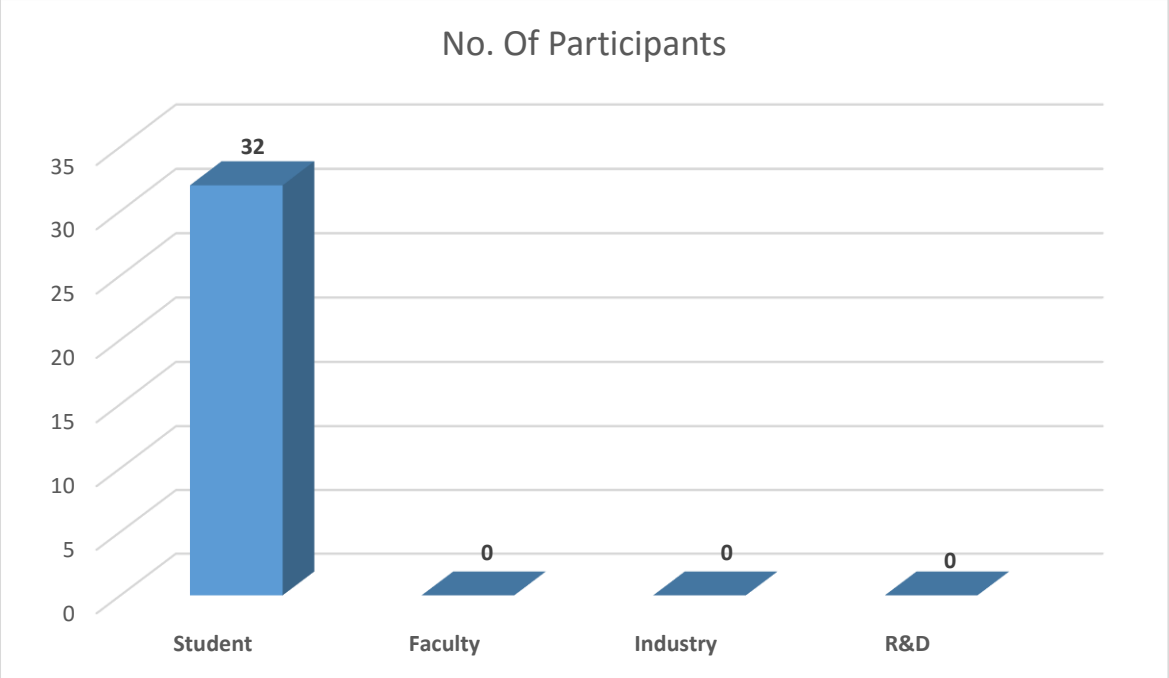
Course Overview:

The continued economic prosperity that has been felt by half the world has only been possible through the use of energy resources. Since the start of the industrial revolution and through the 20th and 21st centuries we have largely relied on fossil fuels to meet our increasing energy demand. Despite attempts to decouple economic and energy growth this demand looks set to continue. However, this economic growth has come at a cost. Pollution and climate change are caused by the burning of fossil fuels. Annually around 3.5 million people die prematurely because of air pollution. Climate change could affect 100s of millions of people. Since the 1992 Rio Earth Summit efforts have been made to cut back on emissions. However, it was the 2015 Paris Agreement has finally led to a global consensus for deep greenhouse gas (GHG) emission reduction to limit global mean temperature rise to 2^0C. The Intergovernmental Panel on Climate Change 5th Assessment Report highlighted the need for all key mitigation options to be used in this battle, namely, energy efficiency, renewables, carbon capture and storage.

What is now needed to meet the targets to mitigate further GHG emissions and adapt to change is an energy revolution. In order to understand how this can be carried out and appreciation of how the global energy system has developed is required. This will look at historic data to show energy use and economic development patterns. The types of energy resources, fossil fuels and nuclear will be discussed with consideration given to environmental issues. Mitigation of these pollution matters will be explored by reviewing different renewable energy technologies, improvements in the efficiency of the transmission and use of electricity, storage of electricity and carbon capture. Future scenarios will also be discussed that include storage and smart grid systems.

Internationally acclaimed academics, researchers and practitioners with proven knowledge, experience, and demonstrable ability in teaching, consultancy, research, and training in the field of Energy Systems will deliver lectures and discuss cases in the course. The course will be planned and offered as per the norms set by IIT Guwahati.

Total nos. of participants: 32


No. Of Participants
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Student
Faculty
Industry
R&D


Design of Electric Vehicle Systems

Prof. Karuna Kalita
Department of Mechanical Engineering, IITG

Prof. Kari Tammi
Aalto University, FINLAND

Duration: 28 Nov 2016 to 09 Dec 2016 (2 weeks)

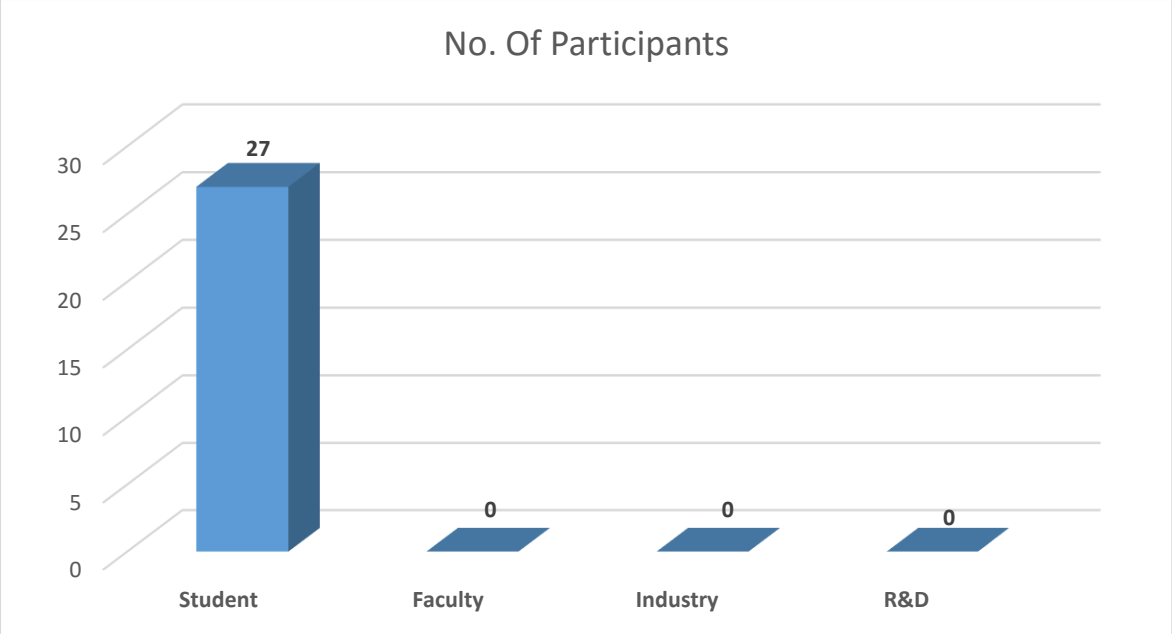
Course Overview:

The increased competences of future engineers will boost the electrification of transport means used in India. The potential of electrification is huge: electrification can improve the air quality and produce new business opportunities in India. With sufficient competences, Indian engineers can develop own products for local companies. The products for electro-mobility exits, but are not limited to electrical vehicle design, manufacturing, charging, and infrastructure. Various opportunities exist also in services related to electro-mobility, such as search engines for charging stations, vehicle-to-vehicle communication, and other service related smart phone and mobility. Significant opportunities exist, particularly in lightweight vehicles such as three wheeler auto-rickshaw and two-wheelers.

Electrical vehicles are booming in Western Countries, California and Norway being the early adaptors for the electrification of transport. Countries with large cities and high population density have started to consider electrical vehicles as a solution for air quality problems in their major cities. China has been a forerunner in electrifying two-wheelers used in large cities. Similarly, it is likely Indian vehicles will electrify in near future. Electrification of electric vehicles will have profound impact in the smart cities planned in India.

The course will deal with electrical vehicle design including the design of the vehicle components, system level design and optimization as well as the infrastructure design. The course is given by internationally known academics that both have about 20-year experience on mechanical engineering, electro-mechanics and power electronics. The hosting faculty, Professor Kalita at the IIT Guwahati, has worked on rotor dynamics, electro-mechanics, electrical machines. He has worked for University of Nottingham and Converteam Ltd, in the UK. The visiting faculty, Professor Tammi at the Aalto University Finland, has worked on rotor dynamics, electrical vehicles, and energy efficiency of electro-mechanical power transmission systems in electrical busses and ships. He has earlier worked at the Technical Research Centre of Finland and North Carolina State University. The host and the visiting faculty have collaborated in multiple projects in the area of electro-mechanics and have now focused on electrical vehicle research together.

Total nos. of participants: 27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Student
Faculty
Industry
R&D


Integration of Molecular Design to Process Simulation for the Development of Industrial Chemical Products and Processes

Prof. Tamal Banerjee
Department of Chemical Engineering, IITG

Prof. Jose Palomar
Autonomous University of Madrid, SPAIN

Duration: 12 Dec 2016 to 17 Dec 2016 (1week)

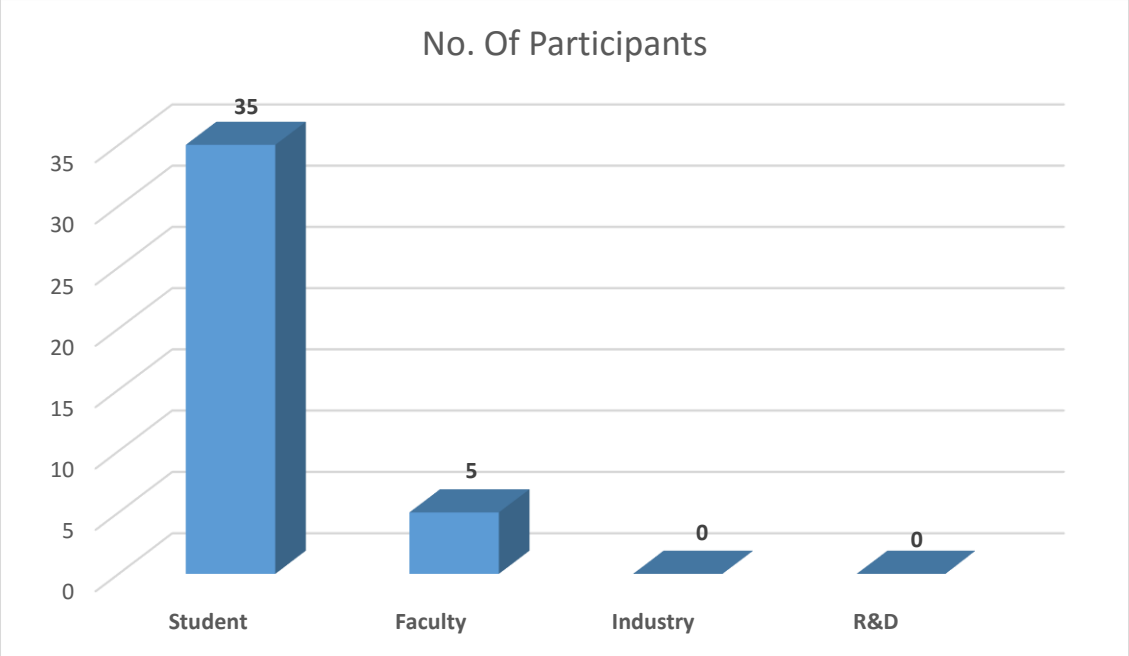
Course Overview:

The main aim of the course is to introduce the fundamentals and practical applications of an emergent discipline in Chemical Engineering field: The multidisciplinary integration of computational tools of molecular and process simulation for the conceptual design of new products and process in the chemical industry.

Currently, lots of R&D departments of chemical companies present multidisciplinary teams of experts in different fields (theoretical chemists, physics, chemical engineers, etc.) applying computers and simulation tools to the development of new commercial products, procedures or processes, with the objective of minimizing the time and expenses investment. This course– taught by academics, researchers and practitioners experts in different simulation methods- is organized in three thematic sessions, concerning the simulation of chemical phenomena occurring at different time and length scale in the chemical supply chain: I) Quantum chemical methods for the design of atomic and molecular systems; II) COSMO-based methods for the prediction of thermodynamic properties of fluids and chemical mixtures, as key parameters to design separation and reaction industrial units; and III) Process simulation tools to model, integrate and optimize the unit operations involved in a chemical process. Each Session will include both theoretical classes to introduce the fundamentals of theoretical methods and practical classes to introduce the use of professional software applied in molecular, product and process design.

The successfully combination of currently available professional tools in different fields of chemistry open new opportunities of development for Chemical Engineers. This course presents a computer-aided multiscale research strategy for the conceptual design of new chemical products and process in the Chemical Industry, based on the successfully integration of well-founded and largely applied simulation methods in different disciplines of Chemistry.

Total nos. of participants: 40


No. Of Participants
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Student
Faculty
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R&D



Advanced Sinusoidal Modeling of Speech and Applications

Prof. S. R. Mahadeva Prasanna
Department of Electronics Engineering, IITG

Prof. S. Dandapat
Department of Electronics Engineering, IITG

Prof. Yannis Stylianou
Cambridge Research Laboratory, GREECE

Duration: 26 Dec 2016 to 30 Dec 2016 (1 week)

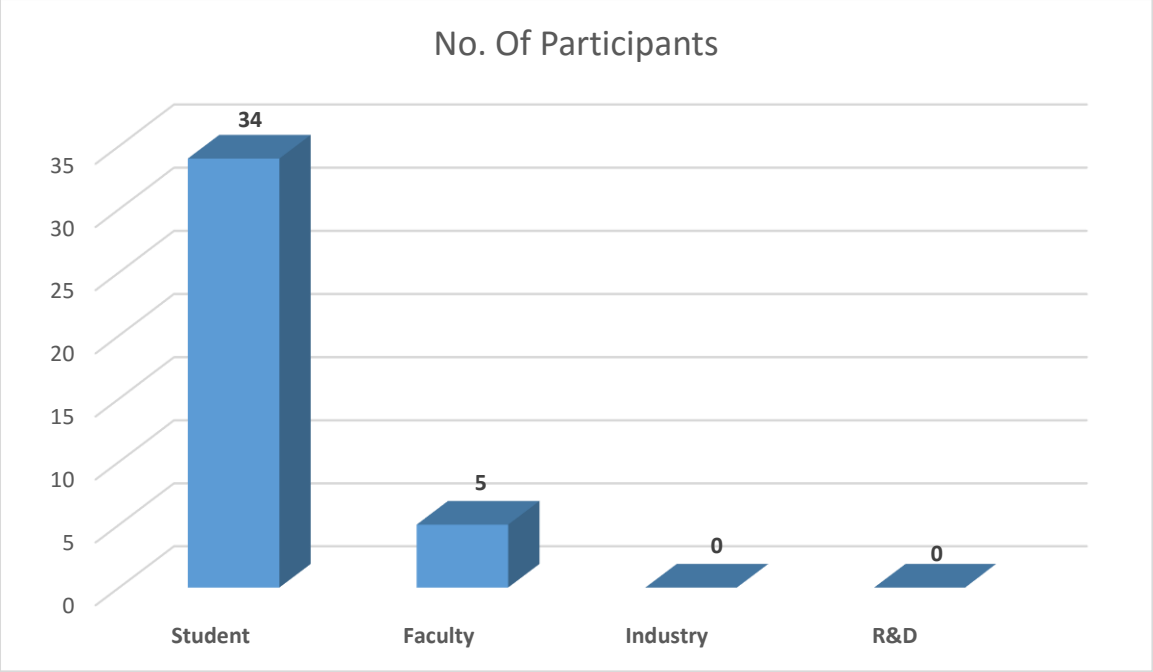
Course Overview:

Speech is a fundamental mode of communication. The speech production-perception apparatus duo has evolved in nature to enable effective human-human communication. The speech production takes place under the controlled cognitive guidance. The production apparatus consists of vocal tract system having flexibility due to articulators and at the same time has some inertia. As a result, the system takes some non-zero time to change from one shape to the other. This aspect has been used in practice to justify the short term stationarity assumption employed in speech signal processing. That is, the characteristics of the speech signal are assumed to be stationary typically when viewed in segments of 10-30 ms. Based on short term processing, several methods have been proposed in the literature including short term Fourier transform, cepstral analysis, linear prediction analysis and sinusoidal analysis. The short term Fourier transform is the modified version of Fourier transform using window functions for analyzing non-stationary signals like speech. The cepstral analysis is based on source – system separation by performing a non-linear operation in the frequency domain. The linear prediction analysis involves source-system separation based on prediction process. The sinusoidal modeling is based on estimating amplitude, frequency and phase values of set of sine waves. All these methods are on the assumption of short term stationarity. However, due to the time varying excitation at a faster rate, this assumption is not fully correct as there are variations within short segments of 10-30 ms also. Hence the quest for exploring new methods for speech signal processing.

The advanced sinusoidal modeling is the modified version of conventional sinusoidal modeling based on the motivation to minimize the effect of assumption of short term stationarity. For instance, adaptive sinusoidal modeling that refers to adapting the parameters of sinusoidal model to the local characteristics (phase and / or amplitude) of the analyzed speech signal. The conventional sinusoidal modeling will have a set of sine waves whose frequency and/or amplitude are constant. In general, the adaptive sinusoidal is based on the principle of projecting a signal segment onto a set of non-parametric, time-varying, nonstationary set of sinusoidal basis functions inside an analysis window.

The sinusoidal modeling has found widespread applications in the domains of speech and audio processing. The primary application of sinusoidal modeling is in speech and audio analysis. Stressed speech analysis and recognition, speech classification, voice transformation and synthesis are other applications. The course will explain in detail about these applications and also future trends of these applications.

Total nos. of participants: 39


No. Of Participants
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Student
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Industry
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Scalable On-chip Interconnects for many-core Systems

Prof. John Jose
Department of Computer Science Engineering, IITG

Prof. Maurizio Palesi
University of Catania, ITALY

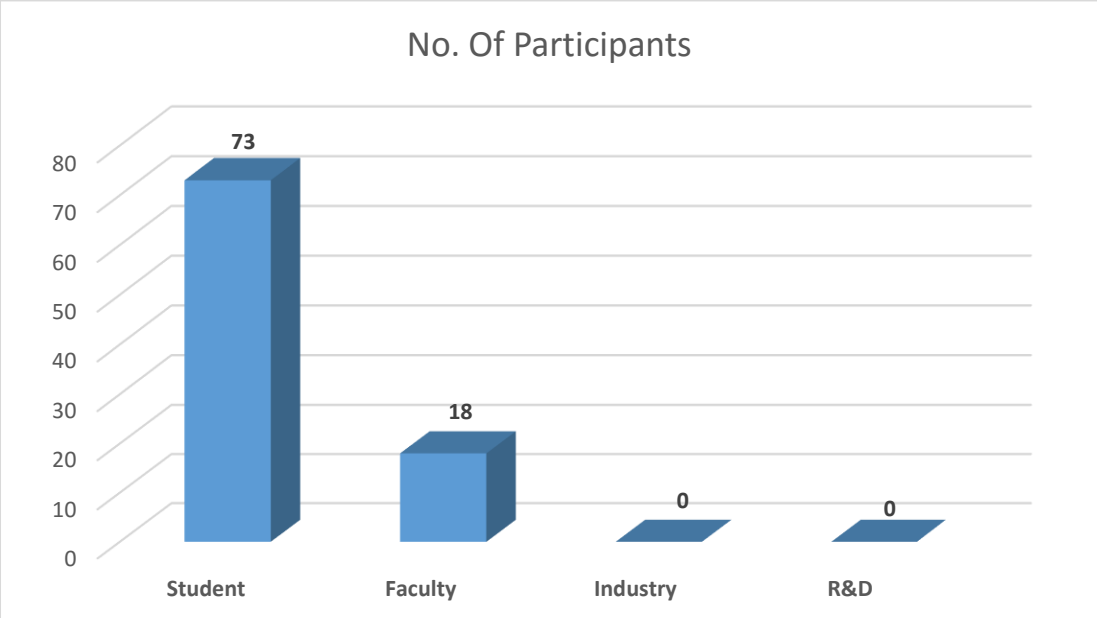
Duration: 24 May 2017 to 30 May 2017 (1 week)

Course Overview:

Power and thermal constraints has led the processor industry to embrace multicore architectures. Today, processor chips with many cores are available commercially. In continuation with the evolution of processor technology, researchers have started focusing on many core processor designs with more than 100 cores on a single chip. This paradigm shift towards many core designs has resulted in a renewed interest in interconnect design due to complexity and criticality involved in the communication pattern of such massively parallel computers. Interconnects play a dominant role in shaping the power and performance profiles of many core processors designed using deep submicron technologies. As a scalable substitute of on-chip bus, network-on-chip (Noc) is proposed as the communication infrastructure in modern multi/many-core system-on-chip (Soc). Efficient communication in NoC is critical to the overall SoC performance.

Many-core embedded systems (MES) are moving towards the integration of hundreds cores on a single chip and hold the promise of increasing performance through parallelism. As the number of cores integrated into a chip increases, the on-chip communication becomes power and performance bottleneck in future MES. In this course we focus on various aspects of many core on-chip networks, including router micro-architecture, flow-control, topology, packet scheduling, power modeling, and scaling. We will also cover some recent research papers. Overall we will aim for multifaceted understandings of the power, performance and scaling behavior of on-chip networks.

Total nos. of participants: 91




Multiphysics Coupling in Energy Storage

Prof. Amaresh Dalal
Department of Mechanical Engineering, IITG

Prof. Partha P. Mukherjee
Texas A&M University, USA

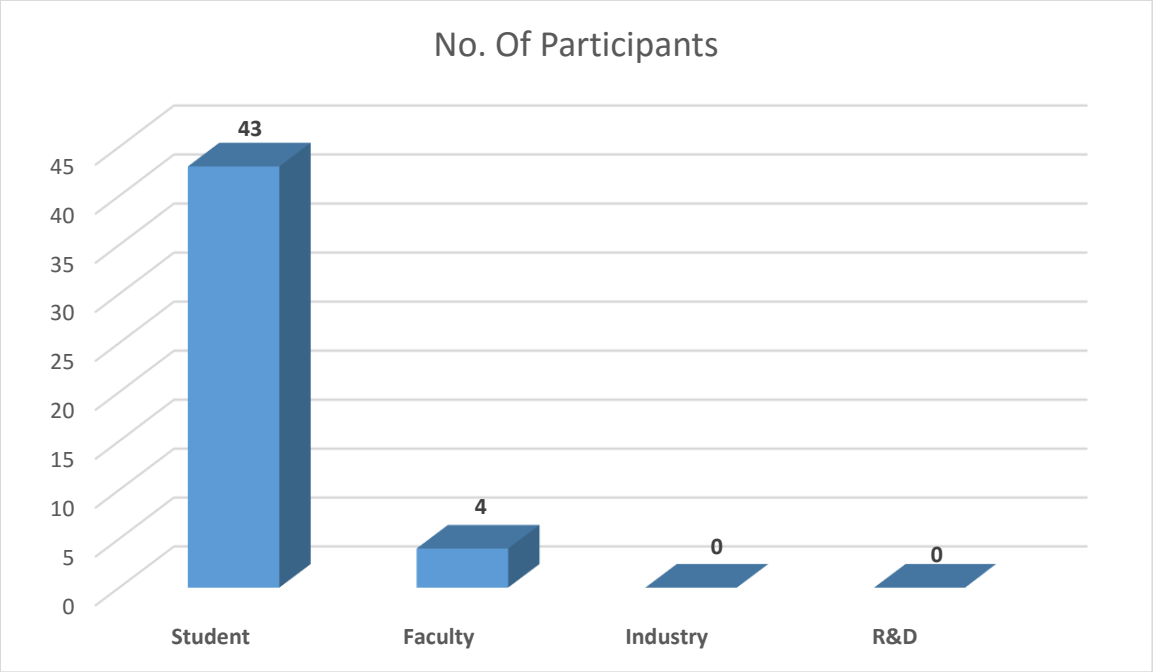
Duration: 26 June 2017 to 30 June 2017 (1 week)

Course Overview:

Recent years have witnessed a critical imperative to accelerate innovation toward improved performance (energy/power), safety and life of energy storage devices for vehicle electrification, renewable energy integration and grid storage. Lithium-ion batteries, for example, are leading the race for electric drive vehicles. These are complex, dynamical systems, which include a multitude of coupled physicochemical processes encompassing electronic, ionic, diffusive transport in solid/electrolyte phases, electrochemical and phase change reactions and stress generation in multi-scale porous electrodes. The performance and lifetime of such electrochemical energy storage devices is dependent on complex reaction/transport processes spanning across multiple length and time scales. Computational models and characterization of mechanical, thermal and electrochemical processes play an important role in providing insight into the coupled multiphysics interactions.

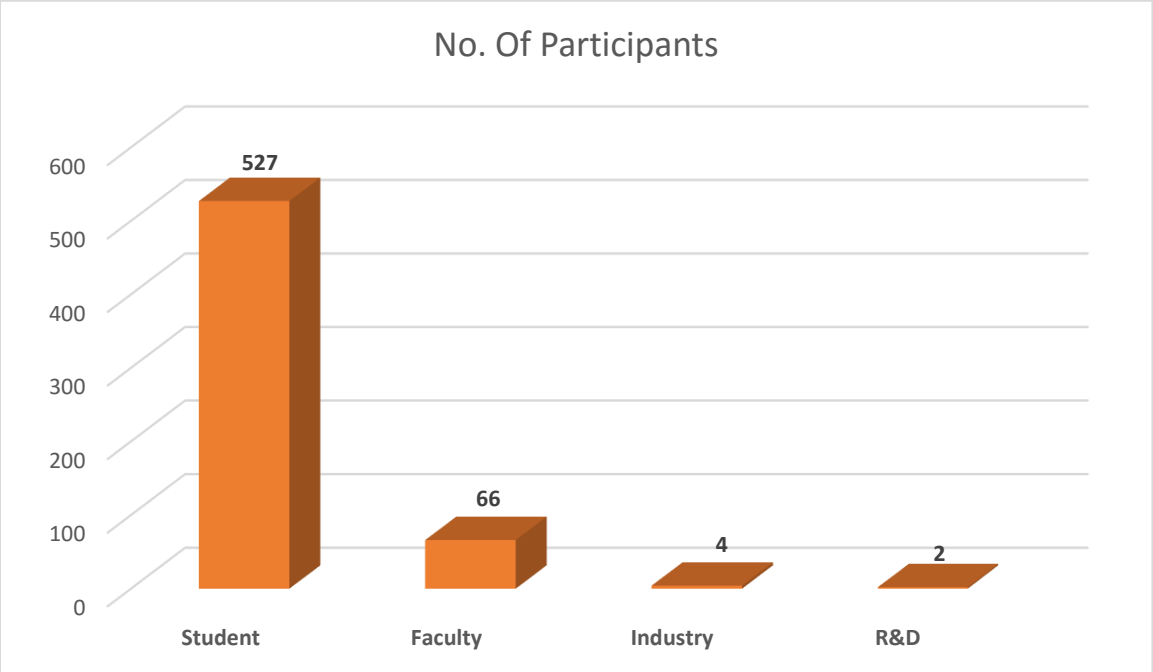
Course participants will learn these topics through lectures. Also case studies and assignments will be shared to stimulate research motivation of participants.

Total nos. of participants: 47



GIAN Phase-I Cumulative data: 2016-2017

Total nos. of participants: 599



Phase-II

Prof. Pankaj Kalita
Centre for Energy, IITG

Prof. Pinakeswar Mahanta
Department of Mechanical Engineering, IITG

Prof. Yoshinori Itaya
Gifu University, JAPAN

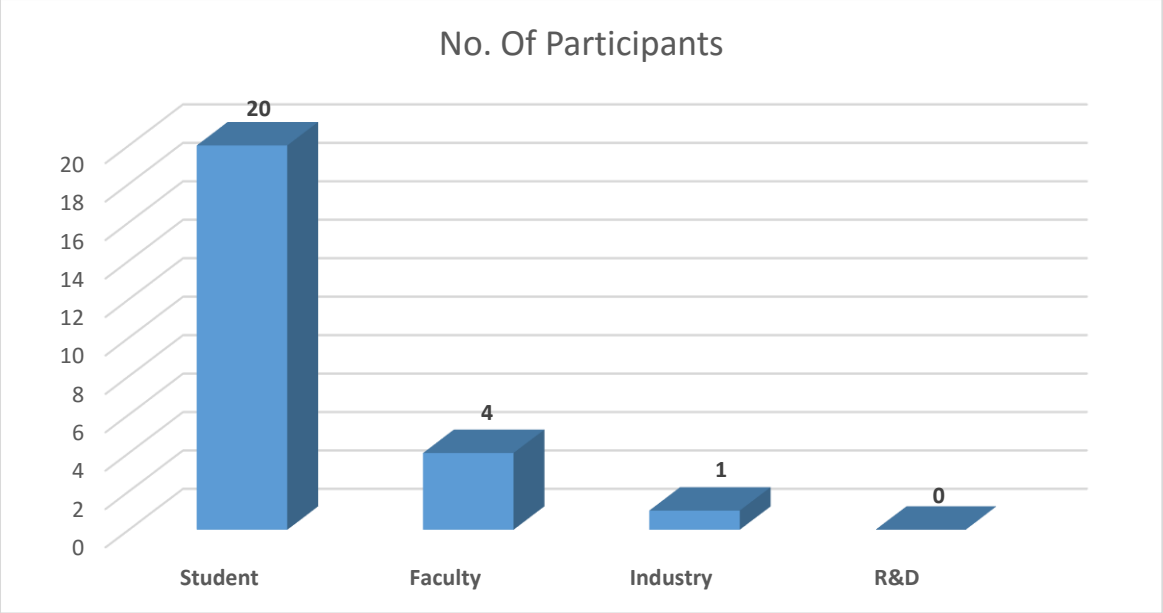
Duration: 29 October 2018 to 2 November 2018 (1 week)

Course Overview:

In the recent past, more emphasis is being given to produce clean energy from various renewable sources due to rise in crude oil price and greenhouse gas emission. Moreover, the sustainable economic development with green environment is a prime focus for the world which has been discussed in global summit held in Paris. In order to mitigate the greenhouse gas emission and other environmental problem and to utilize the available carbon neutral resources like biomass effectively, various technologies and processes have been developed around the world. The co-firing of biomass with coal at low percentages in the thermal power plant avoids the characteristic operating problems of biomass combustion such as ash sintering and fouling of heat exchanger surfaces, along with significant reduction in emission of pollutants. Hence, biomass fuel could substitute more expensive coal and contribute in lowering CO2 emission. Coal and biomass can also be used for both combustion and gasification applications. With the advancement of reactor technology, a higher degree of conversion efficiencies with improved emission characteristics is achieved. The quality of combustion and gasification is also dependent on the type of fuel used and behavior with time when heated to a range of temperatures.

This course will provide deeper insight into combustion and gasification processes and technologies which finally contribute to the understanding of this important topic. The course content includes a brief introduction on gasification and combustion principles, fundamentals of nonhomogeneous reaction kinetics, advanced combustor, advances gasifier system and processes (Fluidized bed, plasma, microwave), fuel characterization, modelling and simulation. Furthermore, the course will be extremely useful for executives, engineers, researchers from manufacturing, service and government organizations including R&D laboratories, scientists, research scholars and graduate students, who are working in the areas of thermochemical conversation of fuel more specifically on gasification and combustion.

Total nos. of participants: 24


No. Of Participants
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Faculty
Industry
R&D


Physical Modelling of Multiphase Processes in Mineral and Chemical Processing

Prof. Raghvendra Gupta
Department of Chemical Engineering, IITG

Prof. Geoffrey Evans
University of Newcastle, AUSTRALIA

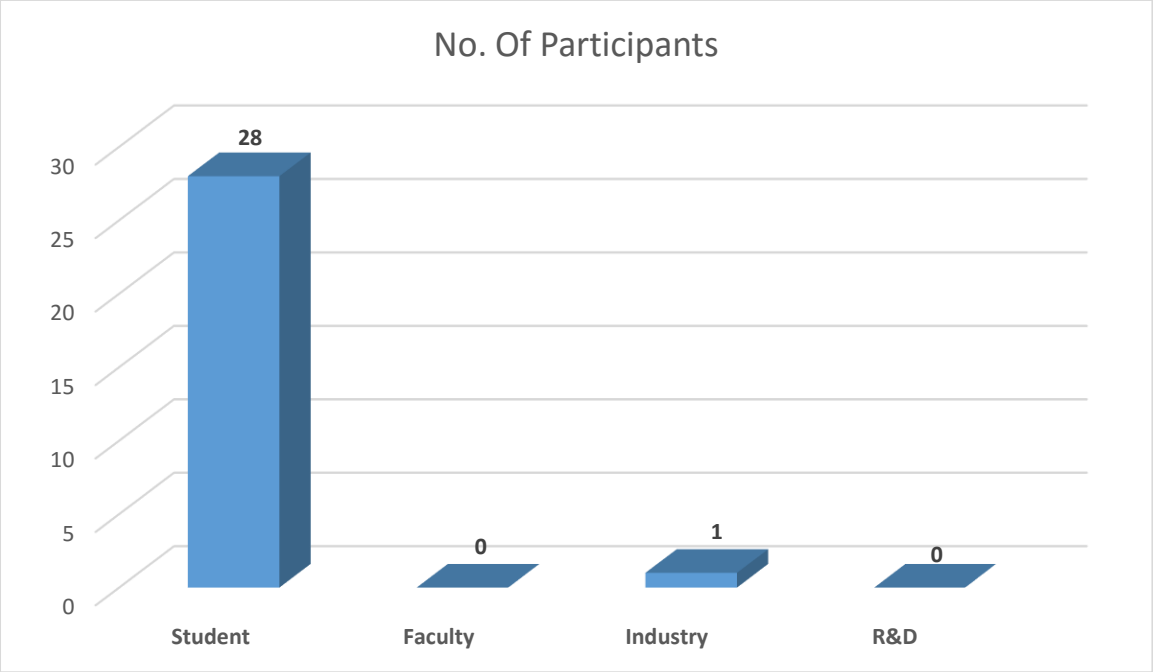
Duration: 23 October 2017 to 28 October 2017 (1 week)

Course Overview:

Many industrial processes involve interaction between gas, liquid and solid phases; and in today's world of global competitiveness and environmental awareness it's important that those interactions are performed as efficiently and with the least amount of energy and resource consumption as possible. The design and operation of processes that meet these requirements requires a good working knowledge of the underlying phenomena of heat, mass and momentum transfer that govern the behavior of multiphase flows. The size and dispersion of bubbles, droplets and particles is also very important and is closely associated with how and where the energy source is introduced into the system—where too much or too little or at the wrong location can have major detrimental effect in both product quality and operating costs. India is a leader in domestic industrial manufacturing and provision of skilled engineers to the rest of the world. This reputation has been created by a strong engineering educational program focusing on mathematics and sciences. Specialization in a broad range of engineering fields is also developing; and this course is aimed at providing unique insight into the underlying principles of multiphase processes.

It includes both (simple) theory and application to real work examples in the fields of mineral and chemical processing; and at the conclusion will provide the tools and knowledge needed to make informed choices that maximizes beneficial output in terms of energy usage, outputs and resource usage.

Total nos. of participants: 29





Empirical Mode Decomposition and its Applications

Prof. S. R. M. Prasanna
Department of Electronics and Electrical Engineering, IITG

Prof. R. Sinha
Department of Electronics and Electrical Engineering, IITG

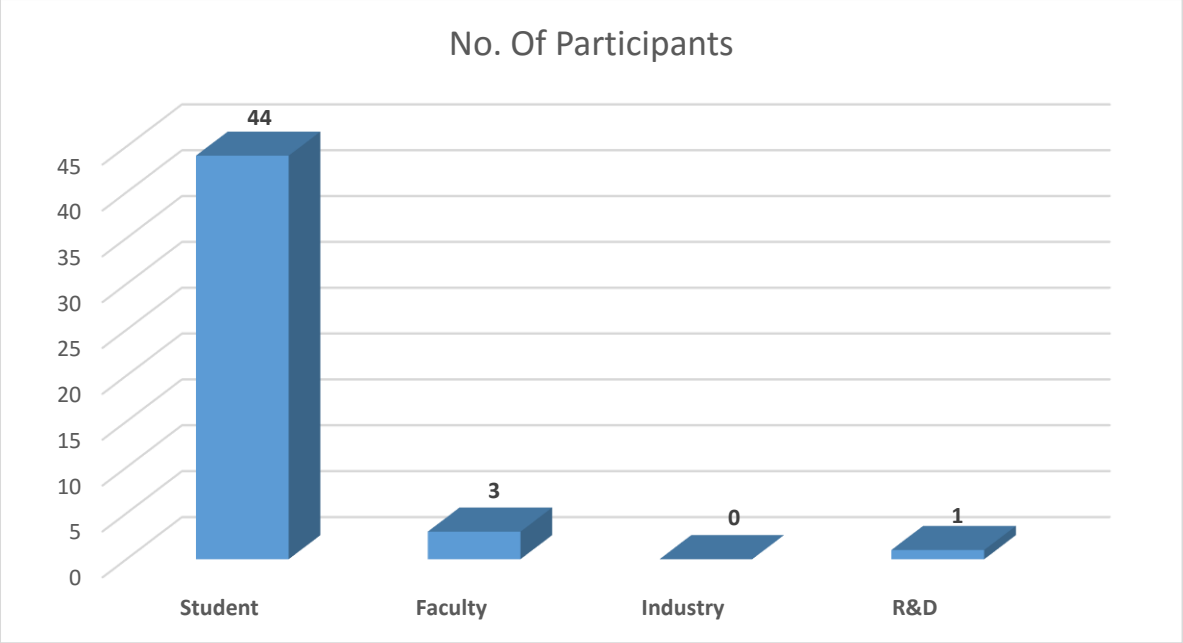
Prof. Patrick Flandrin
Centre National de la Recherche Scientifique, FRANCE

Duration: 23 October 2017 to 27 October 2017 (1 week)

Course Overview:

The objective of this course is to introduce modern methods of analyzing real-world signals to researchers interested in understanding the pure science behind natural signals, or its various engineering applications. As most people are aware, Fourier Transform has remained the most influential technique for signal processing and analysis. Even though Fourier Transform is not suited for analyzing signals which are produced by non-linear and non-stationary processes, i.e., real-world or natural signals, most researchers are almost addicted to it. People working in engineering applications, especially, focus more on the machine-learning aspects, leaving the science behind. At best, engineers and even scientists use stop-gap arrangements like the Short-Term Fourier Transform (STFT). Researchers working in the field of non-linear and non-stationary signal processing, however, have been exploring ways and means of extracting the "true constituents" of any natural signal. Methods like Wigner-Ville Transform, Wavelet Transform, and Evolutionary Algorithms are a result of their efforts. "How to find out the frequency content at every sample point (usually denotes time) of the signal, i.e., how to perform Time-Frequency Analysis (TFA) of the signal?". The task is difficult, but the benefits are extraordinary. If successful, the various mechanisms that produce the signal would be revealed. For engineers working in various applications, this provides a way for better and robust feature extraction, throwing away the shackles of linearity and stationarity. Completely new and efficient methods for different applications could result from such an analysis. This course is dedicated to understanding a modern technique called Empirical Mode Decomposition (EMD), and its applicability to analyzing real-world natural signals. EMD was conceived in 1998 by Huang et al., for which Dr. Norden Huang, the chief architect of this method, was awarded NASA's Special Space Act Awards in 1998, 2003 and 2004. The ability of EMD to decompose real-world signals into their true and meaningful components has been widely appreciated in the various fields of science and engineering. Some of the prominent disciplines where EMD is being actively explored are: The course would be primarily delivered by Prof. Patrick Flandrin, who is an imminent physicist from France, working in the field of TFA, holding around 20,000 citations for his works. We welcome all interested to attend the course.

Total nos. of participants: 48


No. Of Participants
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Student
Faculty
Industry
R&D


Autonomic Networks

Prof. P. S. Mandal
Department of Mathematics, IITG

Prof. Sébastien Tixeuil
Sorbonne University, FRANCE

Duration: 30 October 2017 to 03 November 2017 (1 week)

Course Overview:

Autonomic networks play a major role in many self-organizing networking systems, ranging from computer networks (such as self-management, including self-configuration, self-optimization, self-healing, and self-protecting sensor networks, peer-to-peer networks, delay tolerant networks, robot networks, etc.) to social and even biological networks. Only very recently, researchers have started understanding the fundamental mechanisms underlying autonomic networks and developed mathematical models and designed dedicated efficient techniques (e.g., for fault and attack tolerance, delay tolerance, mobility tolerance, etc.). The goal of this course is two-fold:

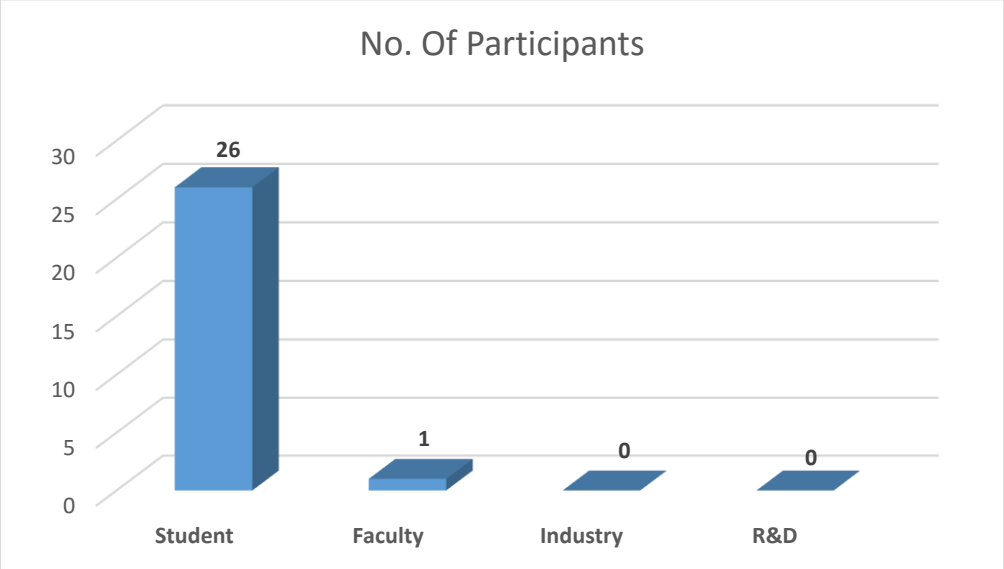
First, we will introduce the fundamental models and methods used to reason about the correctness and performance of autonomic network algorithms. In particular, we will teach essential algorithmic and analytic techniques which, after attending the course, remain a useful toolbox and allow the students to develop and study their own algorithms.

Second, we complement the theoretical lectures with practical case studies. That is we consider case studies in sensor networks, self-managed networks, and even robotics, to show the various application domains of autonomic network algorithms.

In particular, students will learn about mathematical tools such as distributed algorithm design and analysis, computational geometry, randomization, graph theory, etc. This active field of research also offers a wide range of research questions.

Internationally acclaimed academicians, researchers and practitioners with proven knowledge, experience, and demonstrable ability in teaching, consultancy, research, and training in the field of Distributed Computing will deliver lectures and discuss potential research problems in the course. The course is planned as per the norms set by Global Initiative of Academic Networks (GIAN), an initiative by Govt. of India for Higher Education.

Total nos. of participants: 27




Crystal Plasticity Modelling of Micro-Machining Processes

Prof. U. S. Dixit
Department of Mechanical Engineering, IITG

Prof. Anish Roy
Loughborough University, UK

Duration: 11 December 2017 to 15 December 2017 (1 week)

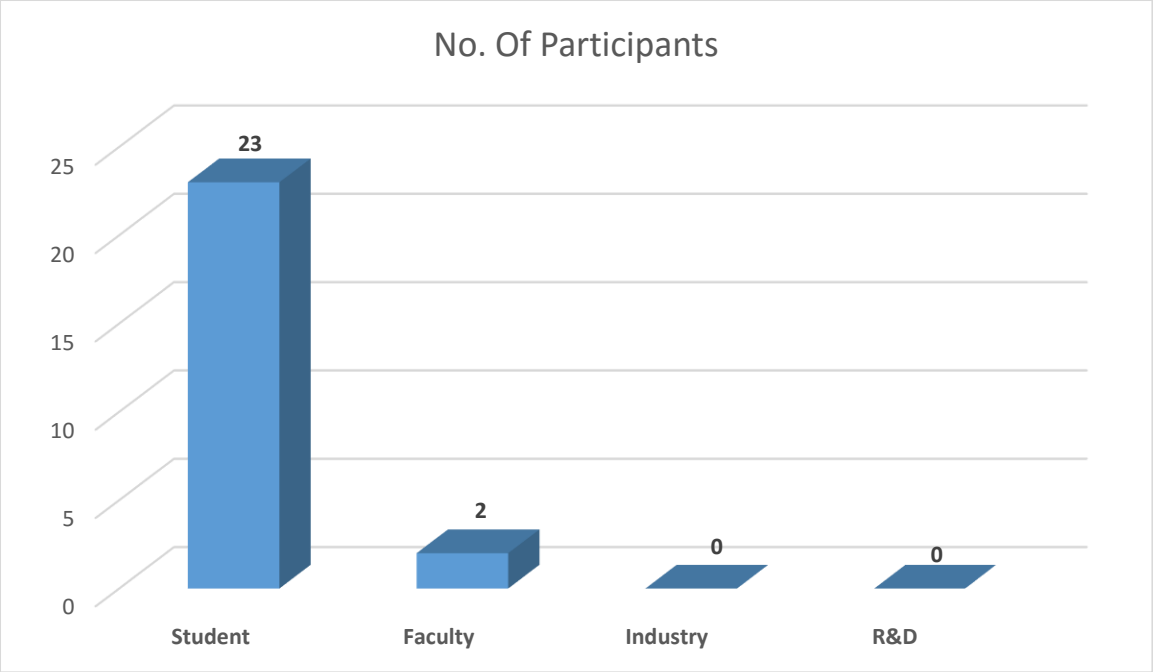
Course Overview:

The production of small-scaled components with complex features is gaining increasing importance due to the trend of miniaturization of products. As a result, there is a growing need for fast, reliable, mass micromachining of functional components. In contrast to conventional macro-scale machining, the process zone in micro-scaled machining is usually limited to one or several grains of the metallic work-piece material. This introduces additional complexity that is non-trivial. Consequently, a cutting response in the micro-scale differs significantly from that of its macro-scale counterpart. For example, it is experimentally observed that the cutting force and chip morphology are dependent on the underlying texture of the work-piece material in micromachining of single-crystal metals. To better understand local deformation processes at a tool–work–piece interface in a micromachining process, a thorough analysis of deformation mechanisms at grain level is required. While the effect of crystallographic orientation on cutting-force variation is extensively reported in the literature, the development of the single-crystal machining models is somewhat limited.

Additionally, in recent years, significant advanced in machining processes has been made to diminish some of the well-known detrimental effects of conventional machining processes. As an example, hybrid or assisted machining processes – in which a main process directly removes material, while the other 'assists' in this by improving the conditions of machining – has been used to demonstrate significant improvements in the quality of the machined component. A well-known hybrid machining process is vibration assisted machining, in which typically high-frequency vibrations are imposed on a conventional cutting tool during machining. This converts the machining to a micro-chipping process, demonstrating significant reductions in cutting forces with improved surface finish. Since machining force is an indication of damage incurred during the process, a significant reduction in cutting forces will lead to damage free component manufacture. With reduced forces, work holding size and constraint can be reduced, therefore allowing more of a component to be machined in one operation.

The present course will focus on modelling aspects in the small length-scale. It will cover some of the essential background material required to build a realistic numerically-robust computational model of small scale plasticity considering the underlying material micro-structure. A part of the course will explore the role of modelling in predicting the outcome of hybrid machining in the small-scale. It will demonstrate the power of numerical modelling in determining appropriate processing parameters without having to design expensive and time-consuming experimental studies. With such knowledge students and practitioners in India can enhance their skill set and make essential contributions in knowledge generation for academic and industrial use in precision machining and manufacture. This will directly address the goal of Make in India, aiding in wealth generation and bringing India to the forefront of next generation high end manufacturing.

Total nos. of participants: 25




Harmonic Grammar Models and Methods

Prof. Shakuntala Mahanta
Department of Humanities and Social Sciences, IITG

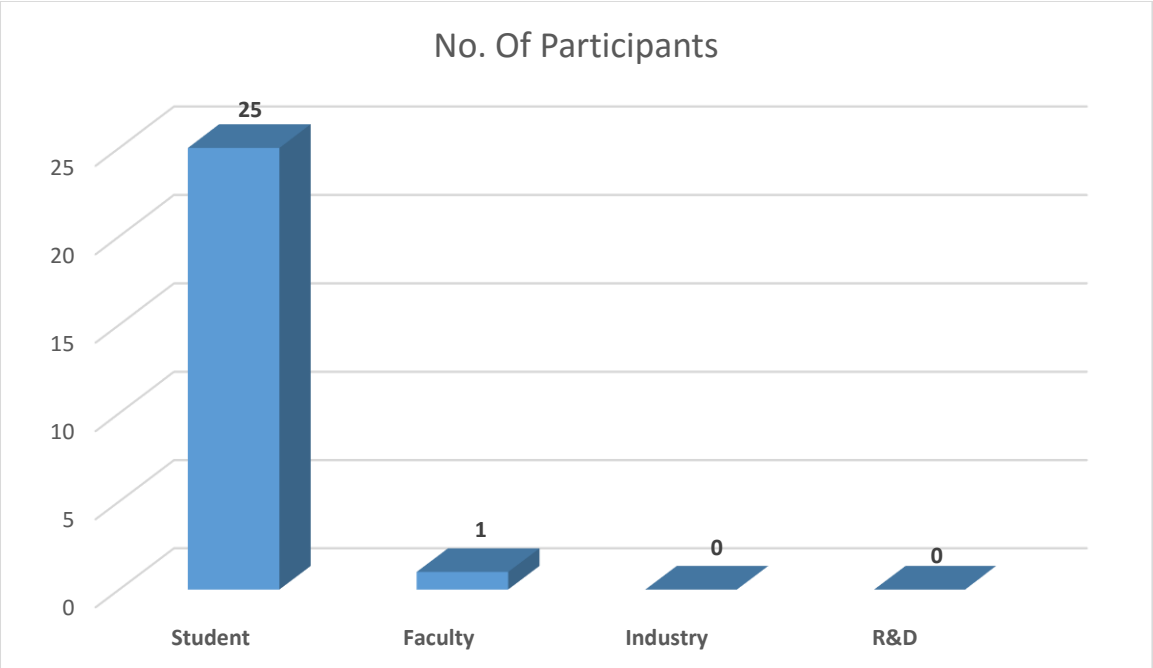
Prof. Joe Pater
University of Massachusetts, USA

Duration: 16 December 2017 to 22 December 2017 (1 week)

Course Overview:

There now exist a number of variants of HG, along with a range of freely available computational tools for exploring these models of grammar. This course provides an introduction to both the models and the methods, assuming no background in either mathematics or computational modeling. Starting with a version of HG that closely resembles the well-known "classic" OT model of Prince and Smolensky (199312004), the course then proceeds to introduce more elaborate probabilistic models (Goldwater and Johnson's 2003 Maximum Entropy Grammar, Boersma and Pater's 2008 Noisy HG), as well as versions of HG that use serial derivations (as Harmonic Serialism - McCarthy 2007 et seq.). lt also shows how HG learning algorithms can be used to model human language acquisition, and how they can be applied to simulations of language change through iterated "agent-based" learning. Step-by step instructions for working with the associated software tools will be provided, along with example input files and scripts.

Total nos. of participants: 26




Electroweak Symmetry Breaking, Flavour Physics and BSM

Prof. P. Poulose
Department of Physics, IITG

Prof. K. S. Babu
Oklahoma State University, USA

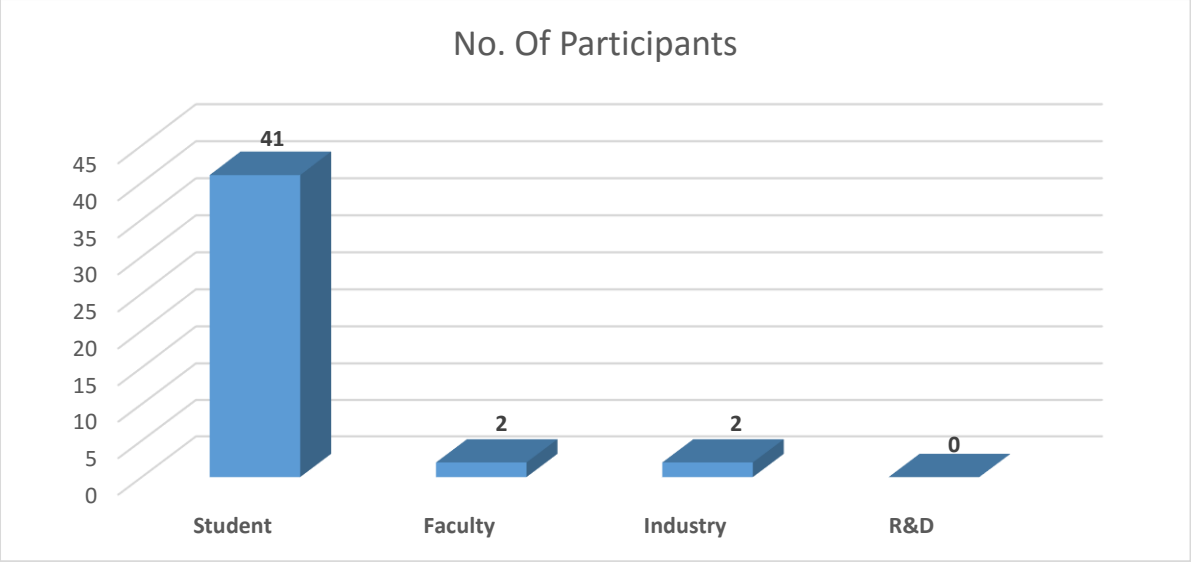
Duration: 18 December 2017 to 22 December 2017 (1 week)

Course Overview:

It is well established that the dynamics of elementary particles is guided by the principle of gauge symmetry. It is also known that presence of mass terms of the elementary particles necessarily breaks the gauge symmetry. In the Standard Model (SM) of particle physics, the Electroweak Symmetry Breaking (EWSB) provides a way to generate gauge boson masses through the celebrated Higgs mechanism; the concept, which was honored with Nobel Prize in Physics in 2012. However, the idea itself, and the technical details of the mechanism are far from understood. First of all, introducing the mechanism in an aesthetically appealing way require generating it in a dynamic way. Radiative EWSB mechanism is an attempt in this direction. Secondly, the standard Higgs mechanism with one electroweak doublet scalar field is troubled with certain technical issues like the stability of mass of Higgs boson against quantum corrections and stability of the vacuum, etc. Dynamics of flavor physics is intimately connected with the EWSB mechanism, and therefore provides valuable insight into the mechanism itself, and often provides decisive experimental inputs in establishing or disproving theoretical propositions. In addition, flavor physics in itself demands close attention to understand the origin of flavor, and other details, in both the lepton as well as the quark sector. With important questions on baryon asymmetry of the universe and issues with the neutrino sector of study of Flavor Physics is one of the main focuses of today's particle physics.

A thorough understanding of the EWSB mechanism including the technical details is essential for all graduate students and young researchers pursuing their research in particle physics, irrespective of their focused field of expertise. The details should include the rapid developments that have happened in the recent years, in view of the LHC experiments, and a wide variety of neutrino physics experiments, as well as dedicated B-meson experiments like Belle.

Total nos. of participants: 45


No. Of Participants
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Industry
R&D

Risk Based Damage-tolerant Seismic Design of Structures - A New Paradigm

Prof. Amit Shelke
Department of Civil Engineering, IITG

Prof. Achintya Haldar
University of Arizona, USA

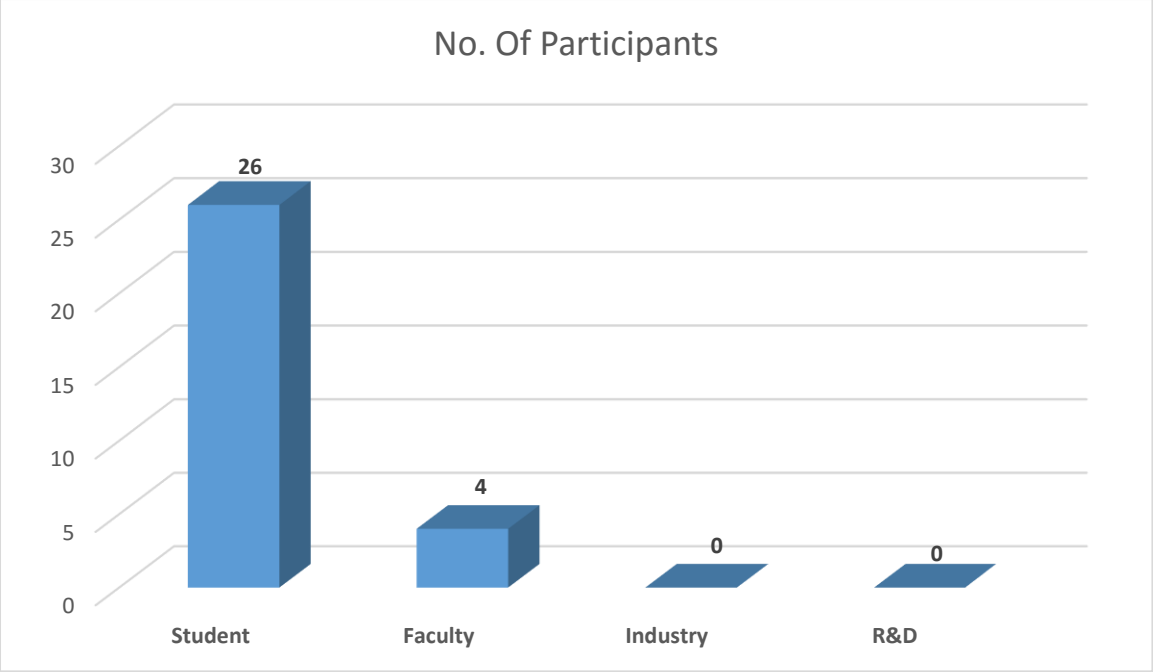
Duration: 18 December 2017 to 27 December 2017 (2 weeks)

Course Overview:

In spite of the best efforts of the engineering community all over the world, structures fail after most major seismic events causing significant property damages and loss of human live. The world communities spent an enormous amount of resources over past several decades, conducting theoretical, analytical, and experimental studies, to study the structural response behavior caused by the seismic excitation. However, the success of such work has been very limited at best so far. Designing seismic damage-tolerant structures has been one of the major challenges facing the civil engineering profession over a long period of time.

The current seismic analysis and design procedures are not adequate and a major shift in the design paradigm is necessary. There is no doubt that the engineering profession has developed full understanding of structural behavior excited by a known earthquake time history. Unfortunately, the profession does not know how to predict a future design earthquake time history at a site at present. This presenter was awarded a major research grant funded by the U.S. National Science Foundation to develop the required paradigm shift in a comprehensive way to replace the current seismic design practices. The ultimate objective is to design more seismic damage-tolerant structures. The underlying seismic risk of a structure cannot completely be eliminated. It needs to be managed. Instead of conducting millions of simulations, can be impractical in most cases, the information on risk can be extracted by conducting only dozens of deterministic analyses at very few intelligently selected points. Multiple deterministic analyses will provide the new seismic design paradigm. This new design paradigm will be introduced in this short course, specifically addressing steel structures. Course participants will learn these topics through lectures, tutorials and case-studies.

Total nos. of participants: 30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Student
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Modeling and Verification of Cyber-Physical Systems

Prof. Purandar Bhaduri
Department of Computer Science, IITG

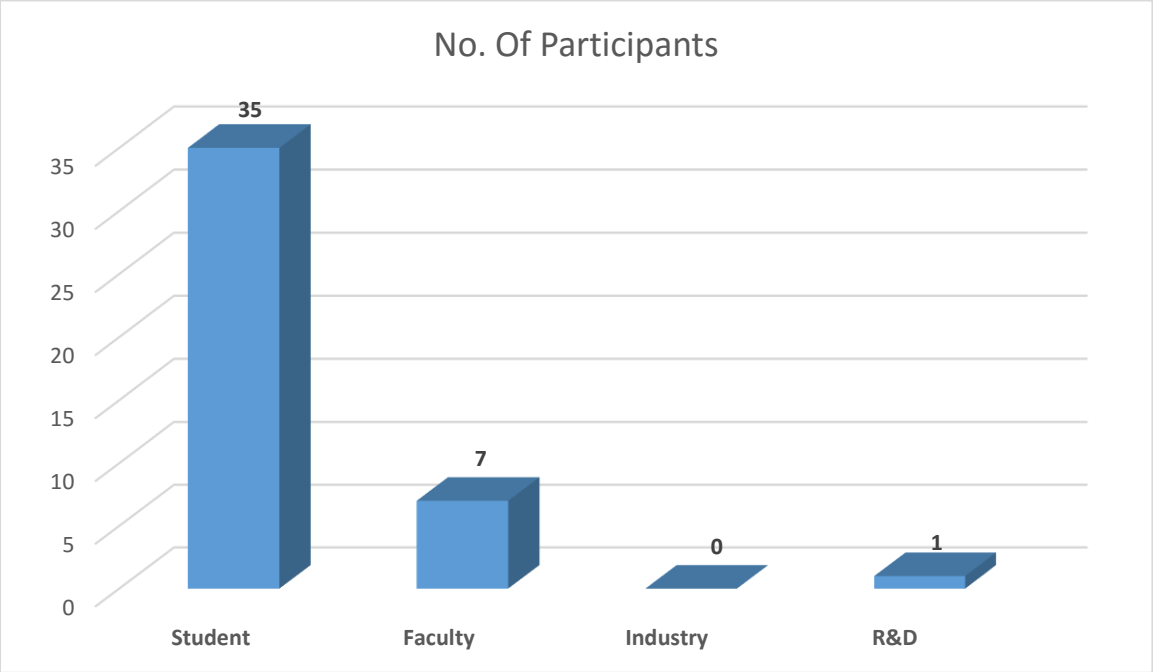
Prof. Sayan Mitra
University of Illinois at Urbana Champaign, USA

Duration: 01 January 2018 to 05 January 2018 (1 week)

Course Overview:

Cyber-physical systems (CPS) result from a tight integration of computing and networking technologies with the physical world. Such systems are at the heart of technological innovations in diverse industries such as aerospace, automotive, manufacturing, robotics and healthcare. For example, algorithms are improving fuel efficiency, driving experience and safety in cars. Manufacturing, healthcare and aerospace systems are undergoing similar transformations. Auditing or checking the correctness of these systems is a grand challenge problem. This course gives the necessary background in formal methods, automated deduction and control theory to introduce the participants to the state-of-the art techniques in modeling and analysis of CPS. The substance of this course provides the scientific basis for regulations and standards that make vehicles and autonomous systems safer, more secure and can also help them meet privacy and fairness expectations.

Total nos. of participants: 43




Speech Enhancement for Hearing Aids

Prof. S. R. M. Prasanna
Department of Electronics and Electrical Engineering, IITG

Prof. Rainer Martin
Willkommen an der Ruhr Universitaet-Bochum

Duration: 23 January 2018 to 27 January 2018 (1 week)

Course Overview:

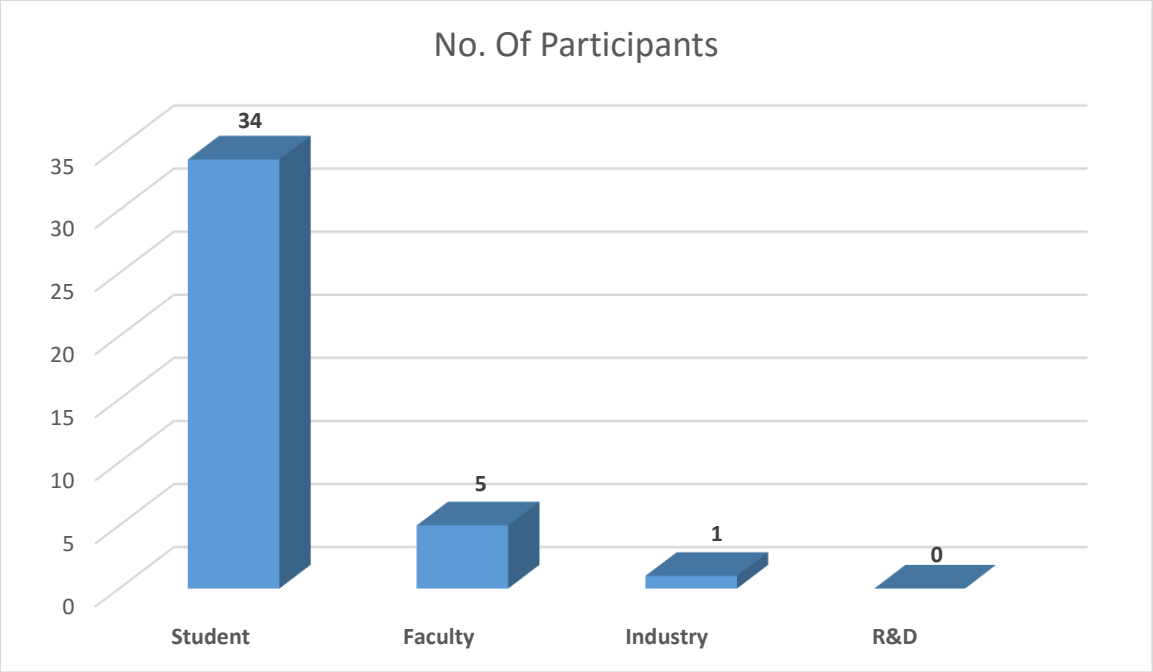
Speech enhancement deals with enhancing speech components in degraded speech signals for either facilitating human perception or improving automatic speech recognition. The degradation types that are in the focus of current research efforts include additive background noise, reverberation and speech from other speakers. Since the characteristics of these degradations are different, the approaches for enhancement are also diverse and need to be tailored to the application. Accordingly, we have noise reduction, de-reverberation and multi-speaker separation methods in the literature.

Most of the existing methods for noise reduction first establish an estimate of the noise power spectrum and then use the same for enhancing salient speech components. However, there are also approaches that perform temporal and/or spatial processing to enhance speech signals degraded by reverberation and other speakers. Furthermore, speech enhancement methods have been categorized into single-channel, dual-channel, and multi-channel methods and have become an important ingredient of any hearing device.

The requirements for speech enhancement algorithms in hearing aids are quite challenging compared to the enhancement approaches developed for consumer devices such as smart phones or for automatic speech recognition systems. The major constraints in case of hearing aids are the limited signal processing resources that are available in these devices and also the requirement to avoid latency with respect to the direct sound component. Therefore, the design of speech enhancement algorithms need to take these factors into consideration. However, recent trends of improved computing power and low memory cost are helping to implement more sophisticated methods for speech enhancement in hearing aids.

This course will give an exposure to key aspects of speech enhancement. The course will provide an overview of single-microphone and multi-microphone speech enhancement methods present in the literature for perceptual enhancement requirement of normal-hearing listeners and for automatic speech recognition tasks. Particular issues with respect to hearing impairments and also with respect to current generation hearing aids will be presented. After this, different approaches proposed for speech enhancement for hearing aids will be explained. Finally, the prevailing challenges and possible directions for future research in the area of speech enhancement for hearing aids will be discussed. Along with the lectures there will be laboratory sessions to implement and understand different enhancement methods.

Total nos. of participants: 40





Brain-Computer Interfaces for Speech Communication: Theory and Applications

Prof. S. R. M. Prasanna
Department of Electronics and Electrical Engineering, IITG

Prof. R. Sinha
Department of Electronics and Electrical Engineering, IITG

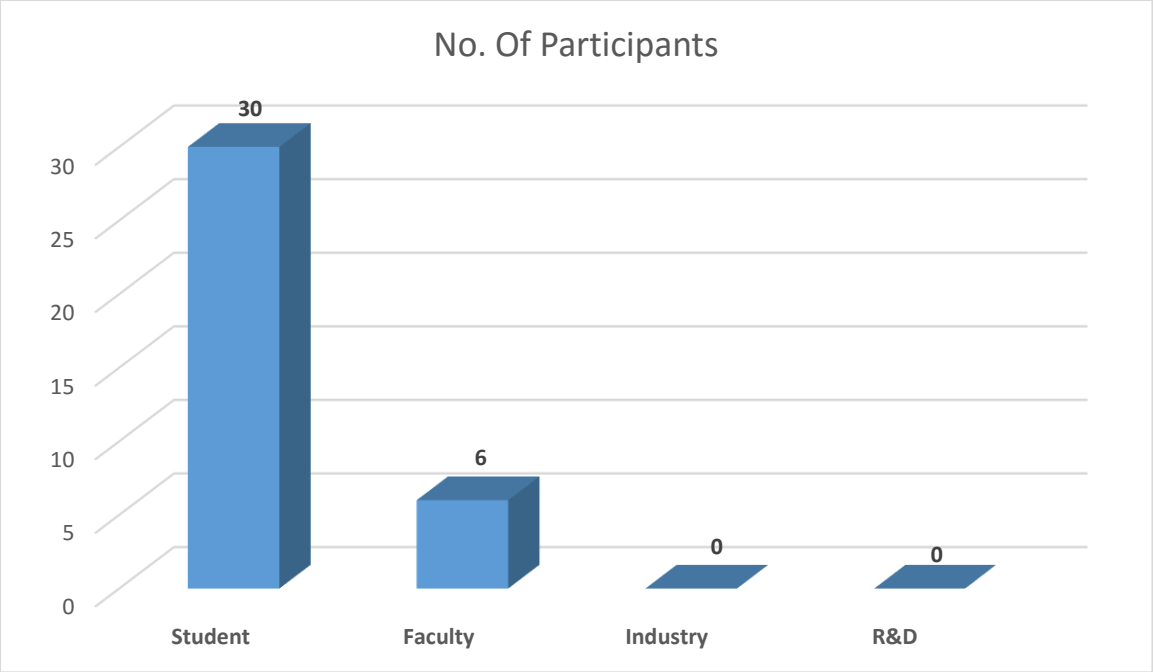
Prof. Hugo Leonardo Rufiner
University of Nebraska-Lincoln, USA

Duration: 26 February 2018 to 02 March 2018 (1 week)

Course Overview:

Some severe muscular disorders, such as amyotrophic lateral sclerosis, advanced stages of multiple sclerosis, and brainstem stroke, among others, can make the usual pathways employed for speech communication unavailable. The patients suffering from these conditions found themselves in a locked-in state, because of lack of control over voluntary muscles. Even though their intellectual capabilities are intact, they cannot interact with their environment. Brain Computer Interfaces (BCI) have been developed for the purpose of bringing a new communication path, allowing the use of brain signals to control devices, such as wheelchairs or voice synthesizers. One way to classify BCI systems is by means of the neurological phenomena used to generate the control signals. The most widely used and better understood mechanisms are slow cortical potentials, P300 event-related potentials, motor imagery, and visual evoked potentials. Each one of these, usually called BCI paradigms, has its own strengths and weaknesses, and it is not presently clear whether or not a single one of them could be used to implement a general purpose BCI. Although initially intended for patients, recently the interest was put on adapting this technology so as to extend the capabilities of information transfer to computerized devices for healthy subjects, enhancing traditional Human-Computer Interfaces (HCI). This change in the classical approach from active or reactive BCIs into what it calls Passive BCI, arising without the purpose of voluntary control, but for enriching HCI with implicit information on the actual user state. Usually, the EEG is chosen as a measure of brain activity because it is a non-invasive technique, has a relative low cost when compared to others like functional magnetic resonance imaging, and it is portable due to the simple equipment needed for its acquisition system. Speech is one of the most natural ways of communication between humans. Speech signal conveys lot of information about the speaker, far from only words, like emotional and health state, identity, age, gender and even height, just to mention some of them. Perhaps of these issues is one of the most studied bio-signals and a big effort was put for several years of research for better using it for HCI, although still being a work in progress. Recent investigations proposed a new BCI paradigm called imagined speech. During imagined speech, the subjects have to imagine pronouncing the word without moving muscles or producing sounds. Some research has been conducted on classifying vowels, syllables and complete words using EEG signals acquired during imagined speech with promising results for this task that can be named as “Speak What You Thought”. Other interesting research line achieved recognizable speech reconstruction starting from direct recording of brain signals from listeners, in a way that demonstrated the feasibility of developing systems that can “Hear What You Hear”. The course would be primarily delivered by Prof. Hugo Leonardo Rufiner, from Department of Informatics, FICH-UNL, working in the field of BCI, Automatic Speech Analysis, Mathematical Modeling of Biological Systems. We welcome all interested to attend the course.

Total nos. of participants: 36





Biofuel Cell Technology: Fundamentals and Applications

Prof. Kannan Pakshirajan
Department of Biotechnology, IITG

Prof. Debasish Das
Department of Biotechnology, IITG

Prof. Piet Lens
IHE Delft Institute, NETHERLANDS

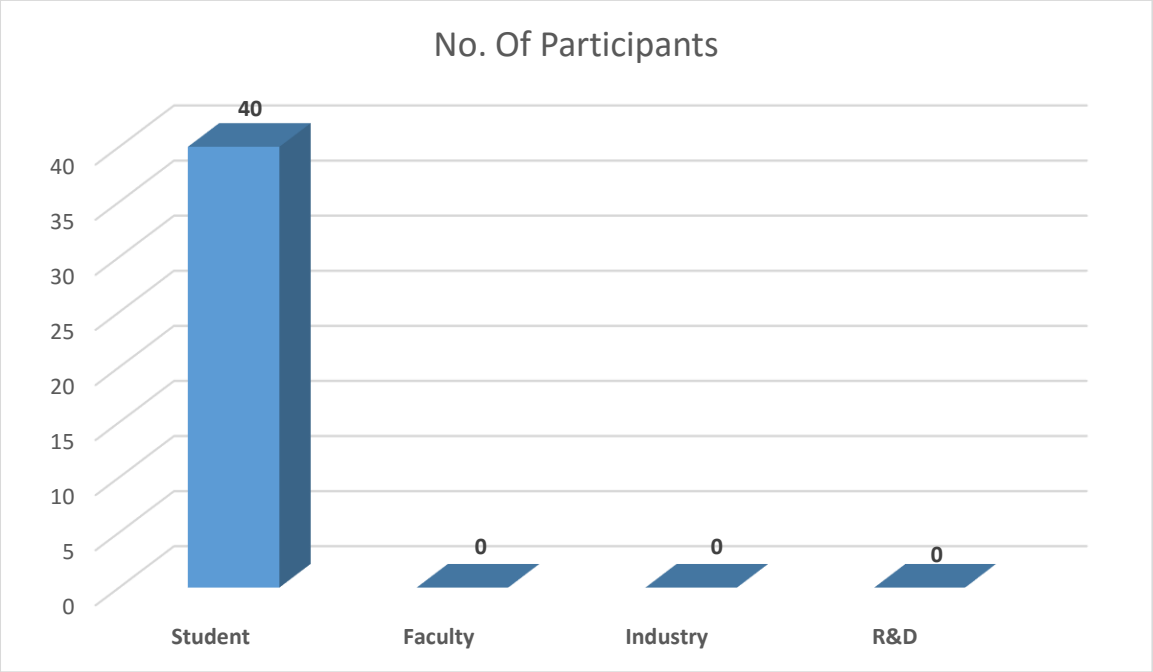
Duration: 23 April 2018 to 27 April 2018 (1 week)

Course Overview:

Biofuels will play a key role in the 21st century as the world faces two critical problems: volatile fuel prices and global climatic changes. Both of these are linked to the overdependence on fossil fuels: petroleum, natural gas, and coal. Despite a significant amount of research into biofuels, the field has not yet been able to replace fossil fuels. Recent advances might change this scenario. The combination of fuel cell and biomass fermentation technologies has emerged as a primary candidate for the renewable generation of heat and power on a decentralized basis. Biofuel cells are devices capable of directly transforming chemicals to electrical energy via electrochemical reactions involving biochemical pathways. Biocatalysts, including proteins, enzymes or whole cell organisms, can also offer cost advantages over metallic catalysts. Widespread usage of a biocatalyst would, however, tend to lower the cost of biofuel production, which is not true of transition metal catalysts.

This course will provide deeper insight into recent advancements in biofuel cells and thereby contribute to the understanding of this important topic. The course content includes a brief introduction on the first, second, third and fourth biofuel generations. The course is intended, however, to largely concentrate on advances made in recent years in the area of biofuel cells together with a discussion surrounding their practical application. Furthermore, the course will be extremely useful for researchers, scientists, engineers and graduate students, who are working in the areas of biofuels, more specifically on biofuels cell.

Total nos. of participants: 40





Mixed-Criticality Real-Time Systems

Prof. Arnab Sarkar
Department of Computer Science, IITG

Prof. Santosh Biswas
Department of Computer Science, IITG

Prof. Sanjoy Baruah
University of North Carolina, USA

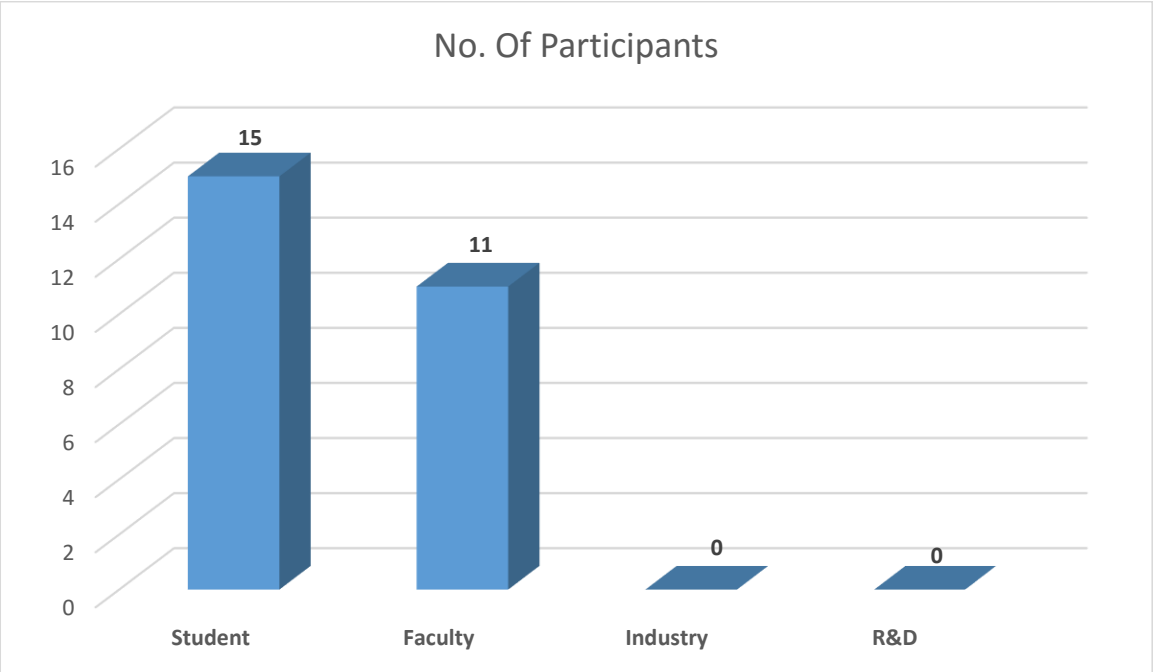
Duration: 21 May 2018 to 25 May 2018 (1 week)

Course Overview:

Methodologies that are currently used widely in the design and implementation of safety-critical real-time application systems are primarily focused on ensuring correctness. This, in conjunction with the trend towards implementing such systems using COTS components, may lead to very poor utilization of the implementation platform resources during runtime. Mixed-criticality implementations have been proposed as a means of achieving more efficient resource utilization upon such platforms, whereby highly safety critical functionalities are implemented upon the same platform as less critical functionalities. Informally speaking, the idea is that the resources which are provisioned to highly critical functionalities during design time, but are likely to remain unused by these functionalities at run-time, can be "re-claimed" and used to make performance guarantees, albeit at lower levels of assurance, to the less critical functionalities.

The real-time scheduling community has been developing a theory of mixed-criticality scheduling that seeks to solve resource allocation problems for mixed-criticality systems, thereby significantly enhancing our ability to design and implement large, complex, real-time systems in a manner that is both provably correct and resource-efficient. The course will include case studies concerning design issues in modern mixed-criticality systems like Unmanned Aerial Vehicles (UAVs), Automotive Systems, Railway Systems etc.

Total nos. of participants: 26




Thermal Processing of Foods

Prof. R. Anandalakshmi
Department of Chemical Engineering, IITG

Prof. K. P. Sandeep
North Carolina State University, USA

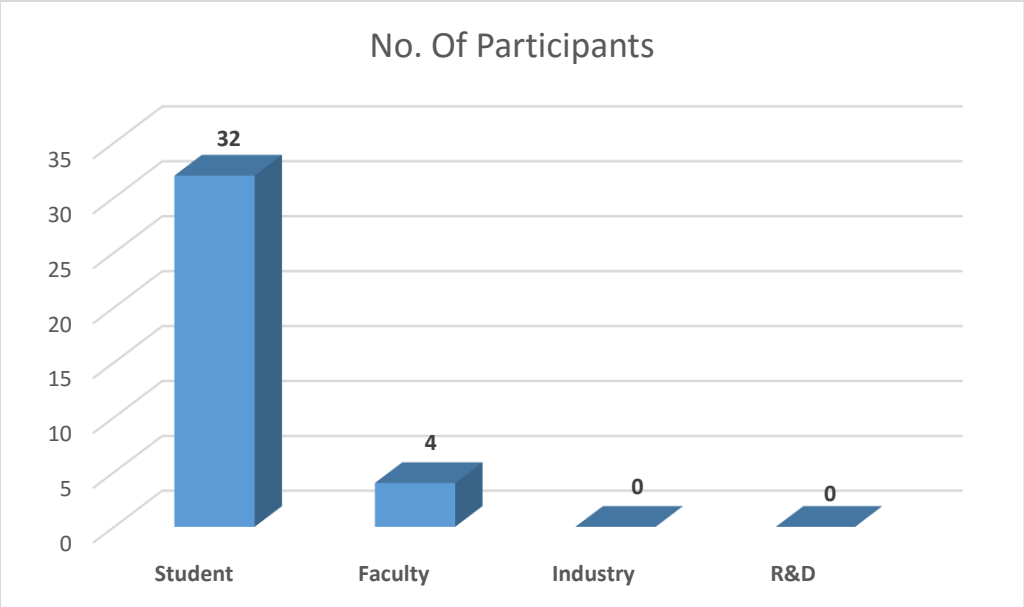
Duration: 28 May 2018 to 01 June 2018 (1 week)

Course Overview:

The Food and Agriculture Organization (FAO) of the United Nations (UN) issued a report on the importance and complexities associated with feeding the projected 9.1 billion world population in 2050. Towards meeting this goal, production of safe and nutritious foods in a sustainable manner (energy-efficient processes that limit water-use, generate very little waste products, and minimizes environmental impact) is of great importance. Some of the other important aspects associated with this are the development of foods that have a long shelf life and foods that are either ready-to-eat or easy to prepare (such as addition of water) so that they can be used when global calamities strike. Understanding "Food Engineering" and "Thermal Processing of Foods" serve as foundation of the technical means of meeting this goal.

The Food industry across the globe has been focused on using existing thermal processing technologies (such as retorting, hot-fill, pasteurization, and aseptic processing) and combining it with novel approaches including the use of microwave and ohmic heating to develop safe and high quality products. As students enter the workforce in industry, academia or government, they need to have a thorough understanding of food processing technologies, especially thermal processing of foods, so that they can be involved in the design and development of safe, nutritious, and tasty food products and processes at the local and global scale in an economically sound and environmentally responsible manner using locally available agricultural commodities.

Total nos. of participants: 36





Density Functional Theory for Heterogeneous Catalysis

Prof. Amit Kumar
Department of Chemical Engineering, IITG

Prof. R. K. Upadhyay
Department of Chemical Engineering, IITG

Prof. Neeraj Rai
Mississippi State University, USA

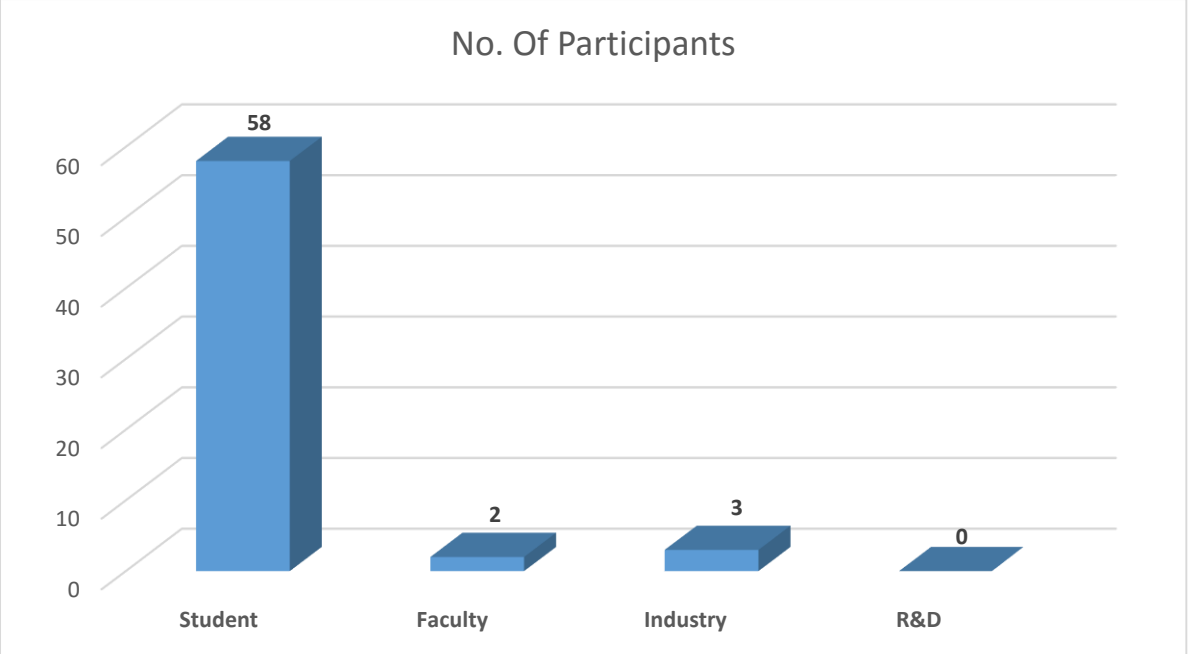
Duration: 6 August 2018 to 11 August 2018 (1 week)

Course Overview:

Catalysis in general, and heterogeneous catalysis in particular, is critical to most industrial processes, including the manufacturing of fine, specialty, petro and agro chemicals, pharmaceuticals, cosmetics, foods, and polymers. Catalysis is also central to the generation of clean energy and to the protection of the environment. At present, catalysts are used in over 80% of all chemical industrial processes, contribute directly or indirectly to ~35% of the world's GDP. Foundation of catalysis depends on chemical kinetics which is a science studying the reaction rates of chemical reactions, taking into account their reaction mechanism. Improved kinetic models could be developed when atomic processes on surfaces and the identification and characterization of surface species become available. In the present GIAN course, the status in the development of an understanding of surface chemistry will be discussed from a theoretical and computational perspective.

Density functional theory (DFT) has emerged as an attractive tool for computational study of chemical reactions. DFT calculations of heterogeneous reactions on catalyst surfaces can provide insights about the reactivity and mechanisms, and can potentially allow in silico screening and design of catalysts. In this course, a theoretical and practical introduction to computational techniques for studying chemical reaction kinetics will be presented. While the primary focus will be on DFT calculations, molecular dynamics (MD) techniques will also be discussed as they allow for explicit inclusion of thermal and coverage effects. The course will illustrate the application of these techniques to the study of surface-catalyzed reactions by considering the steam reforming of alcohols (to generate hydrogen) on catalyst surfaces as a representative case. The participants will be introduced to the calculation of adsorption energies of molecules on surfaces, identification of transition states, reaction pathways and estimation of reaction rates. The open source quantum chemistry software CP2K will be used for demonstrating all the computational methods as well as for the hands-on tutorial sessions.

Total nos. of participants: 63


No. Of Participants
60
50
40
30
20
10
0
58
2
3
0
Student
Faculty
Industry
R&D


Role of Fluid Flow and Mass Transport in Porous Media for Design of Chemical Reactors for Groundwater Remediation

Prof. Suresh A. Kartha
Department of Civil Engineering, IITG

Prof. Diganta Bhusan Das
Loughborough University, UK

Duration: 20 August 2018 to 24 August 2018 (1 week)

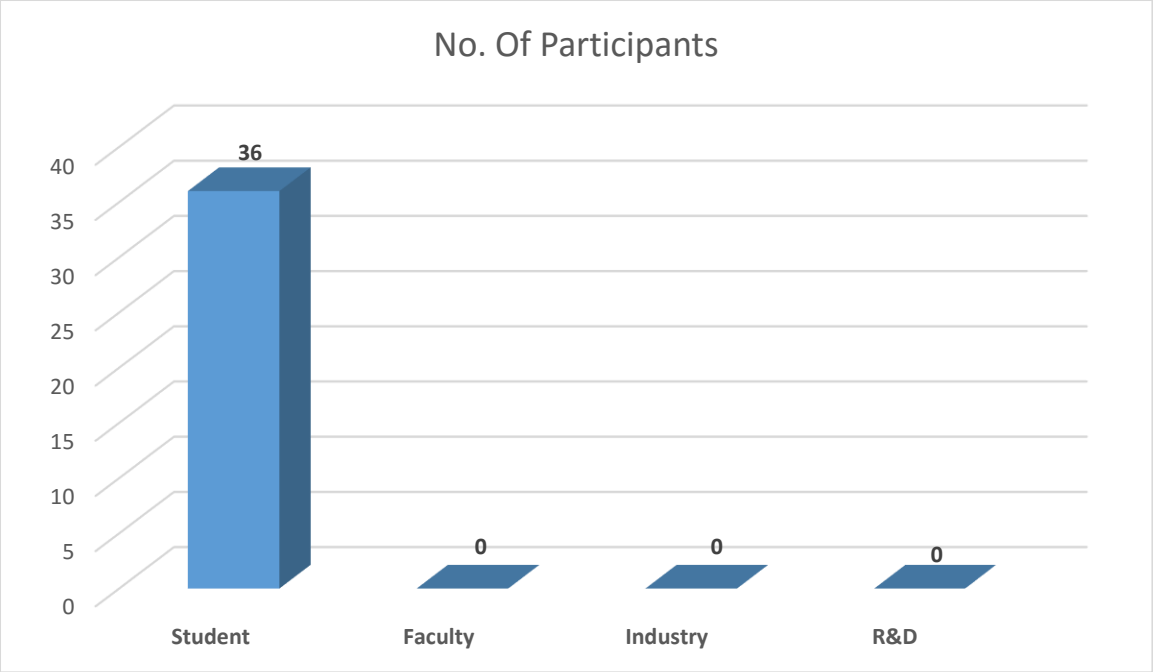
Course Overview:

Groundwater water flow and mass transport constitutes one of the most important components of the natural hydro-environmental systems. The vulnerability of groundwater to various pollutants urge for the development of appropriate remediation techniques of polluted ground water. The proposed course is based on the reasoning that designing a program for
remediating environmental pollutants in the groundwater requires a thorough knowledge of fluid flow and mass transport processes in the subsurface as well as the issues relating to the design and optimization of chemical reactors.

Permeable reactive barrier (PRB), which is a low-cost technology to clean or remediate the contaminated groundwater, has gained significant acceptance worldwide, although its use/application in the Indian conditions have not been explored to a large extent. Dissemination of knowledge on topics involving PRB in the Indian context, is therefore, an ideal step in mitigating and remediating various groundwater aquifers of the country. The overarching objective of this course is to develop an understanding of the design of chemical reactor for treatment of environmental pollutants in the subsurface (saturated and
unsaturated regions) and their dependence on the fluid flow and mass transport in these domains. Modeling is an essential tool in understanding and designing the bio-physico-chemico processes involved in contaminant transport processes. It is necessary for a reliable/realistic model to answer several relevant questions, such as, what is the purpose of the predictive calculations, what level of precision is expected, what are the advantages and disadvantages of the developed approach, etc. For this reason, the application of model in designing PRBs is emphasized in this course.

On completion of this course, the participants should be able to develop an understanding of the general theories of flow and mass transport in porous media, reactor design and optimization, parameter estimation using appropriate experimental techniques, and determine the relationships between the parameters and, coupled processes that govern contaminant
transport and remediation. The participants should also be able to appreciate how to integrate theory and practice to analyses specific contamination problems and develop concepts for the remediation of the environmental pollutants. This course is organized for one week involving 15 hours of lectures, 5 hours of tutorials and 4 hours of laboratory demonstration. The lecture notes, case studies, and assignments will be shared to stimulate research motivation of participants.

Total nos. of participants: 36




Urban Traffic Modeling and Control

Prof. Akhilesh Kumar Maurya
Department of Civil Engineering, IITG

Prof. R Jaykrishnan
Henry Samueli School of Engineering, USA

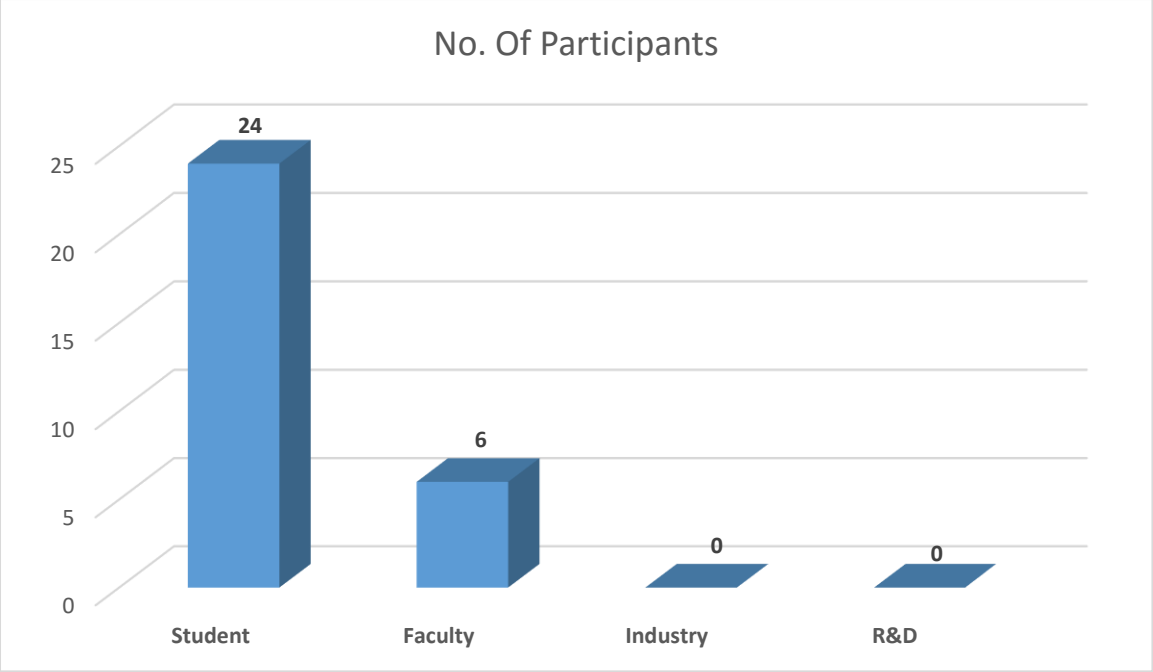
Duration: 04 September 2018 to 08 September 2018 (1 week)

Course Overview:

Social and economic development of any country is closely tied to the efficiency of its transportation systems. The fast pace of growth of vehicle ownership as well as rapid urbanization experienced in many parts of India has caused significant deterioration in mobility in the recent past. Urban congestion also has impacts by way of massive costs in energy usage, loss of productivity from delays, and deleterious environmental effects from vehicle emissions. Controlling vehicle movements with a proper understanding of the fundamentals of traffic behavior as well as the region-specific characteristics is thus important, underscoring the urgent need to produce more experts on the topic.

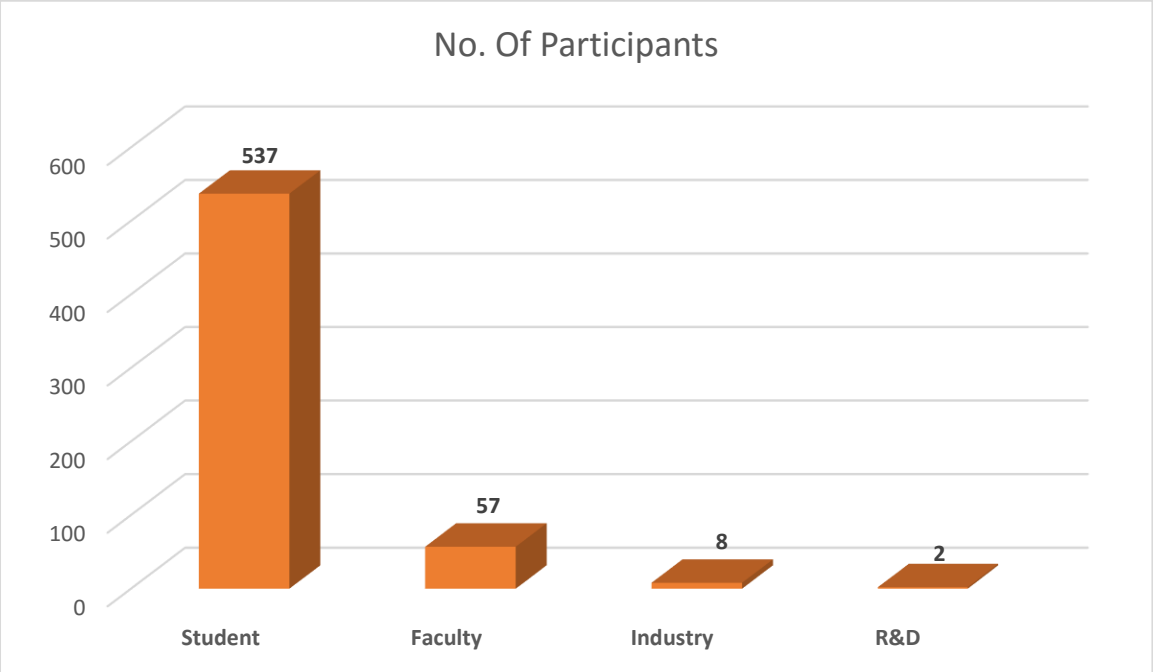
Traffic modeling and control have had several decades of history around the world, though it is not sufficiently well-understood and practiced in many cities and townships in India, outside of the larger metro areas where rapid developments have happened in the past two decades. Though many Indian universities lately produce graduates who are well-versed in transportation planning, expertise in traffic control still requires a certain level of maturation nation-wide. This is particularly so, when it comes to the detection of traffic state in the networks, and use of real-time information, including the use of applications and other facilities possible via smart phone communication that is prevalent in India. Thus it is timely that policy-makers, professionals, academics and students of transportation systems are exposed to the fundamentals of traffic behaviors and control within a more information-rich environment that is increasingly available now. Internationally acclaimed academicians, researchers and practitioners with proven knowledge, experience, and demonstrable ability in teaching, consultancy, research, and training in the field of Traffic Flow Modeling will deliver lectures and discuss potential research problems in the course. The course is planned as per the norms set by Global Initiative of Academic Networks (GIAN), an initiative by Govt. of India for Higher Education.

Total nos. of participants: 30


No. Of Participants
25
20
15
10
5
0
24
6
0
0
Student
Faculty
Industry
R&D

GIAN Phase-II Cumulative data: 2017-2018

Total nos. of participants: 604



Phase- II 2018-2019


Road Safety Engineering

Prof. Akhilesh Kumar Maurya
Department of Civil Engineering, IITG

Prof. Srinivas S. Pulugurtha
North Carolina at Charlotte (UNC Charlotte), USA

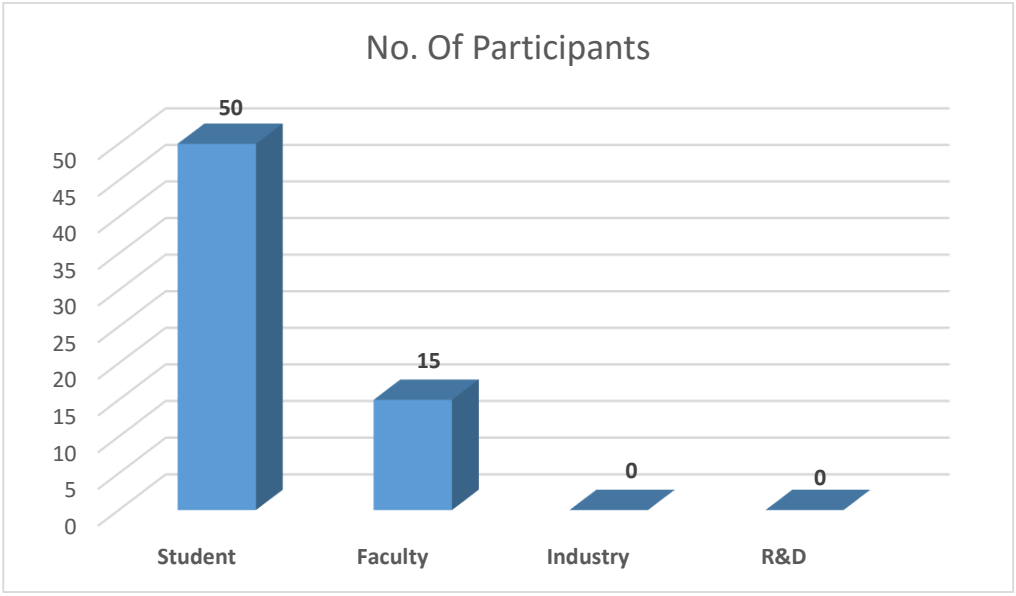
Duration: 24 June 2019 to 28 June 2019 (1 week)

Course Overview:

The rapid development and expansion of the road network, along with an increase in the number of registered motor vehicles, led to a substantial rise in levels of both passenger and freight movement. Concomitantly, the number of road crashes and fatalities have increased at an alarming rate. The fatalities in road crashes was documented as the eight leading cause of deaths, worldwide, in 2018. Over 1.35 million people were killed, worldwide, in road crashes during 2016. The economic losses associated with road crashes exceed $250 billion, annually, just in developed countries such as the United States. However, financial resources as well as manpower to collect adequate data, understand causal factors, identify countermeasures, and implement countermeasures to enhance safety (reduce the number of crashes and fatalities) have not increased at the same rate. The limited financial resources and manpower has made prioritization and allocation of resources efficiently even more important. Furthermore, the effort to enhance road safety is a multidisciplinary problem involving engineering, enforcement and education (3Es).

This course is designed for Executives, Engineers and Researchers of Transportation Engineering to identify and study the factors contributing to road crashes, its data collection, analysis using geospatial and statistical methods, prioritization, management and derivation of preventive countermeasures (3Es), and, before-after evaluations. The before-after evaluations include behavioral studies (conflicts) at treatment sites or using historical crash data (say, three years before and three years after). Overall, the evaluation of planned/existing roadway facilities will be presented from a safety point of view while emphasizing the need for consistent data collection standards (crash data, geometric features, traffic characteristics, environmental conditions and surrogate data).

Total nos. of participants: 65




Isothermal Near-Net Shape Forging of Aluminum Alloys: Advances and Inventions

Prof. U.S. Dixit
Department of Mechanical Engineering, IITG

Prof. Pavel A. Petrov
Moscow Polytechnic University, RUSSIA

Duration: 08 July 2019 to 12 July 2019 (1 week)

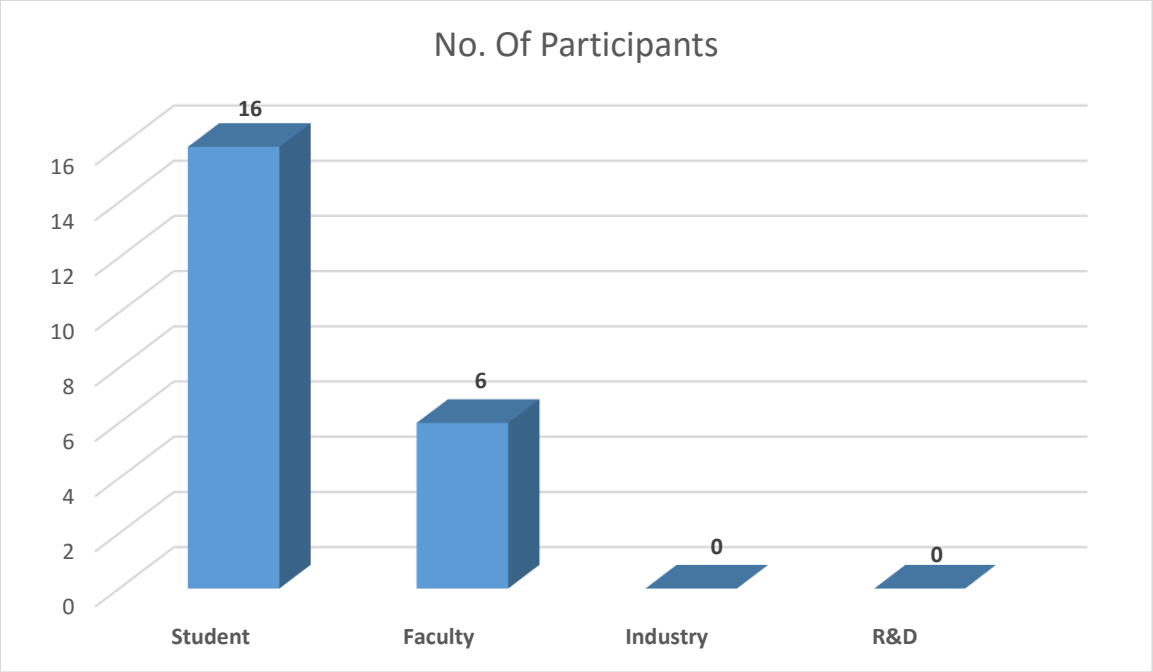
Course Overview:

There is a growing pressure for adopting sustainable and green engineering practices. Material scientists are developing high strength to weight ratio materials for reducing the consumption of the raw material as well as energy. Automobile and aircraft sectors are giving extra emphasis to weight reduction as it directly impacts fuel saving and reduction in global warming. Among various classes of lightweight materials, aluminum alloys are very attractive. Newer and newer alloys are being developed to retain high strength of materials at elevated temperatures. For example, Al-Si-Cu-Mg alloy is used for manufacturing the cylinder blocks of light vehicles due to its reasonably high temperature strength. Small addition of manganese further improves this alloy. However, apart from the material, the manufacturing process has the major influence in developing a product with desired quality. Forging has been used traditionally for developing the products that are subjected to severe fluctuating loads such as connecting rod of an internal combustion engine. Focus of today is to produce the products by forging that is very precise and requires minimal further machining or no machining at all. Such type of forging process is called near-net shape forging, precision forging or flash-less forging.

Near-net shape forging leads to saving in material, processing cost and finishing cost. The elimination of flash also helps to increase the strength of the product as defects cropping up due to trimming of the flash are eliminated. Depending on the temperature employed, near-net shape forging can be classified as hot, cold and warm. Among them cold forging is preferred to other types; however very recently this trend started changing. Very precise forgings are being obtained by hot forging. In fact, precision warm forging, which is performed above room temperature but below the recrystallization temperature, offers better utilization of raw material, improved surface finish and dimensional accuracy compared to hot forging and reduced forming loads compared to cold forging. Nevertheless, temperature plays a critical role in the process. It should not vary significantly during the process. Thus, comes the importance of isothermal near-net shape forging. Depending on the product, a uniform temperature or uniform temperature gradient in the work piece may be needed. Even in the cold forging process, the rise in temperature may be significant (often more than 100°C) and proper control of the temperature may be necessary.

This course will focus on the near-net shape forging of aluminum alloys. It will cover the process as well as tool design. Apart from experimental aspects, the course will emphasize modelling and optimization that will help in producing defect free products with minimal consumption of resources. Ultimately, it will contribute to the goal of Make in India.

Total nos. of participants: 22



RNA interference and Epigenetic Control of Gene Expression in Plants

Prof. Lingaraj Sahoo
Department of Bioscience and Bioengineering, IITG

Prof. Bernard Carroll
University of Queensland, AUSTRALIA

Duration: 11 November 2019 to 20 November 2019 (2 weeks)

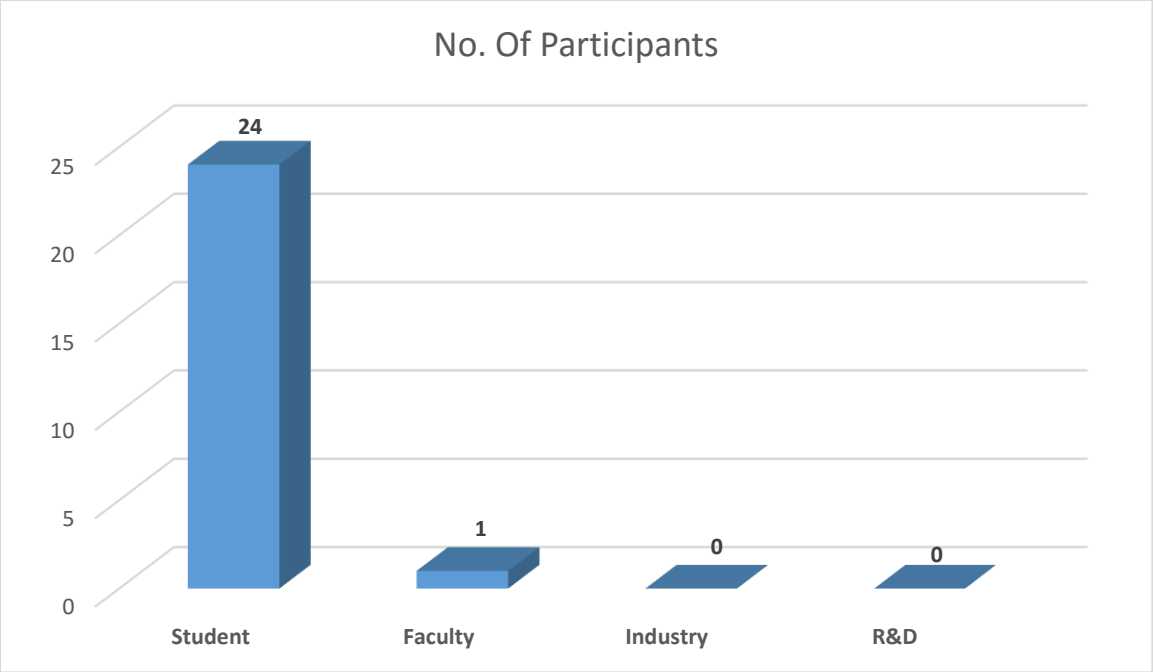
Course Overview:

In eukaryotes, small regulatory RNAs derived from double-strand RNA guide RNA interference (RNAi) and epigenetic modification through repression of complementary RNA and DNA. Arabidopsis thaliana has proved to be an excellent model species for uncovering the pathways and potential mechanisms of RNAi and epigenetics not only in plants, but in eukaryotes in general. In contrast to many other eukaryotic lineages including humans, gene duplication is a common feature of gene silencing pathways in flowering plants. For example, there is one DICER gene in humans compared to at least four DICER-LIKE (DCL) genes in flowering plants. This division of biological function between duplicated members of gene families involved in gene silencing has not only enabled the discovery of the function of individual genes, but also the composite biological function of the gene family as a whole. Case studies in plants will be used to highlight the mechanisms and evolutionary roles of RNAi and RNA-directed epigenetic modification in plants, but the relevance to humans and other eukaryotic species will also be covered. The potential of using topical application of dsRNA to manipulate gene silencing pathways in plants will also be covered.

The course is given by internationally known scientist, Prof. Bernard Carroll of University of Queensland, Brisbane, Australia. In a recent breakthrough research, published in Nature Plants, Bernie was part of the University of Queensland team who showed that by combining clay nanoparticles with designer 'RNAs' (molecules with essential roles in gene biology), it is possible to provide virus protection in plants. The spray they have developed -- known as BioClay -- has been shown to give plants virus protection following a single application. When sprayed with BioClay, the plant is primed for an attack by the virus and responds by protecting itself by using RNAi. This new approach could have huge benefits for agriculture around the world in reducing pesticide use, crop protection and global food security. Professor Bernie's laboratory research focuses on role of RNA interference and epigenetics in regulation of gene expression, and its relevance to plant biology particularly, plant development, plant defense against viruses and transposons. The host faculty, Prof. Lingaraj Sahoo focuses on genomics assisted improvement of Asiatic grain legumes for stress tolerance.

His lab translates basic discoveries in plant genetic and genomics research to protect crops from diseases and adverse environment through manipulation of small RNA and regulatory proteins (TFs) guided plant defense to plant pathogens and abiotic stress. He is a Visiting Professor at Gifu University, Japan, active in facilitating international cooperation in academia- industry linkage for translational bio-resource and food technology. Center has a high end Plant Biotech Research Facility, which is built to international biosafety requirements for research with Genetically Modified plants; a Plant Biotech Incubator Unit, which works closely with local industry and a molecular biology laboratory that offers basic molecular biology services.

Total nos. of participants: 25




Engineering Strategies to Restore the Nervous System

Prof. Utpal Bora
Department of Bioscience and Bioengineering, IITG

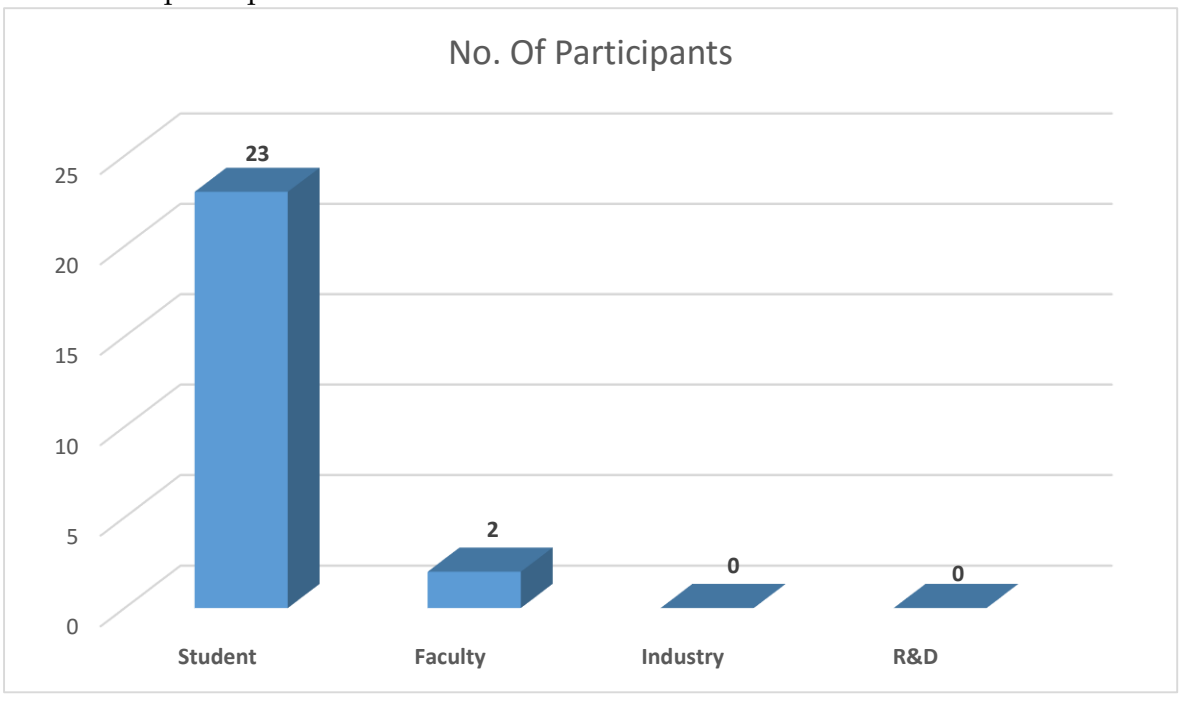
Prof. D. Kacy Cullen
Pennsylvania and the Philadelphia VA Medical Center, USA

Duration: 02 December 2019 to 13 December 2019 (2 weeks)

Course Overview:

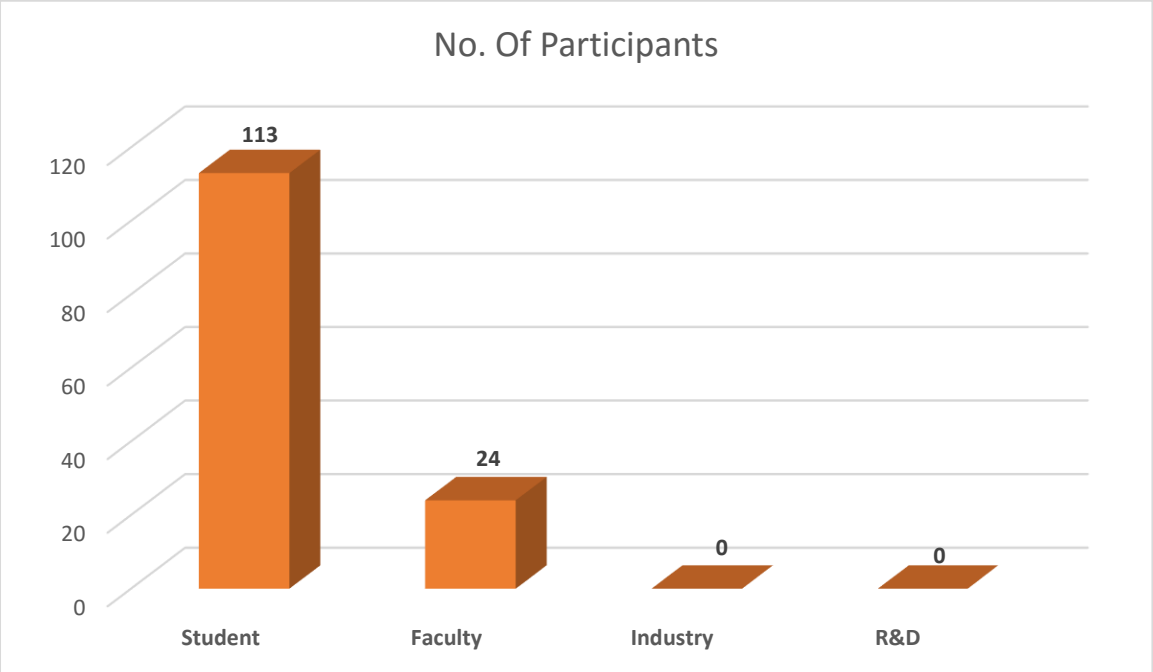
Nervous system trauma and neurodegenerative diseases affect millions of patients annually worldwide, causing significant morbidity and mortality. For instance, the available treatment modalities following traumatic brain injury (TBI) are largely limited to attempts at minimizing secondary injury, maintain cerebral perfusion pressure, and optimize cerebral oxygenation. In cases of peripheral nerve injury (PNI), the gold standard remains end-to-end anastomosis for minor nerve defects and autologous grafts for major injuries. Motor vehicle accidents are the leading cause of neuro-trauma worldwide. With over 400 people dying every day in India from road accidents and many more being debilitated there is an urgent need for technological innovations propelling development of affordable technologies to restore/reconstruct the damaged nervous system. Tissue engineered and regenerative medicine based treatments have considerable promise to facilitate nervous system repair and improve neurological function, and these next-generation approaches have considerable momentum to penetrate the clinical arena and eventually bring relief to large number of patients. The course will delve at the traditional and emerging strategies in tissue engineering, regenerative medicine, and neural engineering, with a focus on the development of polymer-based scaffolds, cell based "living scaffolds", and living bio-hybrid interfaces as constructs to facilitate nervous system regeneration, circuit reconstruction, and neuro-modulation. The course is organized in two modules that should be taken together. The topics in Module A will deal with the field of Neural Tissue Engineering with a focus towards biomaterial types and fabrication methods along with their applications in Peripheral and Central Nervous System. Module B will emphasize on Neural Engineering and development of Bio-hybrid Neuro-modulation platforms. A brief overview of the technological landscape in Neural Tissue Engineering with respect to intellectual property and patents would also be provided.

Total nos. of participants: 25



GIAN Phase-II 2018-2019 Cumulative data:

Total nos. of participants: 137



Phase- III 2021-2022


Modeling and Simulation in Energy Storage

Dr. Amaresh Dalal
Department of Mechanical Engineering, IITG

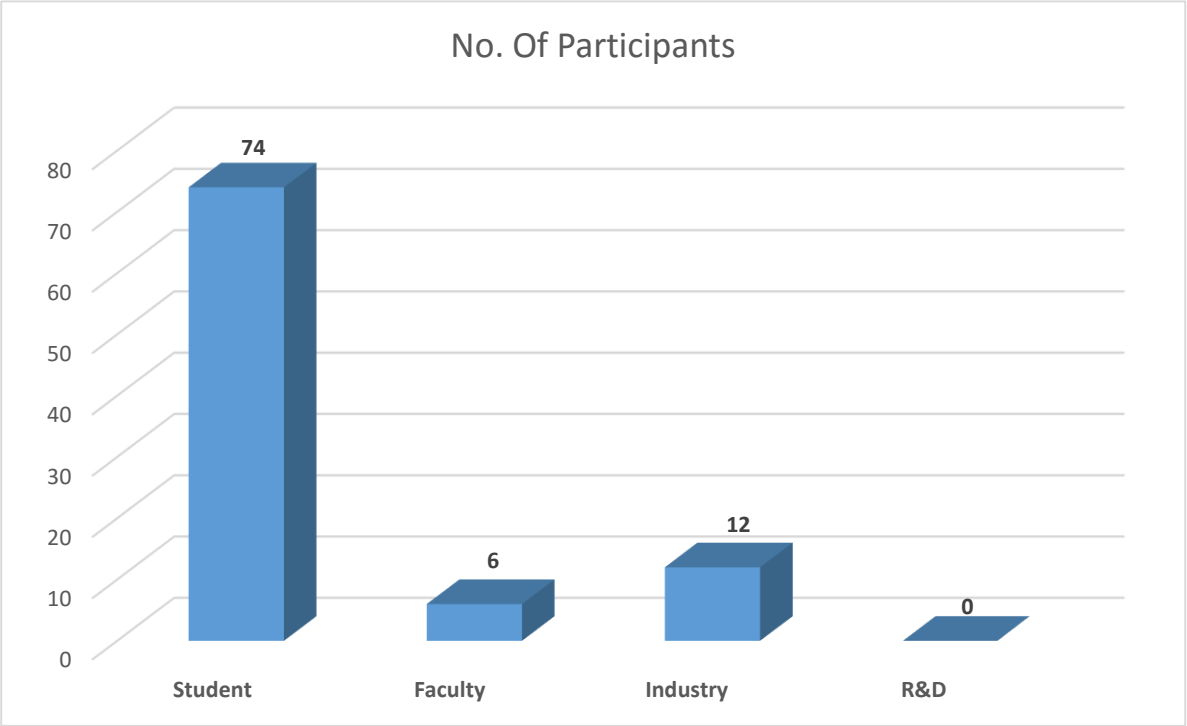
Dr. Partha P. Mukherjee
Purdue University, USA

Duration: 3-9 January 2022 (In Virtual Mode) (1 week)

Course Overview:

Energy storage is a key enabler in the energy sustainability eco-system. Lithium-ion batteries have transformed the modern rechargeable world with footprint in the portable electronics, vehicle electrification and grid-scale storage. The importance of modeling and simulation in accelerating innovation and design toward improved performance (energy/power), safety and life of lithium-ion batteries is critical. These are complex, dynamical systems, which include coupled physical and electrochemical processes encompassing electronic, ionic, diffusive transport in solid/electrolyte phases, electrochemical and phase change reactions and stress generation in porous electrodes. The performance, thermal safety, and lifetime of Li-ion batteries are predicated on fundamental understanding of the underlying reaction and transport processes. This course will lay out the details of a comprehensive computational modeling framework of thermo-electrochemical interactions in lithium-ion batteries toward predicting performance life and safety.

Total nos. of participants: 92



Spatial Data Science for Disaster Management

Prof. Subashisa Dutta
Department of Civil Engineering, IITG

Prof. Sudhanshu Panda
University of North Georgia

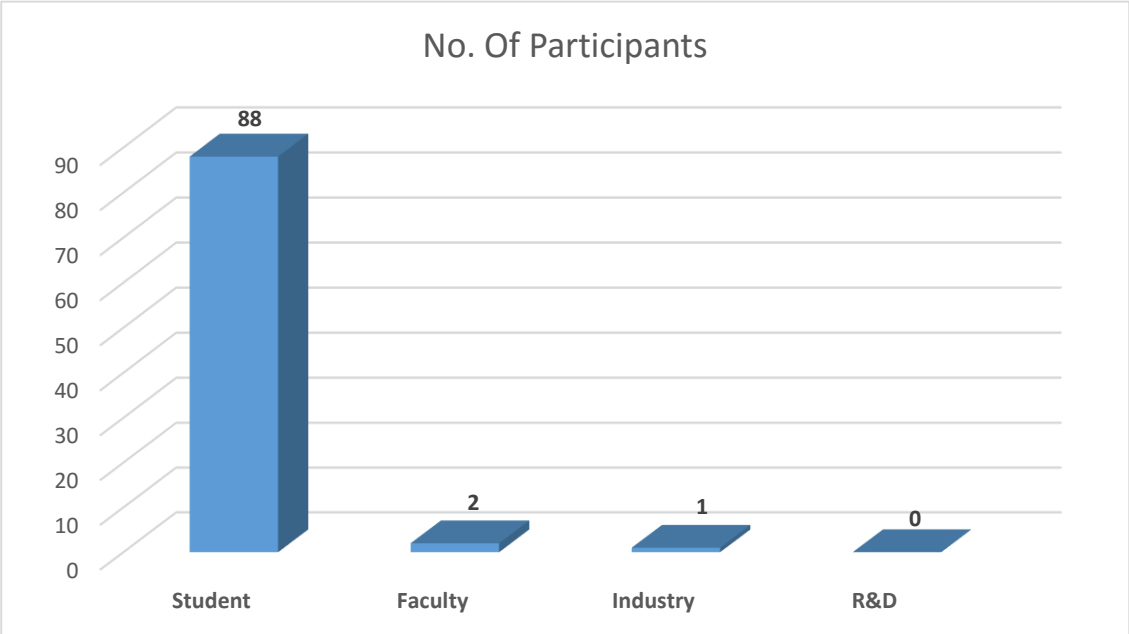
Duration: 3-14 January 2022 (In Virtual Mode) (2 week)

Course Overview:

Increased natural geohazards are a norm lately due to climate change impact. Its growing frequency has become a menace to human habitation across the globe. The economic loss and human casualties due to these natural disasters are significantly increasing in the world and especially in developing countries like India. Effective disaster risk reduction and proactive management decision support can be achieved with the application of geospatial technology for all the phases of disaster management, including vulnerability assessment, preparedness, prevention, mitigation, education, response, and relief. First, we need to model and map spatial disaster vulnerability with geospatial dataset in GIS platforms. Thus, effective proactive mitigation measures would be possible. The geospatial model with advanced geo-visualization will explain the spatial-temporal extent of the disaster, help develop a decision support for interactive management for rescue, evacuation, sheltering, and rehabilitation. Post disaster reconstruction and future disaster reduction measures could be undertaken with spatial engineering support.

In the last two decades, spatial data science has given a new platform in which we model problems geographically, derive results by computer processing, and then explore and examine those results. This type of spatial data science has proven to be highly effective for evaluating the geographic suitability of certain locations for specific purposes, estimating and predicting outcomes, interpreting and understanding change, detecting important patterns hidden in the information, and much more.

Total nos. of participants: 91



Blast and Shock Resistant Bio-Inspired Functional Materials Design Methodologies

Dr. Prasenjit Khanikar
Department of Mechanical Engineering, IITG

Prof. Niranjan Sahoo
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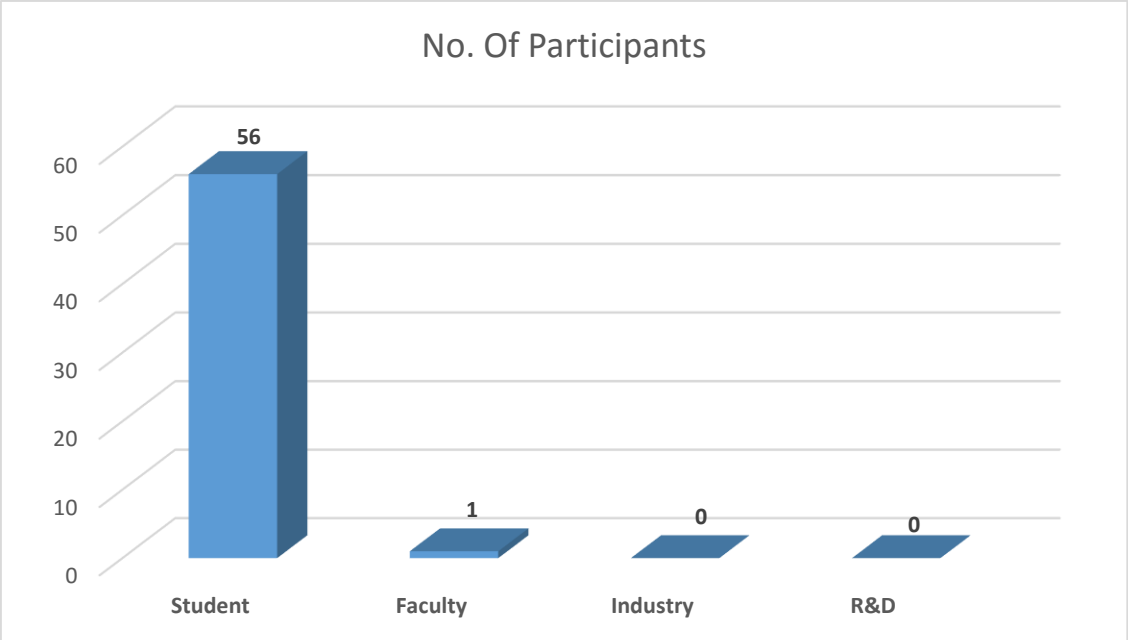
Duration: 10-19 January 2022 (In Virtual Mode) (2 week)

Course Overview:

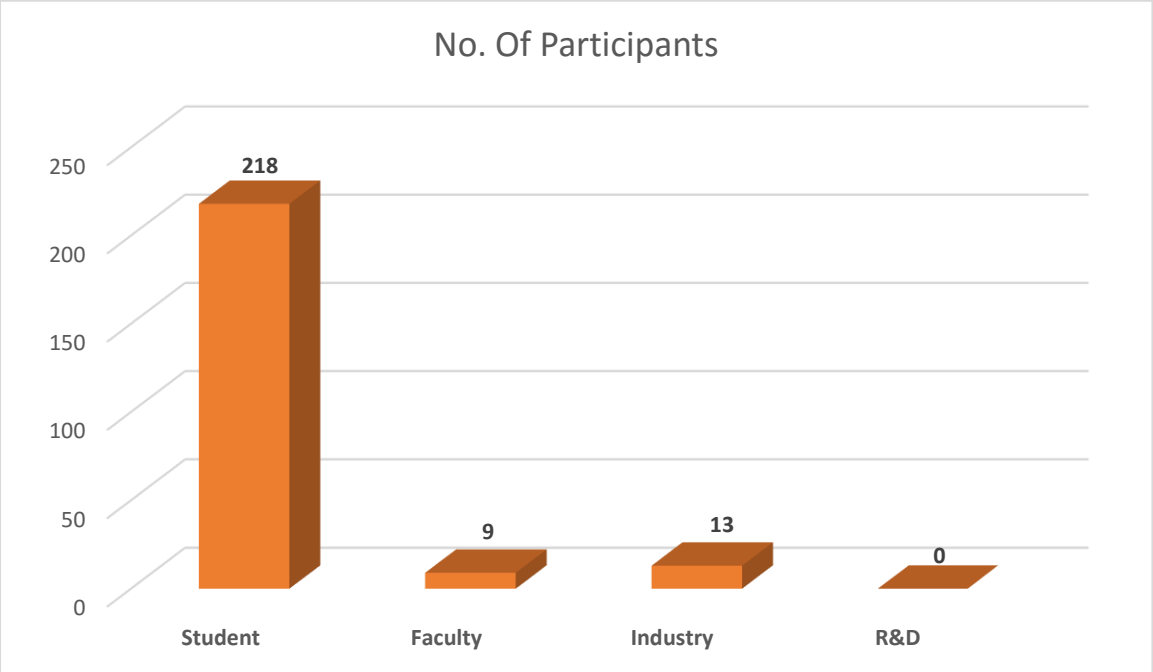
Conventional materials, such as metallic alloys, ceramics, cementitious materials, graphite/glass fiber reinforced woven and unidirectional composites are heavy and fail to provide adequate protection under extreme loading conditions, (e.g. high-energy blast or ballistic protection). The design of ultralight weight structures with enhanced blast and ballistic resistant properties and characteristics for hazard mitigation would require complex heterogeneous, functionally graded, layered composites. A variety of biological systems exhibit unique microstructural constructions that are tailored to provide exceptional functional response to dynamic loading conditions. For instance, fish scales are known to exhibit enormous resistant to penetration loading. A fish scale contains two to three distinct layers with saw tooth type anchoring structural features in addition to the gradation of hydroxyapatites and collagens. The rostrum of a paddle fish and beak of a woodpecker are functional materials with microstructures to absorb energy and momentum in a most efficient manner. The geometrical and material architectures are highly nonlinear with a wide variety of biomolecules providing resistance to defect nucleation and growth that are essential to absorb energy. The nonlinear geometries and materials generate ideal pathways to disperse and attenuate stress wave propagation to efficiently manage intense loadings. To design ultralight weight structures with high strength and toughness, biological systems provide unique design concepts such as the mechanisms involved in mitigating damage progression due to the gradation of protein like collagen fibers along the layers. The ability to design new material system would require characterization and modeling of biomaterials at all length scales and under high strain rate and shock loading conditions. With the advent of 3-D printers, it is now possible to print thin layers with wide range of properties. Bio-inspired systems provide certain design methodology to organize and arrange the various layers of dissimilar materials, from crystalline ceramics to heterogeneous biodegradable wood products. The fundamental elastic properties can be determined using representative volume element based finite element analyses using high resolution models. Dynamic experimental methods such as the split Hopkinson bar and shock tubes provide testbeds to characterize and validate the manufactured functionally layered material panels.

Total nos. of participants: 57



GIAN Phase-III 2021-2022 Cumulative data:

Total nos. of participants: 240



GIAN Cumulative data: 2016-2019

Total nos. of participants: 1340