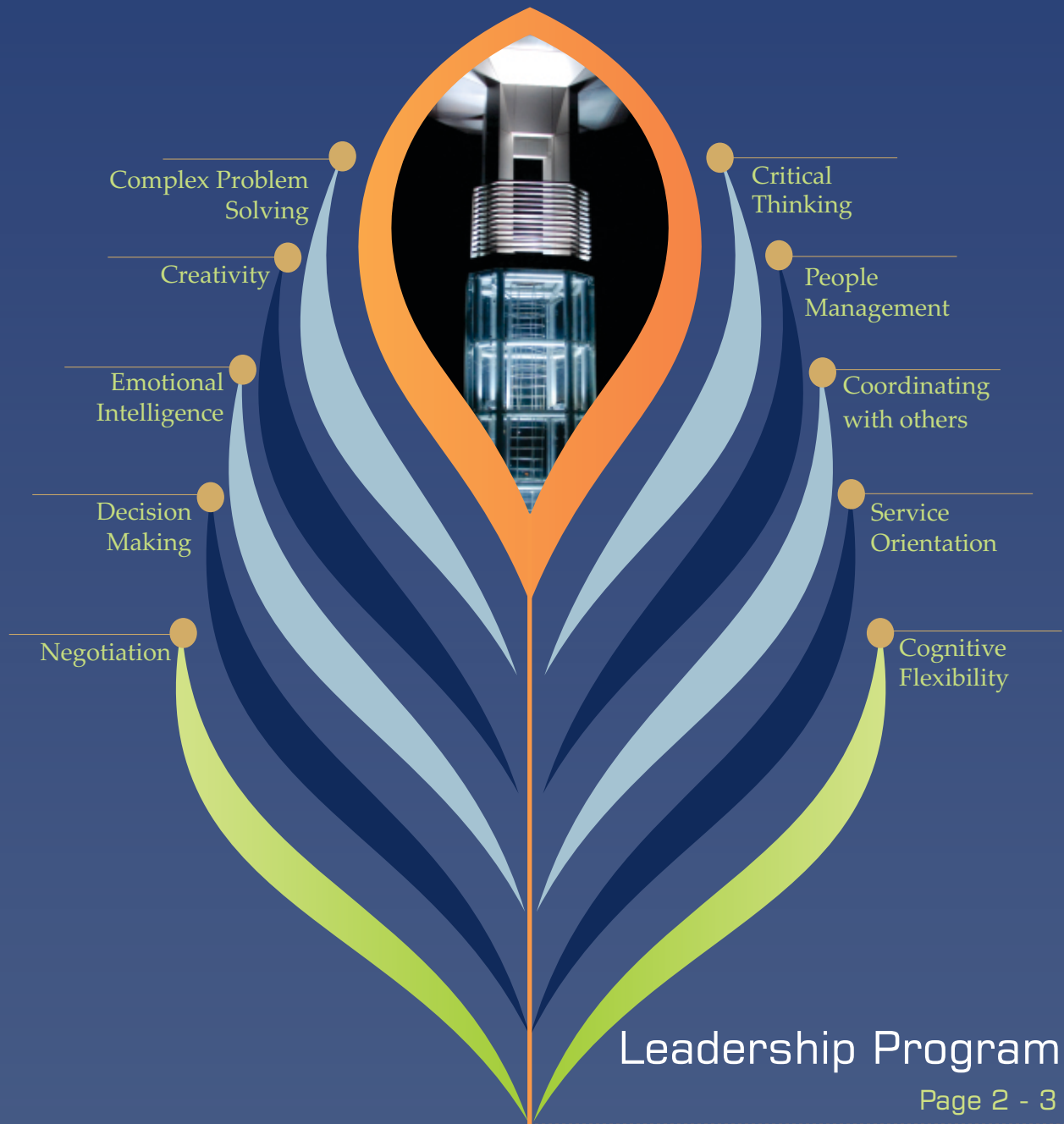




R&D Newsletter



Leadership for Academicians Programme

IIT Kanpur organized Leadership for Academicians Programme (LEAP) from November 19 to November 30, 2018. LEAP is a MHRD funded leadership development training program intended for the second level leadership in major government-held technology institutes. The objective of the program is to prepare second tier academic heads who are potentially likely to assume leadership roles in the future. Leading experts from the academia and industry delivered lectures covering different aspects of leadership. Total twenty eight participants join the programme from various National Institute of technology, Indian Institute of Technology, Central Universities and State Universities. Brain Storming session was organised every day with non-hierarchical discussion among all participants, guest faculty and the organizing faculty. Participants also visited different research facilities and establishment of IIT Kanpur.

Speakers of LEAP

- **Prof. Abhay Karandikar**
Director, IIT Kanpur
Managing Innovation
- **Prof. Manindra Agrawal**
Deputy Director, IIT Kanpur
Leadership in Research
<https://www.youtube.com/watch?v=siiWHyD9WVE>
ICT in Technical Education
<https://www.youtube.com/watch?v=8PkmOmjyl4s>
- **Prof. S Ganesh**
Dean Research & Development, IIT Kanpur
Academic Research & Consultancy
<https://www.youtube.com/watch?v=qrdEezhygyY>
- **Prof. K Muralidhar**
Dean of Faculty Affairs, IIT Kanpur
Faculty Recruitment
<https://www.youtube.com/watch?v=8ue58gDEkCM>
- **Prof. B.V. Phani**
Dean Resources & Alumni, IIT Kanpur
Fund Raising in Academic Environment
<https://www.youtube.com/watch?v=DWpfEts17HY>
- **Prof. Jayant K Singh**
Dept. of Chemical Engineering, IIT Kanpur
Fourth Industrial Revolution
https://www.youtube.com/watch?v=P8Kxk_LxRM4
- **Prof. Neeraj Mishra**
Dept. of Mathematic & Statisticss, IIT Kanpur
Teaching, Student Evaluation & Assessment
<https://www.youtube.com/watch?v=PhUqWZjQrwo>
- **Prof. Mohua Banerjee**
Dept. of Mathematics & Statistics, IIT Kanpur
Chairperson, Women's Cell IIT Kanpur
Gender Sensitivity at the Workplace
<https://www.youtube.com/watch?v=ZTM6k1iHHYE>
- **Prof. HC Verma**
Former Prof. Dept. of Physics
Education for the Under-Privileged
<https://www.youtube.com/watch?v=wm-z25UJm5U>
- **Prof. Vinod Singh**
Dept of Chemistry, IIT Kanpur
Founder Director IISER Bhopal
Publicly Funded Institute New & Old
<https://www.youtube.com/watch?v=PuGofLXHpk>
<https://www.youtube.com/watch?v=ysdSwmXAatc>
- **Prof. Pankaj Jalote**
Director, Indraprastha Institute of Information Technology (IIIT) Delhi
Effective Education
<https://www.youtube.com/watch?v=cbN2vCysTRO>
- **Prof. MS Ananth**
Former Director, IIT Madras
Idea of a University
<https://www.youtube.com/watch?v=Oixldx4qWkC>
- **Prof. S P Sukhatme**
Professor Emeritus, IIT Bombay
Overseeing Academic Activities -Teaching Perspective
<https://www.youtube.com/watch?v=3NdEH0jJUCs>



- **Prof. S G Dhande**
Former Director, IIT Kanpur
Role of a Director
<https://www.youtube.com/watch?v=hNz5evakWFM>
<https://www.youtube.com/watch?v=K0gYKJYO7w>
- **Dr. BV Mohan Reddy**
Founder & Executive Chairman, Cyient Ltd
What is Leadership
<https://www.youtube.com/watch?v=QbJvQLSrKEI>
- **Prof. K L Chopra**
Former Director, IIT Kharagpur
Academic Ethics
<https://www.youtube.com/watch?v=OAlmcKupDno>
- **Dr. Anil Kakodkar**
Former chairman of the Atomic Energy Commission of India and the Secretary to the Government of India
Technical Education- Role & Responsibility
<https://www.youtube.com/watch?v=AHPWPbQ4NVU>
- **Prof. Arvind Sahay**
Prof. Indian Institute of Management, Ahmedabad
Neuroscience & Behavior Changes
https://www.youtube.com/watch?v=P8Kxk_LxRM4
- **Prof. Hrishikesh Krishnan**
Director, IIM Indore
Fiscal Policy and Discipline
<https://www.youtube.com/watch?v=K4AC8kPOwGw>
<https://www.youtube.com/watch?v=Cl16ttb1GVw>
- **Dr. Shahid Jameel**
Chief Executive Officer, Wellcome Trust / DBT India Alliance
Academic Research and Institutions of Higher Learning
<https://www.youtube.com/watch?v=kTShXexbA2s&t=293s>
- **Dr. Pramath Raj Sinha**
Co-Founder & Managing Director, Nine Dot Nine Mediaworx Pvt. Ltd.
Governance of large institute - public and private
https://www.youtube.com/watch?v=_uJQSaCwiZM&t=239s
- **Mr. Srikant Sastri**
Co-founder of Crayon Data Pvt Ltd.
Promoting Entrepreneurship at India's premier tech institutes
<https://www.youtube.com/watch?v=PkQZNnoteXcs>
- **Mr. Ananth Krishnan**
Executive Vice President & Chief Technology Officer, TCSc
Academic Research and Institutions of Higher Learning
<https://www.youtube.com/watch?v=7YyH2LJiRsw&t=201s>
- **Prof. G Rangarajan**
Professor, Department of Mathematics, IISc Bangalore
Comparative Analysis of University Rankings
- **Dr. Praveen Bhagwat**
Co Founder & CTO, Mojo Networks
Institutionalizing Innovation & Infrastructure for Innovation
<https://www.youtube.com/watch?v=XBuv86Cp9QY>
<https://www.youtube.com/watch?v=Q5RRhok9wLg>

Recent Project

Aircraft Engine Combustor Design for Improved Operability, Durability, Pattern Factor and Emissions

PI: Prof. Abhijit Kushari, Dept. of Aerospace Engineering

Sponsor: Ministry of Human Resource Development (MHRD) and GE India Technology Centre Pvt Ltd.



Modern gas turbine engines must cater to a variety of challenging requirements of cost, weight, durability, operability & efficiency while maintaining low cost of ownership for its customers. This cost includes manufacturing cost, maintenance cost (mainly overhaul), and fuel. To address these challenges combustor must meet requirements on profile and pattern factor, altitude relight, ground starting, efficiency, emissions etc.

The proposed effort envisages design, development and realization of an annular rich-burn combustor to optimize conflicting requirements of durability (profile/pattern factor), emissions and operability. It is proposed to use a sector test rig to burn ATF and air (at high temperature and pressure as in practical combustors). The ensuing combustion process will be analyzed with state of the art laser based instruments to elucidate the details of the flow and combustion physics in such a complex system. The velocity field (PIV/LDV), temperature field (Rayleigh scattering), various species field (OH, NO_x, CO, HCHO using PLIF), soot (LII) and emissions (multi-component emission analyzer) will be measured and correlated with each other. The flow field data will be used to understand the interaction of swirler flow and dilution flow which dictates flame stabilization, altitude relight and combustor light-off. The temperature field will help to understand the evolution of profile and pattern leading to combustor and turbine durability. The emission data will also be used to estimate the combustion efficiency. The species field will identify the locations and physics for emission formation.

Using this data, a parametric design study will be conducted to establish the role of dilution hole geometry on the combustion process and, based on that study, design guidelines will be formed to optimize the combustor design in terms of improved operability, durability, pattern factor and emissions.

This Project is under the scheme of Uchhatar Avishkar Yojana (UAY) of Govt. of India.

Funding from Engineers India Limited under EngSui Scheme

SIIC, IIT Kanpur is one of the outreach Centre for EngSUI program of Engineers India Limited (EIL). EngSUI is the startup India initiative of EIL under the Prime Minister's flagship programme of Startup India. This programme intends to build a strong eco-system for nurturing innovation and Start-Ups in the country. They have floated two programs for funding projects.

Innovation Challenge Programme: This has been designed under the same line of PRISM (Promoting Innovations in Individuals, Startups and MSMEs) program of Department of Science & Industrial Research. Under this scheme, the maximum amount of funding is Rs. 20 lakhs for building a prototype.

Start up (Seed Funding): This is the next level start-up program wherein the funding is given for a Start-up entities who have successfully demonstrated proof of concept with the support of any government institutions or agency. The effort is to bring this product / project to a level good for commercialization after which this can attract capital for investment.

Under their two rounds of funding 5 proposals of SIIC, IIT Kanpur have been sanctioned funding under the EngSUI program.

Improved Description of the Water-Cycle in the Upper-Ganga Catchment using Isotopic, Geochemical Data and Model Simulations



PI: Prof. Indra Sekhar Sen, Centre for Environmental Science & Engineering and Earth Sciences
Sponsor: Ministry of Earth Sciences

One-sixth of the world population relies on ice melt-water from the Hindu Kush Himalayan glacier mass. Its alarming rate of melting because of climate change has raised several concerns on the future supply of potable water in the mountainous regions. Despite the important linkages between global warming, shrinking glaciers, changes in ice and snow melt downstream supply, and future supply of potable water - the region is far less studied when compared to Arctic, Greenland and Antarctic ice masses.

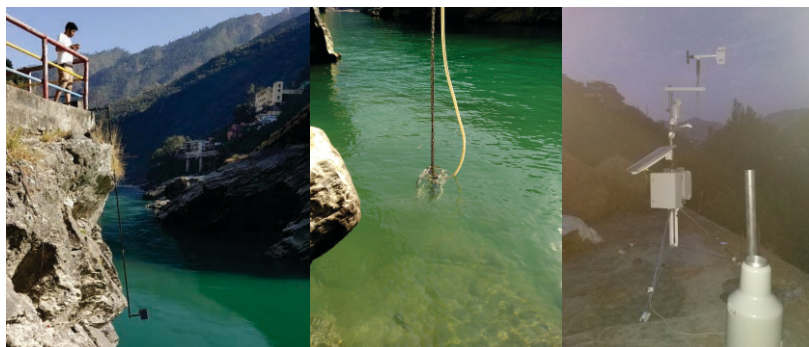


Figure (left to right): Real time water level sensor, continuous water quality monitoring platform, and automatic weather station at Devaprayag, Uttarakhand.

The project intends to carry out real time/high resolution (daily) monitoring of hydrometeorological parameters in the mountainous stretches of Ganga River (Figure above) to obtain a better closure of water budget in the upper Ganga catchment.

The project aims to address the following key science questions :

- What is the best estimate of the relative strengths of discharge contributions from various reservoirs e.g. glacier, snow, rain, groundwater?
- Is there a correlation between the glacier, snow, rain, and ground water contributions at an inter-annual and intra-seasonal scales and what is the implication of these correlations in terms of the river run-off fluctuations?
- Are these field estimates and fluctuations well simulated by state of art hydrological model (e.g., Variable Infiltration capacity Model)?

Collaborators

Prof. A. Banerjee, Department of Earth and Climate Science, IISER Pune

Prof. S. Ghosh, Department of Civil Engineering, IIT Bombay

Construction of a Combined Recoil ION Momentum and Electron Energy Spectrometer to Study Collision Induced Excitation & Fragmentation of Molecules & Clusters



PI: Prof. Aditya H Kelkar, Dept. of Physics
Sponsor: Science and Engineering Research Board

The motivation for this project is to understand the dynamics of Coulomb interaction in weakly bonded many body systems (van der Waals clusters) using ion collisions. The objective of the project is to develop a high resolution spectrometer setup to perform kinematically complete collision experiments at the 1.7 MV tandetron accelerator facility.

Recent Project

Scientific Validations of Ayurvedic Formulations-Medicines Recommended for Mitigations of Cancer Anorexia-cachexia Syndrome (cacs) in the *Drosophila* Tumor Model



PI: Prof. Pradip Sinha, Dept. of Biological Sciences & Bioengineering

Sponsor: Special call under Ayurveda Biology Program, Science and Engineering Research Board (SERB)

Cancer Anorexia-Cachexia Syndrome (CACS) is a multi-factorial systemic condition, which contributes to poor prognosis—besides adverse response to chemotherapy—in nearly 50% of all cancer patients. Currently there is no specific treatment for CACS. Although Ayurvedic herbs/formulations/ medicines promise mitigation of CACS, these have not been scientifically validated in terms of their mechanism of actions. We have now developed a novel in vivo model for CACS in the genetically highly tractable organism, *Drosophila*, where essential pathological symptoms of CACS are closely recapitulated. Using this in vivo platform and assay protocols, the project aims to unravel the mechanisms of action of two promising candidate Ayurvedic formulations: namely, Amlaki Rasayana and Rasa-sindoor that shows promise of being CACS suppressant on one hand, and screen a select collection of Ayurvedic herbs/ formulations/medicines that are recommended for cachexia and anorexia, in general, for their specific ability to mitigate CACS. Together, these approaches that take advantages of the *Drosophila* tumor model and its genetic tools, the project has proposed to provide a comprehensive scientific validation of mechanism of action of several Ayurvedic suppressants of CACS.

Objectives

- Characterization of suppression of cancer cachexia and anorexia (CACS) by Amlaki Rasayana (AR) and Rasa-sindoor (RS) that have shown promise in our early screens.
- Decipher the mechanism of CACS suppression by AR and RS in the *Drosophila* model using a combination of cell and developmental biological, genetical and molecular assays.
- Screen and identification of mechanisms of action CACS suppressants from of a select list of Ayurvedic herbs/formulations recommended by Arya Vaidya Sala (AVS) Kottakal as likely candidate medicine for amelioration of anorexia and cachexia.

Femtosecond Laser approaches to Quantum Information and Computation: towards a Perfectly Secure Channel for Robust and Scalable Information Processing



PI: Prof. Debabrata Goswami, Dept. of Chemistry

Sponsor: Ministry of Electronics and Information Technology

The objective of this project is to address the lack of India's stake in the international quest for developing a scalable quantum computer. The implementation scheme described herein uses optical coherent control approaches that utilize shaped short pulses to implement the Deutsch–Jozsa (DJ) algorithm in rovibrational states. This is towards the goal of developing a scalable model for quantum information and computing. Thus, it presents a novel approach to quantum information processing and quantum computation based on the developments of femtosecond laser pulse shaping from the Femto

laboratory of IIT Kanpur. As there have been only limited efforts on the experimental side nationwide; this proposal is geared towards experimental implementation which would result in a proof-of-principle development with theoretical insight. Thus, this effort would be a significant development that would help bridge the gap between theory and experiment and would provide the much-needed impetus for quantum computing and information research in the country.

Fundamental Process Engineering to Minimize Re-Oxidation of Steel during Teeming via a Ladle Shroud Leading to Improved Castability and Cleanliness

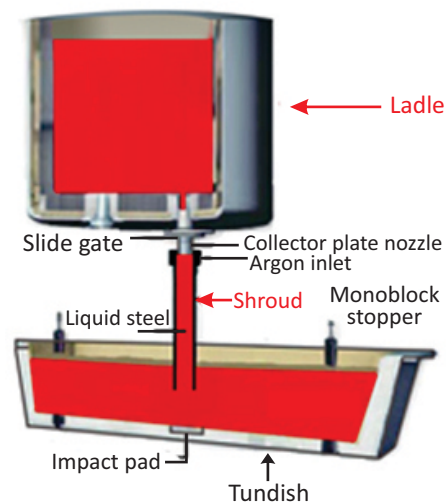


PI: Prof. Dipak Mazumdar, Dept. of Materials Science & Engineering

Sponsor: Ministry of Steel

A ladle shroud is used to transfer molten steel from a ladle to tundish during continuous casting operation (see adjoining figure). Argon is frequently injected at the collector plate-shroud joint to improve shielding of liquid steel during the transfer process. Quantum of argon injection and the associated gas-liquid flows in shroud, refractory-metal interactions as well as multi-phase flow phenomena in tundish tend to exert considerable influence on steel cleanliness and final product quality. The transfer process, as such, in recent years has assumed significant importance since cleanliness of steel is intricately related to superior engineering properties and service performance of the final product.

The present study concerns with an investigation on the shrouded transfer of molten steel and to this end physical and mathematical modelling supported by plant scale trials are being planned. The objective of the project is to develop appropriate melt transfer strategy and evolve operating guidelines leading to improved castability and better final product quality.



Designing and Developing a Desktop Microwave ECM Machine

PI: Prof. J Ramkumar, Dept. of Mechanical Engineering

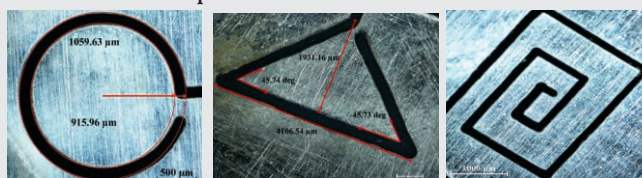
Sponsor: Department of Science & Technology



In the recent past, the development and introduction of new exotic engineering materials with improved strength as well as volume to weight ratio, has exerted a significant thrust on manufacturing industry to develop advanced machining processes for their machining. Wire electrochemical micromachining (Wire-ECMM) process is one of the results of extensive research in this direction.

The project aims to develop a desktop size machine for this process specifically targeted towards machining of very hard and difficult to machine conducting engineering materials at micro and nanometre scale. This setup will be fully automated coupled with a closed loop feedback system and will facilitate relative

motion between tool and workpiece in 4 axes. With a detachable assembly for tool mounting, the applicability of this machine will not be limited to only Wire-ECMM, other machining processes like electrochemical milling, drilling, slitting and different turning operations at micro scale will also be made possible under one work position.



(B) Circle (C) Right angled triangle (A) Square helix

Images of parts machined (Material: Stainless Steel 304) using a concept microwire electrochemical machine (prototype only)

R&D News

InSDB 2018

The Biennial meeting of the Indian Society of Developmental Biologists (InSDB) was held at IIT Kanpur from 11 to 15 December, 2018. The event was organised jointly by IIT Kanpur and the Australia and New Zealand Society for cell and Developmental Biology (ANZSCDB). A large number of developmental biologists across India attended the event.



SPACE 2018

IIT Kanpur organised SPACE 2018 in cooperation with the International Association for Cryptologic Research (IACR) and Cryptology Research Society of India (CRSI) from 15 to 19 December, 2018. This is an annual international conference on Security, Privacy and Applied Cryptography Engineering (SPACE). The conference included workshops for students and talks by internationally-renowned researchers.



IUTAM 2018

IUTAM (International Union of Theoretical and Applied Mechanics) Symposium on Dynamics of Complex Fluids & Interfaces was organised at IIT Kanpur from December 17 to 20, 2018. The symposium aimed to bring together leading researchers to discuss recent developments and the future challenges in the Rheology & stability of polymers, suspensions and the interfaces between fluids and soft solids.



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