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# MESSAGE FROM DIRECTOR



I am happy to see that the Department of Industrial and Systems Engineering (ISE) is publishing the first issue of its semi-annual Newsletter. The Newsletter will definitely help to showcase the achievements, progress and ongoing activities that are happening in the department and the ways the Department looks for the future. I do hope this newsletter will serve as one of the ways to help all stakeholders keep connected with ISE and identify many opportunities to work together.

Best of luck!

A handwritten signature in black ink, which appears to read 'P. P. Chakrabarti'.

**Prof. P P Chakrabarti**  
*Director, IIT Kharagpur*

# ABOUT THE DEPARTMENT

The Department of Industrial and Systems Engineering (ISE) was established in 1973 as Industrial Management Centre and later elevated to a full-fledged department in the year 1983. The department offers (i) B.Tech (4-year) in Industrial Engineering, (ii) Dual Degree (5-year) - B.Tech. in Industrial Engineering and M.Tech in Industrial Engineering and Management, (iii) Dual Degree (5-year) - B.Tech in Manufacturing Science & Engineering and M.Tech in Industrial Engineering and Management, (iv) M.Tech (2-year) in Industrial Engineering and Management, (v) Master of Science (MS) and (vi) Doctor of Philosophy (PhD) programmes. In addition, ISE coordinates the Dual Degree (5-year) programme on B.Tech in Engineering Product Design and Manufacturing and M.Tech in Design and Quality Engineering, with mechanical and industrial electronics verticals. At present, the department has 280 UG (BTech + Dual Degree), 38 MTech, 4 MS and 40 PhD students. The department is well known across the world for its excellent teaching and research in the fields of Data Analytics, Logistics and Supply Chain Management, Quality Engineering and Process Transformations, Information Systems and

E-Business, System Thinking and Policy Planning, Human Factors Engineering and Ergonomics, Safety Analytics and Virtual Reality, and Healthcare Systems. The department has world class laboratories in the above areas of research and teaching. The students are recruited by industries in Analytics Firms, IT/ Software services, Manufacturing/ FMCG Consultancies and Financial firms. Some of the companies that have recruited the students during last five years include: Finance/Insurance- Deutsche bank, Capital One, American Express, Goldman Sachs, Citi Bank, Capital Dynamics, Credit Suisse, HSBC etc; IT/Software services/Consultancy/Analytics- HT media analytics, Essex lake group, JDA, IBM, Oracle, ZS Associates, PWC, Affine Analytics, Atria, Wipro, Impetus, Cognizant, Egain, TCS, HCL, Infosys, Opera solutions, Deloitte, Ernst and Young, Capgemini, Genpact, Byte Consulting, Sapient, Market RX, Fair Isaac etc; Manufacturing/FMCG/ Ecommerce- Schlumberger, ITC, Bosch, Tata Motors, Tata Steel, Coal India, Maruti and Suzuki, TVS, Hero Motocorp, Danieli, Hindalco, Ispat, Flipkart etc.

## The Makers



**Prof. Rajendra Mishra**  
(1919-1979)

**Professor Rajendra Mishra** pioneered the education of Industrial Engineering in India in the mid-50s by teaching Industrial Engineering & Operations Research. He leveraged his experience in industry and constructed an educational curriculum in Production Engineering which covered process engineering, design of jigs and fixtures, tools and gauges, applied plasticity and metrology. Under his leadership the Department of Management Studies was established in 1954 in IIT Kharagpur. He started offering Executive Development Programmes for industry executives with such luminaries as Sir Jahangir Ghandhy, Former President Shri V. V. Giri, Former Minister of Higher Education Dr. Triguna Sen, and Sir Dr. Ramaswamy Mudaliar as members of the faculty. He has been also responsible for the creation of Industrial Management Centre, the first of its kind in IIT system, in 1973.



**Prof. K C SAHU**

**Professor K C Sahu**, the founder head of the Industrial Management Centre, made significant impact in making Industrial Management Centre as the most preferred educational destination in the Subcontinent. Under his able leadership, the research activities spurred up and many of his scholars have occupied prominent positions in industry and academia. The publications made by the Industrial Management Centre under the guidance of Professor K C Sahu in reputed scholarly peer-reviewed journals are worth mentioning. Professor K C Sahu transformed the activities of the Industrial Management Centre and brought excellence in all facets of learning, education, training, research, consulting, and institute-industry collaboration.



## VISION

Department of Industrial and Systems Engineering embodies to act as the hub for knowledge creation, repository, standardization, and dissemination covering the broad domain of Industrial Engineering and Management Sciences and to nurture the students by way of teaching, research and industrial partnership.

## MISSION

- Achieve global excellence and create local impact in research and teaching.
- Design and develop contemporary courses in line with the new developments in academics internationally as well as tailor-made for the companies to meet their emerging requirements.
- Enhance the analytical skill and problem solving ability of the students through innovative design and conduct of teaching, laboratory experiments, case studies, seminars and colloquium.
- Pursue research in the emerging fields of industrial engineering and management sciences through enhancing core competence internally as well as through collaboration with internationally renowned academic institutions worldwide.
- Promote innovation of higher order that directly impacts the need of industries.

## OBJECTIVES

- To promote advanced Teaching, Learning & Resource Growth (student strength, faculty-student ratio with emphasis on permanent faculty), Research and Professional Practices (publications, patents, projects and executive development programs, Graduation Outcomes (placement, higher studies, and entrepreneurship) and Outreach and Connectivity (percent students from other states/countries, percentage of women, economically and socially challenged students and facilities for physically challenged students).
- To conduct guest lectures, short-term courses, workshops and conferences in the recent areas of industrial and systems engineering to enhance the knowledge and skills of students and faculties.
- To design the course curriculum consistent with new advancements in the industrial engineering to be at par with the academics internationally.
- To build excellent laboratory facilities for researchers to build skills related to data analysis, new product development, operations research tools and techniques, etc and to implement artificial intelligence techniques in the areas of safety and systems modelling.
- To encourage interaction of students with industries through sponsored projects, consultancy services, industry visit, vocational training and internships to solve real-life problems and provide solutions to the industry problems.
- To bring coordinated accents between academia and industries, particularly in the area of Industrial and Systems Engineering.
- To encourage collaboration with internationally renowned academic institutions to enhance the quality of teaching and research.





# ACADEMIC PROGRAMS

## Overview

Industrial and Systems Engineering (ISE) is concerned with the design, installation, and improvement of integrated systems of people, material, information, equipment, and energy by synchronizing specialized knowledge and skills in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design to specify, predict and evaluate the results for such systems. Industrial Engineering is providing analytical skills and educational training to analyze, solve and optimize the complex real world problems encountered in different sectors of our economy. Manufacturing, Logistics, financial and insurance, health care and many other service sectors employ industrial engineers to address their problems and gain their efficiency, productivity, and market share. All modern tools and techniques such as optimization, simulation, stochastic modelling, system dynamic, statistical modelling, and computational intelligence are considered in minute details to solve real world problems. Linear and non-linear interactions observed during development of decision support model through analytical tools, are interlinked with recent information and communication tools (ICT) to simplify the implementation of decision making process for the benefit of industry in particular and society in general.

## List of Programs

Listed below are the various academic programs offered by the Department of Industrial and Systems Engineering.

- B.Tech in Industrial Engineering (IE) (Duration: 4 years)
- B.Tech in Engineering Product Design and Manufacturing and M.Tech in Design and Quality Engineering (Duration 5 years)
- Dual-Degree: B.Tech in Industrial Engineering and Management and M.Tech in Industrial Engineering & Management) (Duration 5 years)
- Dual Degree: B.Tech in Manufacturing Science and Engineering and M.Tech in Industrial Engineering and Management) (Duration 5 years)
- M.Tech in Industrial Engineering & Management (Duration: 2 years)
- Master of Science (MS) (By Research)
- Doctor of Philosophy (PhD) (By Research)

# PROGRAM FOCUS

## 5-year B.Tech in Engineering Product Design and Manufacturing and M.Tech in Design and Quality Engineering

This is a unique program conceived at IIT Kharagpur to inculcate in students an enhanced awareness of Engineering Design, Manufacturing and Quality issues related either to Mechanical Engineering Products such as Automotive Systems or to Electronic Products such as Real-time Embedded Systems. The academic contents of the program are accordingly designed to expose the students to major engineering aspects related to products including Product Modelling & Development, Design for Quality, Manufacturability and Assembly.

Students are taught by leading academicians in India with significant experience in industries. The curriculum was developed in close interaction with academia and industry. This course is offered in two verticals – Mechanical Engineering & Industrial Electronics.

### Curriculum

INDUSTRIAL & SYSTEMS	Operations Research	Quality Design and Control	Design for Manufacturability
	Quality Engineering	Design for Assembly and Automation	Product Development
	Production Planning & Control	Optimization and Heuristic Methods	Supply Chain Management
MECHANICAL	Automotive Engineering	Computer Integrated Design and Manufacturing	Machines Tools and Machining
	Design of Machine Elements	Heat Transfer	Casting, Forming and Welding
	Kinematics of Machines	Geometric Modelling for Design and Manufacture	Thermo-Fluid science
INDUSTRIAL ELECTRONICS	Industrial Automation & Control	Digital Signal Processing	Embedded Systems
	Electrical Machines Control System Engineering	Digital Electronic Circuits	Power Electronics
	Signals and Networks	Analog Electronic Circuits	Measurements and Electronic Instruments

### Electives are also offered by

- Computer Science & Engineering (Data Structures and Algorithms, Data Analytics, Machine Learning)
- Vinod Gupta School of Management (Introduction to Finance, Financial Analytics)
- Rajendra Mishra School of Engineering Entrepreneurship (Foundations of Entrepreneurship, Financing New Ventures)
- Subhir Chowdhury School of Quality and Reliability (Introduction to Reliability Engineering, Software Reliability)

### Special Features of the Programme

- Six-Month dedicated internship in Industry in the 8th semester
- Two Month Summer Internship at the end of 4th and 6th Semester
- Interdisciplinary program offered by a host of departments
- Two verticals – Mechanical engineering and Industrial electronics

# FACULTY MEMBERS

Faculty	Research Areas
 <p><b>Jenamani M</b> <i>Associate Professor</i></p>	<ul style="list-style-type: none"> <li>• E-business</li> <li>• Web data analytics and supply chain optimization in the context ICT applications</li> <li>• Recommended systems</li> </ul>
 <p><b>Jha J K</b> <i>Assistant Professor</i></p>	<ul style="list-style-type: none"> <li>• Supply Chain Management and Logistics</li> <li>• Operations Research</li> <li>• Inventory Control</li> <li>• Facility Location</li> </ul>
 <p><b>Kumar A</b> <i>Assistant Professor</i></p>	<ul style="list-style-type: none"> <li>• Business Analytics</li> <li>• Closed-loop Supply Chains</li> <li>• Product Returns and Remanufacturing</li> <li>• Pricing and Revenue Management</li> <li>• Autonomous Diagnostics &amp; Prognostics</li> <li>• Condition-Based Maintenance</li> </ul>
 <p><b>Kumar S K</b> <i>Assistant Professor</i></p>	<ul style="list-style-type: none"> <li>• Supply Chain Management</li> <li>• Port Logistics</li> <li>• Knowledge Management</li> <li>• Game Theory and Optimization</li> </ul>
 <p><b>Mahanty B</b> <i>Professor</i></p>	<ul style="list-style-type: none"> <li>• Operations Research</li> <li>• Operations Management</li> <li>• Project Management</li> <li>• System Dynamics</li> <li>• Information Systems</li> </ul>
 <p><b>Maiti J</b> <i>Professor Head, I&amp;SE</i></p>	<ul style="list-style-type: none"> <li>• Data Science</li> <li>• Safety Analytics</li> <li>• Quality Analytics</li> <li>• Occupational Health and Ergonomics</li> <li>• Virtual Reality</li> </ul>
 <p><b>Mukherjee J</b> <i>Visiting Professor</i></p>	<ul style="list-style-type: none"> <li>• Product development and Research for Automobiles</li> <li>• Design and Development and Manufacturing in Machine Tools</li> <li>• Automotive Testing and Simulation</li> <li>• Reliability Testing and Research</li> <li>• Preventive Maintenance Program for Machine Tools</li> </ul>
 <p><b>Narasimhan P L</b> <i>TVS Chair Professor</i></p>	<ul style="list-style-type: none"> <li>• Process Excellence</li> <li>• Work Systems Design</li> <li>• Product Development</li> </ul>
 <p><b>Naikan V N A</b> <i>Professor</i></p>	<ul style="list-style-type: none"> <li>• Condition Monitoring</li> <li>• Product Design and Development</li> <li>• Quality and Reliability Engineering</li> <li>• Maintenance Engineering &amp; Management</li> <li>• Industrial Engineering</li> <li>• System Simulation</li> <li>• Operations Research</li> </ul>



Faculty		Research Areas
	<b>Ray P K</b> <i>Professor</i>	<ul style="list-style-type: none"> <li>Ergonomics/Human Factors Engineering</li> <li>Healthcare System Optimization</li> <li>Process Optimization</li> <li>JIT-based Process Modeling</li> <li>Productivity/Performance Measurement in Service/Manufacturing</li> <li>Quality Engineering,</li> <li>TQM, New Product Development</li> <li>Knowledge Management</li> <li>Materials/Inventory Management</li> </ul>
	<b>Sarmah S P</b> <i>Professor</i>	<ul style="list-style-type: none"> <li>Logistics and Supply Chain Management</li> <li>Inventory Management</li> <li>Reverse Logistics</li> <li>Supply Chain Coordination and Risk Management</li> <li>Logistics Issues of Waste Management</li> </ul>
	<b>Thakkar J J</b> <i>Associate Professor</i>	<ul style="list-style-type: none"> <li>Lean &amp; Sustainable manufacturing</li> <li>Supply Chain Management</li> <li>Quality Management</li> <li>Small and Medium Enterprises and Performance Measurement</li> </ul>
	<b>Tiwari M K</b> <i>Professor</i>	<ul style="list-style-type: none"> <li>Modeling and Analysis of Manufacturing Systems</li> <li>Supply Chain Network</li> <li>Operations Management</li> <li>Optimization and Heuristics</li> </ul>
<b>Adjunct Faculty</b>		
	<b>Krishna O B</b> <i>Adjunct Faculty</i>	<ul style="list-style-type: none"> <li>Occupational Safety and Health</li> <li>Ergonomics/Human Factors Engineering</li> </ul>
	<b>Shree Ranjan</b> <i>Adjunct Faculty</i>	<ul style="list-style-type: none"> <li>Inventory Management</li> <li>Supply Chain Management</li> <li>ERP</li> <li>Manufacturing Planning</li> <li>Operations Management</li> <li>Big Data Analytics</li> </ul>
<b>Newly Joined Faculty</b>		
	<b>Sen G</b> <i>Tenure Track</i>	<ul style="list-style-type: none"> <li>Integer Programming</li> <li>Large Scale Optimization Techniques</li> <li>Facility Location</li> <li>Transportation and Network Design</li> <li>Nature Inspired Algorithms (Metaheuristics)</li> <li>Hybrid Solution Approaches</li> </ul>

Technical Staff	Administrative Staff
Bhunia S B	Marik D K
Das A	Rama P
Pandey K N	

# FACULTY FOCUS

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**Prof Pradip Kumar Ray**

**Prof Pradip Kumar Ray** received his PhD (in 1991) and M. Tech (in 1981) degrees from IIT, Kharagpur, and B.E. in Mechanical Engineering (in 1979) degree from IEST, Shibpur, India. Prof Ray has more than 36 years of diversified experience - 8 years as Senior Industrial Engineer/Manager at General Electric Company of India and 28 years of teaching and research experience at IIT Kharagpur. He has served as Associate Professor at Eastern Mediterranean University, Cyprus (2 years), as Visiting Faculty at University of South Pacific, Fiji Islands and has been trained in Japan on Production Management/JIT-based Manufacturing. He has published one text book titled 'Product and Process Design for Quality Economy and Reliability', 13 book chapters, six lecture packages, and around 163 papers in international and national journals of repute and conferences. His current areas of interest and research include productivity modeling, quality engineering, healthcare management, ergonomics, safety engineering, asset management, and management of production and service operations. He has supervised 17 PhD scholars in his research areas till date. He has coordinated more than 45 outreach training programmes for industries/educational institutions. He acted as an investigator in two-year duration UKIERI-sponsored project in collaboration with Aston Business School, Birmingham, UK. Currently, he is acting as Chief Expert guiding APO-sponsored project on 'Research on Institutions Offering Productivity Courses' for six Asian countries. Prof. Ray is a certified Lead Assessor for ISO-9001 registration, and actively involved in a number of industrial consulting and research projects (26 such projects till date) in his interest areas. He is a member of several professional bodies, such as INFORMS and IIMM, and a Fellow of World Academy of Productivity Sciences and a Fellow of Institution of Engineers (India).



**Prof Biswajit Mahanty**

**Prof Biswajit Mahanty** has obtained his B.Tech (Hons) degree in Mechanical Engineering, and his M.Tech and Ph.D. degrees in Industrial Engineering and Management—all from IIT Kharagpur. He has had a rich and varied professional career with over six years of industrial experience and 24 years of teaching, research, and industrial consulting work experience. His areas of interest are operations research, operations management, project management, maintenance and monitoring, system dynamics and simulation, information systems and supply chain management. To date, he has guided 12 doctoral and more than 100 undergraduate and post-graduate level dissertations. Presently 10 research students are carrying out their doctoral level research work under his guidance in areas ranging from supply chain management, e-commerce, transportation science, technology management, software project management, and system dynamics. He has also carried out about 20 industrial consulting projects and 7 sponsored research projects. He has, to his credit, a large number of publications in peer-reviewed international journals of repute. He is also an author of the book "Responsive Supply Chain" published by the prestigious CRC press. He has developed a 29-lecture NPTEL course on Management Information System. He has also taught in the School of Management at AIT, Bangkok as a visiting faculty member. He is inducted into the editorial board of the International Journal of System Dynamics and Policy Planning in 2003. He has received several academic and professional awards. He has received Alumni Gold Medal from IIT Kharagpur at the Master of Technology level in January, 1989. He has achieved recognition for Policy Framework Writing from the Asian Institute of Technology, Bangkok, Thailand in April, 1999. He is presently the coordinator of the Quality Engineering, Design, and Manufacturing programme at IIT Kharagpur.

# LABORATORY FACILITIES



Operations Research & Data Science Laboratory



Work System Design and Ergonomics Laboratory



Quality Design and Control Laboratory



E-Business Laboratory



Logistics System Laboratory



Product Development Laboratory



Design for Manufacturability and Assembly Laboratory



Safety Analytics and Virtual Reality Laboratory



# LABORATORY FOCUS

## Safety Analytics and Virtual Reality Laboratory

The Safety Analytics and Virtual Reality (SAVR) laboratory, a research laboratory and the first of its kind in India, was established in March 2016. The research group currently works in four major inter-dependent domains of occupational Safety & Health namely Safety Analytics, Health Analytics, Engineering Ergonomics, and Virtual Reality applications. In addition, the facility is coupled with two other laboratories namely work system design and product development.

In order to carry out research activities as per the world standard, the SAVR laboratory is equipped with the following software and hardware.

### Software

R, SAS, SPSS, MINITAB, MATLAB, Mathematica, CPLEX, QUEST, Solidworks, 3DSSPP, Autodesk, Unreal Engine, Unity, Blender, Google Sketch-up, and Vizard.

### Hardware

Network Server, High End Workstations, 3D DLP Projector, Head Mounted Display (HMD), Intersense Tracking System, Head Trackers, Hand Trackers, 5DT Data Gloves, 3D Glasses, 3D Space Mouse, Surround Sound System, Robotic Total Station (RTS), and 3D Laser Scanner.



(a)



(b)



(c)



(d)

Figure: (a) Safety Analytics and Virtual Reality Lab. Virtual Reality application of (b) Head tracker, (c) Hand tracker, and (d) Crane simulator. Head Mounted Display (HMD) is also used.

In the SAVR laboratory, the cutting age research on safety and health analytics, virtual reality, and engineering ergonomics are being carried out. Some of the research issues involved are: (i) Creation of safety analytics database, (ii) Safety data visualization and exploration, (iii) Development of prediction models for predicting accidents/injuries illnesses in workplaces, (iv) Safety performance evaluation and monitoring, (v) Health assessment of employees at workplace, (vi) Identification of the health risk factors responsible for deterioration of occupational health of employees, (vii) Optimization model for health risk scoring, (viii) Work design and methods improvement, (ix) Biomechanical modeling, (x) Axiomatic design of processes and practices, (xi) Work compatibility modeling, (xii) Job stress management, (xiii) Cognitive ergonomics, (xiv) Human-machine-material interactions, (xv) Accident scenario development, (xvi) Behavioral control, (xvi) Design for assembly, (xvii) Virtual prototyping, and (xviii) Design and verification of safety training programmes

The philosophies, methodologies, mathematics, techniques and algorithms needed for our research are drawn from quality management concepts and practices, statistics (both frequentist and Bayesian approaches), data mining, machine learning, and operations research. We continually adopt advanced technologies such as Virtual Reality (VR), Information & Communication Technology (ICT) including internet of things (IoT) and analytics infrastructure for data capture and storing.

Our primary focus is on creating database (offline, online and experiments based), learning from data, predict the future and take data driven decision making. The current major research project of the SAVR laboratory is "Safety analytics: save people at work from accidents and injuries"; Sponsored by MHRD, Ministry of Steel, and Tata Steel, Jamshedpur, under Uchchatar Aviskar Yojana (UAY), Govt. of India.



# PUBLICATIONS IN THE YEAR 2016-17

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# SPONSORED RESEARCH AND CONSULTANCY PROJECTS

## Key Sponsored Projects

- **Mega Project:** Sustainable Food Security through Technological Intervention for Production, Processing & Logistics
- **UAY Project:** Safety Analytics: Save People at Work from Accident and Injuries
- **IMPRINT Project:** Manufacture of Shells for Field Guns with Improved Design and Performance
- **APO Project:** Research on Institutions Offering Productivity Courses for Six Asian Countries
- **E-business Center of Excellence**
- Data Driven Sustainable and Resilient Safety Management System for Tata Steel, Jamshedpur
- EU - India Research and Innovation Partnership for Efficient and Sustainable Freight Transportation (REINVEST)
- Intelligent Decision Support for Online Auctions
- National Initiative for Design Innovation
- Segmentation and Design of Bus Service in Urban India: Kolkata as a Pilot Study
- Urban Governance: Sustainable Policies and Implementations
- Virtual Labs Phase II & Gaming and Simulation Lab

## Key Consultancy Projects

- Computerization of Corporate Contracts Management System for Neyveli Lignite
- Data Analytics based Axiomatic Design of Interventions for Job Stress Management
- Decision Support Model to Optimize Bulk Material Handling Operations
- Development of Diesel Price Escalation Formulae for Hemm Contract
- Dynamic Scheduling and Hartering of Oil Tankers and their Solution by Simulation based Optimization
- Hazard Identification, Risk Assessment and Risk Control for Ammunition Storage and Preparation in PXE Chandipur
- Process Audit of Design and Manufacturing of 130-mm-diameter Shell at Ambajhari Plant of Ordnance Factory
- Yield Improvement of Ball Powder Manufacturing Process



# RESEARCH OPPORTUNITIES IN INDUSTRIAL AND SYSTEMS ENGINEERING

The Department of Industrial and Systems Engineering has several broad research areas for students to choose from. Every research area is unique and has its own research themes and course work. The current thrust/research areas of this department are listed below.

- Data Analytics
- E-Business
- Ergonomics & Human Factors Engineering
- Healthcare Systems Management
- Logistics & Supply Chain Management
- Management Information System
- Manufacturing/Production Planning & Control
- Operations Management
- Operations Research
- Performance/Productivity Analysis
- Process Excellence & Lean Six Sigma
- Product Development
- Project Management
- Quality Design, Control and Improvement
- Safety and Health Analytics
- Service Science
- Systems Dynamics & Simulation
- Work Systems Design & Human Computer Interaction

## JOB OPPORTUNITIES

### Faculty Openings

#### Posts: Professor, Associate Professor and Assistant Professor

Qualifications for the Post: PhD with first class or equivalent at the preceding degree in the appropriate branch with a very good academic record throughout.

#### Experience for the Posts

**Professor:** A minimum of 10 years' teaching / research / industrial experience of which at least 4 years should be at the level of Associate Professor in IITs, IISc Bangalore, IIMs, NITIE Mumbai and IISERs or at an equivalent level in any such other Indian or foreign Institution(s) of comparable standards.

**Associate Professor:** A minimum of 6 years teaching / research / industrial experience, of which at least 3 years should be at the level of Assistant Professor or equivalent positions in IITs, IISc Bangalore, IIMs, NITIE Mumbai and IISERs or in any such other Indian or foreign Institution(s) of comparable standards.

**Assistant Professor:** At least 3 years teaching / research / industrial experience, excluding however, the experience gained while pursuing Ph.D.

Candidates with less than 3 years experience may be put on Tenure Track for the regular post of Assistant Professor.

Candidates possessing requisite qualification & experience are required to apply online (<https://erp.iitkgp.ernet.in/FacultyCareer/homeFacultyCareer.jsp>) and send a signed hardcopy print out of online application to "Assistant Registrar, E-III, Indian Institute of Technology Kharagpur-721302, WB, India". Unless the hardcopy is received, the application will not be considered.

For any other details please contact Assistant Registrar, E-III, Phone: 03222- 282135/282137, Fax: 03222-282020, Email: [asregre@adm.iitkgp.ernet.in](mailto:asregre@adm.iitkgp.ernet.in)/ [recsec@adm.iitkgp.ernet.in](mailto:recsec@adm.iitkgp.ernet.in)

### Temporary Project Position

The Department, time to time, offers time bound temporary positions for project work, funded by Government agencies, industries, and other profit and non-profit organizations. Interested candidates may look at the institute website (under SRIC) and departmental website for sponsored research and consultancy projects. Depending on the interest, the candidates may write to the respective principal investigators/ consultants of the projects for such opportunities. However, the candidates are selected through a selection process as per the norms of the institute.

# RECENT & PAST EVENTS

## International Conference on E-Business and Supply Chain Competitiveness, EBSCC-2016 (February 12 – 14, 2016)

The conference is jointly organized by E-Business Centre of Excellence, Department of Industrial and Systems Engineering and Production and Operations Management Society (POMS). The objective of the conference is to provide a platform for academics, researchers, practitioners and entrepreneurs who are interested in cutting edge technology of E-Business and its applications to exchange knowledge, experiences and share innovative ideas to improve business processes, includes managing internal processes such as human resources, financial and administration systems, as well as external processes such as sales and marketing, supply of goods and services, and customer relationships. The various conference tracks includes ICT for managing value chain and supply chain operations, supply chain integration, inter-operability and enterprise computing, service computing, mobile computing, cloud and internet of things in supply chain, supply chain collaboration and coordination, supply chain traceability and visualization, supply chain data analytics, supply chain issues in SMEs and role of ICT, ICT for supply chain sustainability, innovation E-business models, applications, implementations and case.



## Global Initiative for Academic Networks (GIAN-2016) on Production and Operations Management (May 23 – June 03, 2016)



In today's competitive and global environment, production and operations management is a powerful tool for gaining competitive advantage and achieving business excellence. The accelerating pace of technological advances, shorter product life cycles, ever-increasing demands from customers and globalization of markets have posed unique challenges to the practicing managers, researchers and students to address these needs. These trends call for acquiring new and additional skills and knowledge in the field of production and operations management and hence the purpose of introducing such a course Academicians with proven knowledge, industrial experience, and demonstrable ability in teaching, consultancy, research, and training in the field of production and operations management (POM) have conduct sessions and case-based real-life problems solving exercises

in the training course. Lectures are delivered by internationally-renowned faculty, Prof Jyoti Mukherjee, Professor at the Department of Aerospace and Mechanical Engineering, University of Arizona at Tucson, USA and the course coordinators Prof Pradip Kumar Ray and Prof Kunal Kanti Ghosh. The objectives of the programme is to expose participants to the fundamentals of production and operations management, to build in the participants' knowledge and confidence in the varieties of the state-of-the-art production and operations management tools, techniques and methodologies, to provide exposure to practical problems and their solutions through case studies and live projects in the field of production and operations management and to reduce the gap between demand and supply of trained personnel in the field of production and operations management.

### Short Term Course on Applied Machine Learning (September 12-16, 2016)

To develop a good understanding of application of various machine learning and statistical methods to solve complex industrial and systems engineering problems. Focus will be on the recent progress made by the scientific and technical community in the field of analytics ranging from decision pertaining to scheduling of maintenance activity for an equipment at a manufacturing plant to real time vehicle routing problem for a logistics company to demand forecasting and price optimization for an online retailer. The course will draw from various case studies and thus emphasis will be on application. The goal of this five-day short-term course on Applied Machine Learning is to provide a broad introduction to the key ideas in machine learning. The topics of the course includes Learning Theories, Linear/Logistics Regression, Artificial Neural Network, Kernel methods and Radial Basis Functions, Support Vector Machines, K-means clustering, Factor Analysis, Principle Component Analysis, Hidden Markov Models, Hands on exercise using R/MATLAB supplemented by research articles and case studies.



### International Conference on Management of Ergonomic Design, Industrial Safety and Healthcare Systems (MESH- 2016) (December 20 - 23, 2016)

Over the years, organizational systems engaged in production of goods and services in any sector of a national economy have undergone a significant change in their characteristics. Such changes are all occurring rapidly from a pure technology era to an era of appropriate technology. In view of critical importance of such interaction, all types of organizations are required to be designed, assessed and controlled from several perspectives, such as man-machine interaction, occupational hazards and risks, environmental impact and sustainability. In order to promote and provide quality of work-life, in general, an effective total service delivery to critical sections of population is essential. In this context, three specific issues, viz. Ergonomic Design, Industrial Safety and Healthcare Systems have assumed importance world-wide. Organizations may have to overcome different kinds of problems related to technology adoption, methods development, and resource deployment as management principles and theories of these issues with their operational and research areas are constantly evolving over time. The objective of the conference is to provide a platform for academicians, researchers and practitioners who are interested in cutting edge technology of ergonomic design, industrial safety management, healthcare system management and its current applications to exchange knowledge, experiences and share innovative ideas.



### Global Initiative for Academic Networks (GIAN-2016) on Quality Engineering in Products and Processes (December 19-30, 2016)



After globalization of markets and liberalization of Indian economy, the Indian industries have been experiencing stiff competition. In such a competitive environment, industries need to continually improve quality of their products, services and processes. Establishment of total quality system with support and commitment of top management makes significant difference to its performance and pursuit of excellence. The aim of quality engineering is to achieve good and affordable design and management control assurance of quality performance of an organization's products and processes. Academics with proven knowledge, industrial experience, and demonstrable ability in teaching, consultancy, research, and training in the field of quality engineering will handle sessions and case-based real-life problems solving exercises in the training programme. Lectures are delivered by internationally-

renowned faculty, Professor Amitava Mitra, Department of Aviation & Supply Chain Management, Harbert College of Business, Auburn University, USA and the course coordinators Prof Pradip Kumar Ray and Prof B Mahanty.



### Workshop on Decision Support Models in E-Business and Supply Chain Management (February 11-12, 2017)



In the today's era of increasingly globalized economy, context of supply chain has been redefined due to the development of ICT and e-business, which are growing leaps and bounds over the past few years. With a great potential to overcome the stumbling blocks for supply chain integration, information availability, and challenge of managing more complex interfaces, e-Business is undoubtedly the key focus for competitiveness of the firms. Consequently, industrial and academic research facilities need to learn the application areas under the gamut of e-business, the enablers and drivers for the successful application of e-business in the supply chain integration, the state of art research in this field, and future of e-business and supply chain.

### Short-Term Course on Lean Six Sigma (February 2-18, 2017)

The Six Sigma methodology is a systematic application that is focused on achieving significant financial results and increasing customer satisfaction. When properly deployed on carefully selected business projects, this methodology can lead to a significant reduction and in many cases, elimination of defects, process waste and out-of-control process, which translate into dramatic business gains. This Black Belt course provides a comprehensive and disciplined model for improvement. Every participant will learn how to meet his or her company's business objectives through the recognized DMAIC process. Attendees will learn how to direct Lean Six Sigma projects and obtain the maximum improvements from the techniques and skills. This course is conducted in one comprehensive continuous course on campus.



### Short-Term Course on Inventory Management in Supply Chain (March 3-5, 2017)



The term inventory refers to the goods or materials to be used by a firm for the purpose of production and sale. It also includes the items, which are used as supportive materials to facilitate production. From a firm's perspective, inventory management is extremely important as it enables to address various important issues like fluctuation in demand over time period and revenue loss due to lost sales. Maintaining optimum inventory to increase profitability and address issues like stock out problems, interruption in production and selling operation due to which the firm may lose the customers as they shift to the competitors.

### Short-Term Course on New Product Development using Systems Engineering Principles (March 16-18, 2017)

After globalization of markets and liberalization of Indian economy, the Indian industries have been experiencing stiff competition from companies outside India. In such a competitive environment, industries need to continually design and introduce new innovative products, services and processes on a regular basis. Systemic platform based Product Design and Development methodologies with support and commitment of top management may make significant difference to an organization's financial performance in order to become industry leaders in a desired target market segment.



### Short-Term Course on Data Analytics with SAS (March 22 -24, 2017)



Data Analytics is all about sophisticated quantitative and qualitative analysis and predictive as well as prescriptive modeling used towards building competitive strategies based on data-driven insights that in turn generate impressive business results. Exemplars of analytics are using new tools to identify their most profitable customers and offer them the right price, accelerate product innovation, optimize system performance, and the true drivers of financial performance. Data analytics aroused on a strong foundation by bringing together a diverse body of knowledge from applied statistics, applied mathematics, computer science, optimization, consumer behavior, risk management, operations research and decision theory. As the use of analytics growing rapidly, need of skilled analysts, who understand the data, shift through the information and help solving the business problems, is inevitable in future. With the growing support of analytics software, practitioners can solve complex problems related to business transactions, manufacturing, healthcare, finance, insurance, etc. SAS covers the entire gamut of data analytics and provides platforms for data mining, statistical analysis, forecasting, text analytics and optimization and simulation.

### Doctoral Colloquium and Research Scholars' Day-VISHLESHAN 2017 (March 24-25, 2017)



The colloquium aims at providing a forum for researchers and young scientists, from academia and industry on various themes in Industrial and Systems Engineering. It provides the participants an opportunity to discuss their dissertation research with other reputed academicians and doctoral students to develop an insight on the ongoing trends in Industrial Engineering. This programme addresses on four specific themes, viz. Occupational Health and Safety, Data Analytics, Supply Chain Management (SCM) and E-Business, and Engineering Product Design and Quality that have assumed importance worldwide.



# SCHOLARS' AVENUE

## Presentations by Research Scholars in International Conferences

- **Suman Banerjee**, Mamata Jenamani, Dilip Kumar Pratihari, "Properties of Projected network of a Bipartite Graph", ICCSP (6th International Conference), April 6-8, 2017, Chennai, India.
- **Y Sinjana**, R S Srivastava, Monalisa Sarma, M K Tiwari, "Application of Random Forests Algorithm in Apparel Industry for Demand Forecasting", ICBAI (4th International Conference), December 19-21 2016, Bangalore, India.
- **Sobhan Sarkar**, Saicharan Pardhu, Rutwick Ayi, J Maiti, "Text Mining Based Prediction Model for Incident Occurrences in Steel Plant", Informs Annual Meeting 2016, November 13-16, 2016, Nashville, Tennessee, USA.
- **Ajinkya Tanksale**, J K Jha, "A fix-and-optimize heuristic for capacitated foodgrain inventory transportation problem in the Indian PDS", Informs Annual Meeting 2016, November 13-16, 2016, Nashville, Tennessee, USA.
- **Arindam Ghosh**, J.K. Jha, S.P. Sarmah, "Optimal production and lot-sizing under carbon tax policy considering stochastic demand", Conference on Computers & Industrial Engineering (CIE 46), October 29-31, 2016, Tianjin, China.
- **Esha Saha**, Dharmendra Sharma, Pradip Kumar Ray, "Biomechanical Evaluation of Patient Handling Jobs in Healthcare: A Case Study in India" AHFE-2016, July 27 - 31, 2016, Orlando, Florida, USA.
- **Rofin T M**, Biswajit Mahanty, "Impact of Customer Preference of Online Channel on the Firm Profit under Dual channel Supply Chain Competition", POMS 27th Annual Conference, May 6-9, 2016, Orlando, Florida, USA.
- **Thomas A Vempiliyath**, Biswajit Mahanty, "Improving supply chain resiliency through dynamic simulation: A multi-objective approach", POMS 27th Annual Conference, May 6-9, 2016, Orlando, Florida, USA.
- **Arindam Debroy**, S P Sarmah, "Capacity Sharing among Truck Owners: A Collaborative Approach to overcome Overloading", POMS 27th Annual Conference, May 6-9, 2016, Orlando, Florida, USA.





## IISE IIT Kharagpur Student Chapter (#660)

IISE IIT Kharagpur student chapter supplements the Industrial and Systems Engineering Department's educational curriculum by providing its members with professional development and networking opportunities. Our endeavor is to benefit existing members by hosting meetings featuring industry speakers, networking events with recruiters from companies seeking to hire for full-time or internship opportunities, social events; and to attract and recruit new members; under the mentorship of the Head, Industrial and Systems Engineering Department, Indian Institute of Technology Kharagpur.

The mission of IISE IIT Kharagpur student chapter is to promote the profession of Industrial Engineering through organized effort in study, research, and discussion of the fields of Industrial Engineering and the dissemination of knowledge thereby gained. The student chapter promotes membership in IISE by acquainting the student body with the ideas, purposes and objectives of IISE. The objective of this student chapter is to provide members the opportunity to interact with recognized academic and industry personnel related to the field of Industrial and Systems Engineering to have an insight to the ongoing trends of industrial engineering, to involve present members of IISE by organizing academic workshop, industrial field visit and various activities for betterment of their technical and organizational skillset and to recruit new members by promoting the IISE IIT Kharagpur student chapter to the freshmen and sophomore level engineering students.



## Guest Lectures

	Name of the Guest	Affiliation	Lecture Topic
March 2017	Dr. Tridib Mukherjee	Area Manager, Conduent Labs India	Business Transformation through Research and Innovation in Conduent Labs India
Feb 2017	Dr K J Parekh	Director (Medical) of Safety Excellence Centre, Jamshedpur	Occupational Health - Challenges and Opportunities
Jan 2017	Prof. Shantanu Dutta	Professor, Telfer School of Management, University of Ottawa, Canada	Managing Institutional investors Demand for Information through Private Meetings
Dec 2016	Prof. Sunderesh Heragu	Head, School of IE&M, Regents Professor; Donald and Cathey Humphreys Chair), Oklahoma State University, USA	Contemporary Issues related to Industrial Engineering
Nov 2016	Prof. Rabindranath Bhattacharya	Formerly GM of TVS group and Adjunct Professor at Vinod Gupta School of Management, IIT Kharagpur	Supply Chain Management for 21st Century
	Dr. Siddhartha Sengupta	Principal Scientist, TCS, Mumbai	Opportunities from Efficient Asset Performance: Operational Components of Railways
August 2016	Mr Shivakumar Mathapathi	CTO, Dew Mobility, California, USA	Internet of Things - Industrial Environmental Monitoring and Smart Cityuse Cases
	Prof. R K Shyamasundar	Professor, TIFR	BigData: A Game Changer for Security and Privacy
May 2016	Dr. Jyotirmoy Dalal	Assistant Professor, Operations, Quantitative Methods and Information Systems, Indian Institute of Management Udaipur	Strategic Emergency Preparedness Network Design Integrating Supply and Demand Sides in a Multi-Objective Approach
Feb 2016	Prof. William G Ferrel	Associate Dean, Clemson University (USA)	Recent Trends in Industrial Engineering

# UPCOMING BEST CONFERENCES

## **CIE 47 – International conference on Computers and Industrial Engineering October 11-13, 2017**

University Nova of Lisbon, Portugal.  
Deadline for Submission of papers/  
abstract: April 20, 2017

Website: <http://www.cie47.com/>

## **2017 Informs annual meeting Houston October 22 - 25, 2017**

George R. Brown Convention Center &  
Hilton Americas Houston, Texas, USA

[http://meetings2.informs.org/wordpress/  
houston2017/](http://meetings2.informs.org/wordpress/houston2017/)

## **International Conference on Production Research (ICPR 2017) July 30 – August 3, 2017**

Poznan University of Technology (PUT),  
Poland, Submission deadline:  
March 7, 2017

[http://www.24icpr2017.put.poznan.  
pl/#important-dates](http://www.24icpr2017.put.poznan.pl/#important-dates)

## **International Conference on Applied Human Factors And Ergonomics (AHFE) July 17 - 21, 2017**

Los Angeles, California, USA  
Deadline: April 20, 2017

<http://www.ahfe2017.org/>

## **XXI World Congress on Safety & Health at Work 2017 September 3 - 6, 2017**

Sands Expo and Convention  
Center, Singapore

<https://www.safety2017singapore.com/>

## **The 35th International Conference of the System Dynamics Society July 16 – 20, 2017**

Cambridge, Massachusetts, USA  
Deadline: March 22, 2017

<https://conference.systemdynamics.org/>



# STUDENTS' CORNER

## Awards and Honors

- **Abhilasha Priyadarshini** presented a paper on "Striation free laser cutting of steel sheets" in National laser symposium.
- **Ankit Barde** presented a poster on "Conceptual framework of Inclusive Manufacturing" at National Institute of Advanced Studies (NIAS).
- **Anubhav Goyal** and Team won Gold medal in case study competition at 5th Inter IIT Tech Meet 2017 , IIT Kanpur.
- **Anubhav Goyal** awarded with GS Sanyal Cup for Best outgoing all-rounder with distinction in technology & Order of Merit in Technology at IIT Kharagpur.
- **Bhanu Pratap**, Bhupendra Bule and Team won Goldman Sachs Quantify 2016.
- **Chandan Karwat** bagged Silver medal in Stage play for IIT Kharagpur in 1st Inter-IIT Cultural Meet, 2016 held at IIT Bombay.
- **Chandan Karwat** felicitated as Special Mention in Dramatics at IIT Kharagpur.
- **Kunal Kulbhushan Jain** felicitated as Order of Merit in Literary at IIT Kharagpur.
- **Kunal Kulbhushan Jain** won 2nd National Law University British Parliamentary Debate.
- **Manish Datta Annam** elected as General Secretary Sports and Games 2017-18, Students Gymkhana, IIT Kharagpur.
- **Rahul Pentti** filed for a patent on geo-spatial data based lossless compression algorithm.
- **Sagar Kalbande** achieved the award for Honorable Mention in Volleyball, IIT Kharagpur.
- **Sagar Kalbande** won Silver Medal in Duet Dance in Inter IIT Cultural Meet 2016-17 held at IIT Bombay.
- **Shyam Simaria** felicitated as Honorable Mention in Dramatics at IIT Kharagpur.
- **Vishakha Sinha** ranked Third at All India Level Global Student Challenge 2015-2016, organized by Supply chain and Finance Community.



# TRAINING AND PLACEMENT

The education and training imparted to the students on analytical tools and techniques with business applications make us one of the sought-after disciplines during placement season with most of our students getting placed within first two weeks of opening. A broad range of companies employ our students that includes core manufacturing, financial services and insurance, consulting services, software services, e-commerce, supply chain and logistics. With increase in the requirement for data analytics and data science, our discipline is the destination for the companies across every discipline. With recent boost from Government of India many of our students are getting self-employed with their own start-up.

## Some of our Recruiters

- ABB Ltd.
- Bank of India
- Bosch India
- Capital One Financial Services (India)
- Cognizant Technology Solutions
- Flipkart Online Service Pvt. Ltd
- Hewlett Packard
- IBM India Pvt. Ltd
- ICICI Lombard Gic Ltd
- ITC Ltd.
- JCB India Ltd.
- JDA Software India Pvt. Ltd
- Oil and Natural Gas Corporation
- Opera Solutions
- Pipavav Defence and Offshore Engineering Company Ltd.
- Schlumberger Asia Services Ltd.
- SKF India Ltd.
- Tata Consultancy Services
- Tata Motors
- Tata Steel
- Thought Works Tech India Pvt. Ltd
- Verity Knowledge Solutions Pvt. Ltd
- Wipro Technologies
- Z. S. Associates India Pvt. Ltd





# INSTITUTE NEWS

- IIT Kharagpur crowned as India's best university for graduate employability, five others feature at QS Rankings.
- Prof. Ajoy K Ray, Department of E&ECE, awarded Padma Shri in the field of Science and Engineering.
- Prof. Partha Pratim Chakrabarti, Director, IIT Kharagpur is honoured with Techno Visionary Life Time Achievement Award.
- Prof. Partha Pratim Chakrabarti, Director, IIT Kharagpur received the prestigious ACCS - CDAC Foundation Award, 2016.
- Prof M K Tiwari, Department of Industrial and Systems Engineering, IIT Kharagpur received the Most Influential Researcher Award in the domain of Operations and Supply Chain Management in the Third Green Supply Chain International Conference, 2016 organized by School of Business and Economics, Loughborough University, London Campus.
- Professor Debdeep Mukhopadhyay, Department of Computer Science and Engineering has been awarded the prestigious Swarnajayanti Fellowship.



# BEYOND ACADEMICS

## Department Viswakarma Puja



Department of Industrial and Systems Engineering celebrated September 16, 2016 as Vishwakarma Puja to pay obeisance to Lord Vishwakarma. This ritual is performed in the department with special prayers, havan and distribution of sweets. The occasion was attended by all faculty members and students of the department

## Departmental Football Match at Tata Sports Complex

The occasion of Vishwakarma Puja on September 16, 2016 was followed by a Football Match at Tata Sports Complex. The faculty members of the department along with the students participated in the match.



## Departmental Picnic 2017 at Chilkigarh

Department of Industrial and Systems Engineering arranged picnic at Chilkigarh, Jhargram on January 28, 2017. The picnic included sightseeing, boating and visit to the Kanak Durga temple and the Deer Park. The faculty members, office staffs and the students of the department participated in the occasion.



# PATH THROUGH HISTORY

## Industrial Management Centre, 1973-1983



Sitting from the left: Prof P K J Mohapatra; Prof N P Rao; Prof K C Sahu; Prof P S Das.  
Standing from the left: Prof S S Sahay; Prof R N Banerjee; Prof S Sahu; Prof A Saha; Prof D Acharya

## Department of Industrial Engineering and Management (IEM), 1983-2013



Sitting from the left: Prof J J Thakkar, Prof J K Jha, Prof P K Ray, Prof R N Banerjee, Prof J Maiti, Prof B Mahanty, Prof M K Tiwari, Prof M Jenamani, Prof S Sahu, Prof S Srinivasan, Prof V N A Naikan, Prof S P Sarmah, Prof A Kumar.

Standing from left: Office Staff Members: Mr Gopal Mohanty, Mr S B Bhunia, Mr K N Pandey, Mr A Das, Mr R N Saha, Mr Datta, Mr S N Pati

## Department of Industrial and Systems Engineering (ISE), since 2013



Sitting from the left: Prof M Jenamani, Prof J J Thakkar, Prof B Mahanty, Prof P K Ray, Prof M K Tiwari, Prof J Maiti, Prof S P Sarmah, Prof J K Jha

Standing from Left: B.Tech Students of Batch 2012-2015

# TECHNOLOGY NEWS AROUND THE WORLD

## Egyptian Mummy's Face Recreated with 3D Printing



"An Egyptian mummy's head and face have been reconstructed with forensic science and 3D printing, offering scientists a tantalizing glimpse of the individual's life and death."

Source: August 30, 2016 Richa Malhotra, | Live Science>Tech

## TESLA's Driverless Car using AI

Driverless cars with self-start and self-stop that can follow various road conditions such as curving roads, changing lanes and pass-through interactions as well as being able to react to the randomness of the traffic flow and actions of other drivers are now a reality. This self-driven technology is built through modelling of high level data using artificial intelligence (AI) techniques, particularly deep learning architectures of multiple nonlinear transformations such as deep neural network (DNNs), conventional neural networks (CNNs) and deep belief networks (DBNs).

Source: Jan 17, 2016 John Markoff | The New York Times



## Blockchain: The Next Evolution of Supply Chains



"As described in Fortune, blockchain is a way to structure data and the foundation of cryptocurrencies like Bitcoin. This coding breakthrough- which consists of concatenated blocks of transactions- allows competitors to share a digital ledger across a network of computers without need for a central authority. No single party has the power to tamper with the records: the math keeps everyone honest."

Source: Jan 13, 2017 Peter Loop | Industry Week: Advancing the Business of Manufacturing.



# POINTS TO THINK ABOUT

## ISE from Efficiency Expert to Data Scientist

Innovative and young society is embarking more on doing something exceptional which may drive many transformative changes in the industry, services and society. The intertwined key challenges for Industrial and Systems Engineering (ISE) that have emerged in the recent years are: (i) the role of ISE to realize, plan, design, construct, monitor and maintain the critical systems such as health care, energy, environment, infrastructure, safety & security, food & agriculture, defence, critical manufacturing, transportation and logistics, and (ii) coping with the emergence of data sciences. While ISE, a known expert in handling the first challenge, the key question up front is, "Is ISE prepared for both the two intertwined challenges?" Can we train our students to become data scientist? Then, what modifications do we need in our course curriculum? Or, should we maintain the status quo?

Then, what is data science? Why so much of craze of it? For example, University of Michigan states that "Data science has become a fourth generation approach to scientific discovery, in addition to experimentation, modeling, and computation". To understand the origin of data science, as Donoho (2015) mentioned, we need to study the seminal work of John W Tuckey (1962) entitled "The future of data analysis". Tuckey's central claim differs from the traditional statistical inferences (from specific to general) to statistical modelling where data collection, analysis and interpretation with the help from mathematics, statistics and other approaches (e.g., engineering approaches) for more and more accurate explanation (create meaning from the data) and prediction can be made. The other pioneering works in this scientific discovery are John M Chambers (1993) who had emphasized on "Data preparation and presentation", Leo Breiman's (2001) two cultures (prediction vs inference) and William S Cleveland's (2001) data science as the superset of statistics and machine learning.

On the explanation of Cleveland's 6 foci of activity pertaining to data science, Donoho (2015) states that in most of

academic statistics departments, only 20% of Cleveland's contents are being taught (i.e., the theory part only). Cleveland's 6 foci encompass the following:

- Multidisciplinary investigation (25%)
- Models and methods of data (20%)
- Computing with data (15%)
- Pedagogy (15%)
- Tool evaluation (5%)
- Theory (20%)

Similarly, most of the computer science (CS) departments focus on computing with data and models and methods of data (e.g., development of algorithms and coding). The other three functional areas are often neglected. On the other hand, ISE gives a perfect blend of all the six areas. Since its inception, ISE (more precisely IE and ORMS) has been offering, both researchers and practitioners, a wonderful set of models and methods to solve potential real life problems "by drawing upon specialised knowledge and skills in the mathematical (including statistics and computing), physical, and social sciences, together with the principle and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems" (Womack and Jones, 1996).

So, what changes do we need to incorporate in our future curriculum? Should we make it data driven? We need our ISE education to be data oriented and it is also not new in the ISE domain. Our challenge to provide data oriented education is to dwell with big data. Today's data is all pervasive and covers across all human endeavours. We need our models to be verified, validated and up-graded to make it consistent with the data. We need to collaborate more with CS and statistics disciplines. To add to this endeavour, we also should keep in mind that in recent past, ISE students have shown great interest on data sciences and they are also recruited as data scientists in reputed data analytics companies. And this trend will continue.....!

### References

1. Donoho D. 50 years of Data Sciences. Based on a presentation at the Tukey Centennial Workshop, Princeton NJ, 1 – 41, Sept 18, 2015.
2. Tukey J W. The Future of Data Analysis. The Annals of Mathematical Statistics, 33(1), 1-67, 1962.
3. John M Chambers. Greater or Lesser Statistics: A Choice for Future Research. Statistics and Computing, 3(4):182-184, 1993.
4. William S Cleveland. Visualizing Data. Hobart Press, 1993.
5. Leo Breiman. Statistical Modeling: The Two Cultures. Statistical Science, 16(3), 199–231, 2001.
6. Womack J T and Jones D T. Lean Thinking: Banish Waste and Create Wealth in your Corporation, Simon and Schuster, New York, 1996.



# FUN CORNER



## Quiz and Puzzle

Three friends Pablo, Edvard, and Henri are talking to each other about the art collection of Leonardo. Pablo says: "Leonardo has at least four paintings of Rembrandt." Edvard says: "No, he has less than four paintings of Rembrandt." "According to me," says Henri, "Leonardo has at least one Rembrandt."

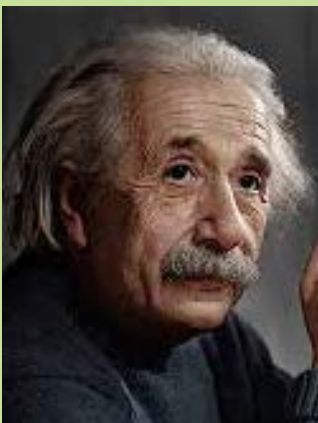
The Question: If you know that only one of the three friends is right, how many Rembrandts does Leonardo possess?

Source: [http://www.puzzle.dse.nl/logical/index\\_us.html](http://www.puzzle.dse.nl/logical/index_us.html)

- What color is cobalt?
- Which device do we use to look at the stars?
- Who is the father of the atomic bomb?
- Who invented vulcanized rubber?
- Which unit indicates the light intensity?

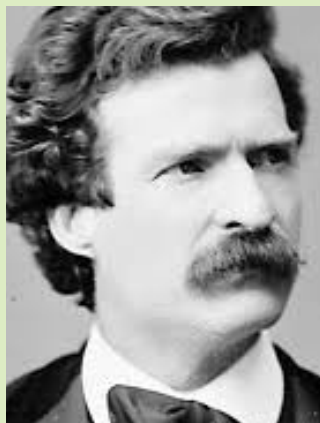
Source: <http://www.quiz-questions.net/science.php>

## Memorable Quotes



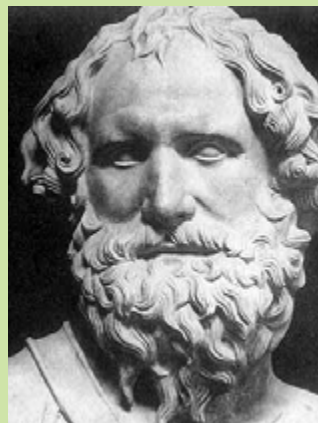
*The difference between stupidity and genius is that genius has its limits.*

**Albert Einstein**



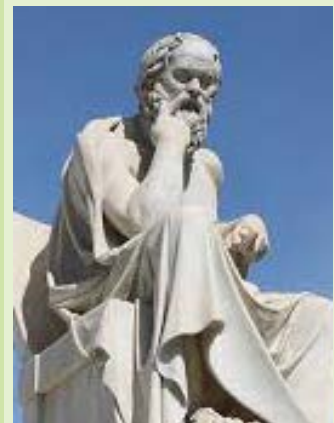
*The only way to keep your health is to eat what you don't want, drink what you don't like, and do what you'd rather not.*

**Mark Twain**



*My dream? After I am dead, I would love it if people thought I was made of marble.*

**Archimedes**



*I know that I am intelligent, because I know that I know nothing.*

**Socrates**

# FEEDBACK FORM

1. Do you find the content informative and interesting?

Yes

☐

No

☐

2. How interesting do you find this month's newsletter?



3. Do you like the design and contents?

Fantastic

☐

Not bad

☐

Could be better

☐

4. What item do you enjoy the most?

5. Which of the following elements of the newsletter do you think could be improved?

Content

☐

Layout

☐

Frequency of newsletter

☐

Others (Please Specify)

☐

6. List the topics you would like to see in contents in future issue of the newsletter.

Please send feedback form to the editor-in-chief Prof J Maiti, Head of the Department

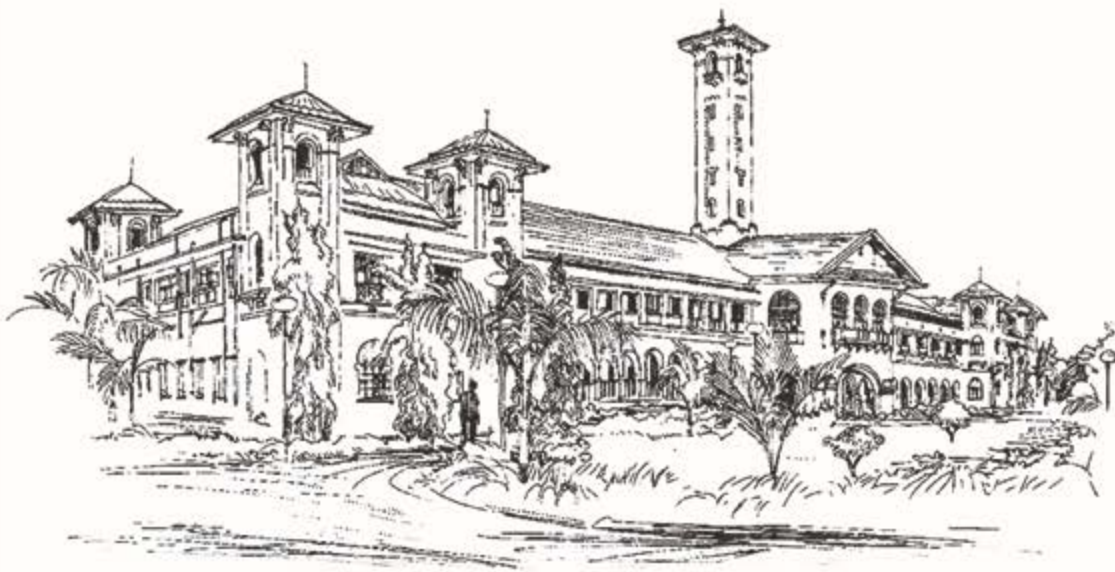
Email: [jmaiti@iem.iitkgp.ernet.in](mailto:jmaiti@iem.iitkgp.ernet.in)

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