

## About IIT Kharagpur



Kharagpur - a dusty town tucked away in the eastern corner of India, famous until 1950 as home to the longest railway platform in the world - became the nursery where the seed of the IIT system was planted in 1951. IIT Kharagpur started its journey in the old Hijli Detention Camp in Eastern India, where some of the country's great freedom fighters toiled and sacrificed their lives for India's independence. Spurred by the success of IIT Kharagpur, four younger IITs sprouted around the country in the two following decades, and from these five came thousands of IITians, the brand ambassadors of modern India. It was the success of this one institution at Kharagpur that wrote India's technological odyssey.

The Institute takes pride in its relentless effort to provide the best platform for both education as well as research in the areas of science and technology, infrastructure designs, entrepreneurship, law, management, and medical science and technology. IITKGP is not just the place to study technology, it is the place where students are taught to dream about the future of technology and beam across disciplines, making differences enough to change the world.

### Program Features/ Structure

Classroom lectures - **50%**  
Numerical / Problem solving, Case study and Activity - **25%**  
Hands-on work with coding - **25%**

### Program Schedule and Venue

1 week, 27 September - 3 October 2020 (9:00 AM - 5:00 PM)  
IIT Kharagpur - Structural Reliability Research Facility

### Program Fee

Nil for AICTE-QIP sponsored participants  
For students - INR 7,000 + GST @ 18% per participant  
For others - INR 20,000 + GST @ 18% per participant

### Who will benefit (Eligibility)

1. For faculty/students of Civil, Mechanical, Electrical, Electronics, Aerospace, Mining, Metallurgy, Chemical.
2. Practicing engineers
3. Industrial researchers

### Last day of Registration

**18**  
September 2020

### Accommodation

AC accommodation will be provided to the AICTE-QIP sponsored participants at the campus Guesthouse. Limited AC accommodation is available for others on first-come-first-serve basis at no extra cost.

## How to Apply

Use the link: <https://erp.iitkgp.ac.in/CEP/courses.htm> to apply ONLINE.



Payment if applicable is to be done **ONLINE** after getting short listed for the program.

## Contact Us

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# AICTE QIP

## QUALITY IMPROVEMENT PROGRAMME

Indian Institute of Technology Kharagpur  
2020

## RISK AND RELIABILITY ANALYSES OF ENGINEERING SYSTEMS

1 Week

27 September – 3 October 2020

## Why take this course

Engineering systems are subject to various uncertainties during their service lives: randomly occurring loads, environmental degradation and unpredictable operator errors.

The competing demands of economy and performance, while shortening the product design cycle, have led our systems to become more complex. The prototype or the mathematical model of the system can deviate from actual system behavior under service conditions in unknown ways.

Because of these uncertainties and incomplete information, our products and systems sometimes fail, and some failures have unacceptable consequences.

It is therefore necessary that we accurately determine the reliability of our products and systems, estimate the risks from their failure, set reliability targets and know how to achieve them.

## What you will get

- The mathematical tools for tackling uncertainties and incomplete information in engineering
- The ability to define performance objectives and estimate reliabilities of engineered systems
- A global view of your profession and the ability to manage risks in engineering activities

## Course structure

Day	Topics
1	<ul style="list-style-type: none"><li>• Review of basic probability. Random variables, probability laws, common probability distributions - origins and interrelations</li><li>• Functions of random variables. Joint probability distributions, conditional distributions. Joint Normal distribution</li><li>• Concepts of stochastic process</li></ul>
2	<ul style="list-style-type: none"><li>• Reliability - historical development, applications, different measures of reliability.</li><li>• Probabilistic formulation of engineering problems. Concepts of performance requirements and definitions of failure.</li><li>• Component reliability - time to failure.</li><li>• Formulation of structural reliability problems: limit states</li></ul>
3	<ul style="list-style-type: none"><li>• System reliability - representation of failure, series and parallel systems, redundancy, fault trees.</li><li>• Common cause failure and multi-state components</li><li>• Reliability-based maintenance. Perfect and imperfect repair</li></ul>
4	<ul style="list-style-type: none"><li>• Concepts of robustness and resilience of systems.</li><li>• Consequence of failure, concepts of risk, utility, societal impact</li><li>• Probability-based acceptance criteria - target reliability, uniform hazard vs. uniform risk, decision making in the presence of uncertainties</li></ul>
5	<ul style="list-style-type: none"><li>• Probability-based design.</li><li>• Reliability-based design codes - factors of safety, assignment vs. calibration of target reliabilities</li><li>• Case studies</li><li>• Final Exam</li></ul>

## Grading

Daily quiz: 10 points each

Final exam: 60 points



## About the Faculty

**Baidurya Bhattacharya**

Professor Bhattacharya works in the area of probabilistic mechanics and computational materials science.

His research on material degradation, probabilistic modelling, extremal processes and risk assessment of structural systems have resulted in improved load modelling, damage detection, system identification, seismic reliability analysis and design guides for structural components, nuclear power plant shells, ships, offshore vessels and bridges. He has set up the Structural Reliability Research Facility including a high performance parallel computing cluster at IIT Kharagpur.

Bhattacharya obtained his BTech in Civil Engineering (1991) from IIT Kharagpur and his MS (1994) and PhD (1997) in Civil Engineering from Johns Hopkins University.

He joined the faculty of Civil Engineering at IIT Kharagpur in 2006. He is currently Professor (HAG) and the Dean of International Relations. He is also the convener of IIT Kharagpur's Joint Program Committee with IGCAR on safety analysis of sodium cooled nuclear reactors. He has served the Institute as Chairman Civil Construction and Maintenance.

Bhattacharya has been a visiting faculty at Stanford and Johns Hopkins and has served on the faculty of the University of Delaware. He has been a speaker at the Frontiers of Engineering series at the US National Academy of Engineering. He served as an associate editor of ASCE's Journal of Bridge Engineering for 8 years. He was elected Fellow of the Indian National Academy of Engineering in 2016 and Fellow of the American Society of Civil Engineers in 2018.