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Title: Beyond Traditional Models: Flexible Conditional Hazards for Reliability and Biostatistics

Speaker: Prof. Sujit GHOSH, DEPARTMENT OF STATISTICS, NC STATE UNIVERSITY, USA

Date: 16th December 2025 at 11:00 a.m.

Venue: Lecture Hall no. 3, Department of Statistics, SPPU

Abstract: Hazard functions play a foundational role in both reliability engineering and survival analysis in biostatistics, as they describe how the instantaneous risk of failure or event occurrence evolves over time. Classical examples include decreasing hazards associated with early failures, constant hazards reflecting random failures, and increasing hazards arising from wear-out mechanisms. The well-known "bathtub curve" encapsulates all three phases, illustrating a product or system's complete life cycle. Despite their central importance, many widely used semi-parametric models for conditional hazard functions lack the flexibility to accommodate complex real-world phenomena such as crossing survival curves or delayed separation—features frequently encountered in biomedical studies and reliability applications. Traditional parametric models further constrain inference by imposing rigid functional forms that may fail to capture the true underlying hazard dynamics.

This talk introduces flexible semiparametric approaches based on B-splines and Bernstein polynomial basis functions, which allow richly shaped hazard functions without restrictive assumptions. These methods provide a unified framework for modeling diverse hazard behaviors, improving the accuracy and interpretability of analyses in both reliability and biostatistics. Applications include enhanced prediction of product lifetime, more effective maintenance and replacement strategies, and better characterization of treatment effects and risk patterns in biomedical research.

Speaker's Bio and headshot: https://statistics.sciences.ncsu.edu/people/sghosh2/