INTRODUCTION TO BIOSTATISTICS

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INTENDED AUDIENCE : BE Biotech/Biosciences/Bioengineering,MSc Biotech/Bio sciences/Bioengineering, PhD Biotech/Biosciences/Bioengineering. It is taught as a cor course for M. Tech Biomedical

PRE-REQUISITES : Basic knowledge of 12th standard mathematics is sufficient.

INDUSTRIES APPLICABLE TO : Biotech companies, pharma companies and omics companies may be interested in this course.

COURSE OUTLINE :

Observations from biological laboratory experiments, clinical trials, and health surveys always carry some amount of uncertainty. In many cases, especially for the laboratory experiments, it is inevitable to just ignore this uncertainty due to large variation in observations. Tools from statistics are very useful in analyzing this uncertainty and filtering noise from data. Also, due to advancement of microscopy and molecular tools, a rich data can be generated from experiments. To make sense of this data, we need to integrate this data a model using tools from statistics. In this course, we will discuss about different statistical tools required to
(i) analyze our observations, (ii) design new experiments, and (iii) integrate large number of observations in single unified model.

ABOUT INSTRUCTOR :

Prof. Shamik Sen joined IIT Bombay in July 2010 as an Assistant Professor in the Department of Biosciences and Bioengineering. Dr. Sen earned a B.E. in Mechanical Engineering from Jadavpur University, Kolkata, and a M. Tech in Mechanical Engineering from IIT Kanpur. He then completed his PhD in Mechanical Engineering from University of Pennsylvania, where he worked in the area of mechanobiology.He is currently working in the area of mechanobiology where he is integrating mechanics and biology for probing stem cell biology and cancer cell biology. He is combining experiments with simulations for addressing his research questions.

COURSE PLAN :

Week 01 : Introduction to the course, Data representation and plotting, Arithmetic mean, Geometric mean, Measure of Variability, Standard deviation.

Week 02 : SME, Z-Score, Box plot, Kurtosis, R programming, R programming, Correlation.

Week 03 : Correlation and Regression I&II, Interpolation and extrapolation, Nonlinear data fitting, Concept of Probability: introduction and basics.

Week 04 : Counting principle, Permutations, and Combinations, Conditional probability, Conditional probability and Random variables, Random variables, Probability mass function, and Probability density function, Expectation, Variance and Covariance.

Week 05 : Expectation, Variance and Covariance II, Binomial random variables and Moment generating function, Probability distribution: Poisson distribution and Uniform distribution, Uniform distribution Part-II and Normal distribution Part-I & II and Exponential distribution.

Week 06 : Sampling distributions and Central limit theorem Part-I, Part-II, Central limit theorem Part-III and Sampling distributions of sample mean, Central limit theorem - IV and Confidence intervals Part- I & II,

Week 07 : Test of Hypothesis - I, II, III & IV, T-test.

Week 08 : 1 tailed and 2 tailed T-distribution, Chi-square test, ANOVA I, II, III, ANOVA for linear regression, Block Design