MTH 202: Probability and Statistics (3 credits)

Classes in L4, LHC on Mon: 10-10:55; Tue and Thurs: 12:00-12:55

Tutorial in L4, L7, L10, L11, LHC on Fri: 3-3:55

Instructor: Dr. Nikita Agarwal. Office: 25, AB-2 Bhauri
Phone: 0755-6692-368
Email: nagarwal@iiserb.ac.in
Webpage: http://home.iiserb.ac.in/~nagarwal/MTH202.htm
(Please check the webpage for homeworks and updates)

Tutors:
Dr. Nikita Agarwal (Roll Nos. 13001-13039, Room: L4)
Dr. Romie Banerjee (Roll Nos. 13040-13083, Room: L7)
Dr. Prahlad Vaidyanathan (Roll Nos. 13084-13122, Room: L10)
Dr. Kashyap Rajeevsarathy (Roll Nos. 13123-13161, Room: L11)

**** Students who are repeating this course will attend tutorial in L4.***

Syllabus:

- Algebra of Sets: sets, classes, limit of a sequence of sets, rings, sigma rings, fields, sigma-fields, monotone classes
- Probability: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes Theorem and independence, problems
- Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality, Chebyshev's inequality, problems
- Special Distributions, Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, bivariate normal distribution
- Transformations: functions of random vectors, distributions of order statistics, distributions of sums of random variables
- Sampling Distributions: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions
- Descriptive Statistics: Graphical representation, Summarization and tabulation of data
- Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions
- Testing of Hypotheses: Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications

Suggested Reading:

- P. Hoel, S. Port, C. Stone, *Introduction to Probability Theory*, 1st Edition, Brooks Cole, 1972
- V. Rohatgi, A. Saleh, *Introduction to Probability Theory and Statistics*, 2nd Edition, Wiley, 2000
- W. Feller, *An Introduction to Probability Theory and Its Applications*, Volume 1, 3rd Edition, Wiley, 1968
- S.M. Ross, *A First Course in Probability*, 6th Edition, Prentice Hall
- Craig, R. Hogg, J. McKean, *Introduction to Mathematical Statistics*, 6th Edition, Prentice Hall, 2004
- J.S. Milton and J.C. Arnold, *Introduction to Probability and Statistics*
- R. Isaac, *The Pleasures of Probability*, Springer (Undergraduate Texts in Mathematics)
- H.J. Larson, *Introduction to Probability Theory and Statistical Inference*

Grading Policy:

Various components of your overall grade are as follows:

- Homework: 10%
- Quiz: 10%
- Mid-semester examination: 30%
- End-semester examination: 50%