

**FIRST COURSE HANDOUT,
PROBABILITY THEORY (MTH309A),
2019-20 EVEN SEMESTER**

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1. PRE-REQUISITES

Familiarity with Real Analysis and basic Probability distributions will be assumed (MSO201 or MTH431).

2. COURSE CONTENTS AND REFERENCES

- Limits of sequences of sets, σ -field of events.
- Probability measure, probability space. Random variables, induced probability space, probability distribution.
- Distribution function, decomposition theorem.
- Expectation and moments, inequalities.
- Convergence theorems for expectations of sequences of random variables (monotone convergence theorem, Fatou's lemma, dominated convergence theorem).
- Various modes of convergence of sequences of random variables (in probability, almost surely, in r th mean).
- Convergence of sequences of distribution functions, Helly-Bray theorems, convergence of moments.
- Characteristic function and its properties, inversion formulae.
- Independence of events and random variables, zero one laws.
- Convergence of series of independent random variables, Kolmogorov inequality, Kolmogorov three-series criterion.
- Khintchin's weak law of large numbers, Kolmogorov strong law of large numbers. Central limit theorems of Lindeberg-Levy, Liapounov and Lindeberg-Feller.

References:

- Probability & Measure Theory (2nd Edition), Robert B. Ash and Catherine A. Doléans-Dade. Elsevier.
- A Course in Probability Theory (3rd Edition), Kai Lai Chung. Academic Press (Elsevier).
- Probability and Measure (3rd Edition), Patrick Billingsley. Wiley.

Supplementary texts:

- Probability: Theory and Examples (4th Edition), Rick Durrett. CUP.
- Probability Essentials (2nd Edition), Jean Jacod and Philip Protter. Springer.
- Probability with Martingales, David Williams, CUP.
- Modern Probability Theory (3rd Edition), B. R. Bhat, New Age International.
- Probability Theory - I (4th Edition), M Loève, Springer.

3. LECTURE, TUTORIAL, LAB SCHEDULE & VENUE

Lectures: Mondays, Tuesdays & Fridays 14:00 - 14:50 hrs (Venue: T201)
Tutorials: Wednesdays 11:00 - 11:50 hrs (T201)

4. OFFICE HOURS

Mondays 10:00 - 11:00 hrs (Students should make appointments through email beforehand).

5. WEIGHTAGES FOR DIFFERENT COMPONENTS OF EVALUATION (OUT OF 100)

Component Name	Weightage
Mid-semester Examination	30
End-semester Examination	40
Quizzes	30

- Quizzes ($3 \times 10 = 30$): 3 Quizzes (10 marks in each) will be held during the tutorial hours of January 29, March 4 and April 1/8 (tentative, will be confirmed in due time).
- Homework/Exercises: Exercises will be mentioned during lectures and students are expected to solve them on their own. There is no weightage towards these exercises. However, students are strongly encouraged to discuss amongst themselves and solve problems from the books mentioned above. Some of these problems may be discussed during the tutorial sessions.

6. COURSE POLICIES: ATTENDANCE, HONESTY PRACTICES, WITHDRAWAL

- No extra weightage for attendance.
- Make-up option for exams would be given only if the student produces a medical certificate or a proof of sanctioned leave. There will be no make-up opportunity for the quizzes.
- Any dishonest practice during examinations or quizzes will be reported to DOAA and appropriate action would be taken to penalize such action.
- Students are allowed to withdraw from the course as per guidelines set by DOAA.