Course Syllabus

offered by Department of Mathematics
with effect from Semester A 2022/23

Part I Course Overview

Course Title:	Selected Topics in Random Matrix Theory
Course Code:	MA8025
Course Duration:	One semester
Credit Units:	3
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course aims to provide an introduction to the theory, methodology and applications of random matrices. It will help students develop a solid and systematic understanding of random matrix theory, explore the cutting-edge development, and apply the obtained knowledge to solve some problems.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Explain the fundamental background and property of random matrix theory.	30%	✓	✓	
2.	Develop a solid and systematic understanding of the classical techniques for random matrix theory.	40%	✓	✓	✓
3.	Conduct literature search and explore the cutting-edge development of random matrix theory.	20%	✓	✓	✓
4.	Apply the obtained knowledge to solve some problems from mathematical physics.	10%		✓	✓
		100%			

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4		
Lectures	Learning through teaching is primarily based on lectures.	✓	✓	✓	✓		3 hrs/wk
Assignments	Learning through assignments helps students implement mathematical theories and techniques of random matrices, as well as applications.		✓	✓	✓		After-class

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4				
Continuous Assessment: 50%								
Hand-in assignments	✓	✓	✓	✓			50%	Questions are designed for the most part of the course to see how well the students have mastered the subject and are well-versed in its applications.
Examinations: 50% (duration: 3 hours)		✓	✓	✓			50%	Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in random matrices and their applications.
							100%	

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Hand-in assignments	DEMONSTRATION of the understanding of the basic materials	High	Significant	Basic	Not even reaching marginal levels
2. Examination	DEMONSTRATION of the exploration and understanding of the modern research	High	Significant	Basic	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
3. Hand-in assignments	DEMONSTRATION of the understanding of the basic materials	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	DEMONSTRATION of the exploration and understanding of the modern research	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

Gaussian orthogonal/unitary/symplectic ensembles, determinantal point processes, non-intersecting Brownian motions, eigenvalue distributions, orthogonal polynomials, special functions, and the Riemann-Hilbert problem.

2. Reading List

2.1 Compulsory Readings

- Orthogonal polynomials and random matrices: a Riemann-Hilbert approach, Courant lecture notes, by Percy Deift, New York University, 1999.
- An Introduction to Random Matrices, by G.W. Anderson, A. Guionnet and O. Zeitouni, Cambridge University Press, 2009.

2.2 Additional Readings

Random Matrices, by M. L. Mehta, Elsevier/Academic Press, 2004.