Course Syllabus

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

Part I Course Overview

Course Title:	Complexity Theory
Course Code:	MA8008
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

- introduce the basic notions and major theoretical problems related with complexity;
- evaluate and compare possible algorithms of solving problems in terms of efficiency.

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.	Describe mathematical formulation of computational and decisional problems	20%	✓	✓	
2.	Implement machine models, including non-deterministic machines to simulate processes arising in industry and sciences	20%		✓	✓
3.	Evaluate computation costs of algorithms and compare their efficiency on the basis of such algorithmic costs	20%		✓	✓
4.	Explain at high level mathematical concepts and applications of the P=NP problem	20%	✓	✓	
5.	Describe computational complexity of randomized algorithms and their applications, e.g. in graph theory	20%	✓	✓	✓
		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	5	
Lectures	Learning through teaching is primarily based on lectures	✓	✓	✓	✓	✓	3 hours/week
Assignments	Learning through take-home assignments helps students implement basic concepts and techniques of complexity theory in cost evaluation, efficiency comparison and probabilistic analysis, as well as related applications	✓	✓	✓	✓	✓	After-class

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.					Weighting*	Remarks
	1	2	3	4	5		
Continuous Assessment: 40%							
Test	✓	✓	✓			20-40%	Questions are designed for the first part of the course to see how well students have learned mathematical formulation of computational and decisional problems in complexity theory, as well as the associated techniques of cost and efficiency computation.
Hand-in assignments	✓	✓	✓	✓	✓	0-20%	These are skills based assessment to help students implement methods and techniques of complexity theory in analysing algorithms and solving related application problems.
Examination: 60% (duration: 3 hours)	✓	✓	✓	✓	✓	60%	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 concepts and techniques of complexity theory.
						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. Test	DEMONSTRATION of the understanding of the first part of the course	High	Significant	Basic	Not even reaching marginal levels
2. Hand-in assignments	DEMONSTRATION of the understanding of the basic materials	High	Significant	Basic	Not even reaching marginal levels
3. Examination	DEMONSTRATION of skills and versatility in concepts and techniques of complexity theory	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)
1. Test	DEMONSTRATION of the understanding of the first part of the course	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	DEMONSTRATION of the understanding of the basic materials	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	DEMONSTRATION of skills and versatility in concepts and techniques of complexity theory	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

Computational and decisional problems, machine models, cost of a computation, worst-case and average-case complexity, polynomial time, nondeterministic machines, complexity classes, the P=NP problem, randomized algorithms.

2. Reading List

2.1 Compulsory Readings

1.	
2.	
3.	
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2.2 Additional Readings

1.	
2.	
3.	
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