MA4547: ASYMPTOTIC ANALYSIS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Asymptotic Analysis

Subject Code
MA - Mathematics
Course Number
4547

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MA3511 Ordinary Differential Equations
MA3517 Complex Analysis

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to introduce basic notions of asymptotic analysis with application to ordinary differential equations. It helps students understand how to find approximate solutions to algebraic and differential equations, as well as how to find asymptotic behaviours of certain integral transforms.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain clearly the meaning of asymptotic expansions and related notations.	20	x		
2	Find asymptotic behaviours of integrals using Watson’s lemma and Laplace’s method.	20	x	x	
3	Find asymptotic behaviours of complex integrals using the method of stationary phase.	15		x	
4	Compute asymptotic solutions of certain algebraic equations.	15		x	
5	Apply perturbation theory to find asymptotic solutions of certain ordinary differential equations.	15			x
6	Perform WKB analysis to find asymptotic solutions of linear ordinary differential equations.	15		x	x

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 real-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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5	39 hours in total
2	Take-home assignments	Learning through take-home assignments helps students understand basic techniques of asymptotic analysis and their applications to ordinary differential equations.	1, 2, 3, 4	after-class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Test	1, 2, 3	20	Questions are designed for the first part of the course to see how well the students have learned basic concepts and techniques of asymptotic expansions.	No
2	Hand-in assignments	1, 2, 3, 4	20	These are skills based assessment to help students understand techniques of asymptotic analysis and related applications.	Yes
3	Formative take-home assignments	1, 2, 3, 4	0	The assignments provide students chances to demonstrate their achievements in applying techniques of asymptotic analysis learned from this course.	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

40% Coursework 60% Examination (Duration: 2 hours, at the end of the semester)

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)

Assessment Task

1. Test

Criterion

Ability in problem solving

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
2. Hand-in assignments

Criterion
Understanding of concepts and applications

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
3. Formative take-home assignments

Criterion
Study attitude

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)

Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
4. Examination

Criterion
Comprehensive ability in independent problem solving

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Asymptotic series. Watson’s lemma. Laplace’s method. Method of stationary phase. Perturbation theory. WKB analysis.

Reading List

Compulsory Readings

	Title
1	Murray, J.D. Asymptotic Analysis (Applied Mathematical Sciences, Vol. 48), Springer, 1984. (Reference book)

Additional Readings

	Title
1	Nil