BACHELOR OF SCIENCE PROGRAM IN APPLIED MATHEMATICS

BACHELOR OF SCIENCE (APPLIED MATHEMATICS)

B.Sc. (APPLIED MATHEMATICS)

FACULTY OF SCIENCE AND TECHNOLOGY

THAMMASAT UNIVERSITY

1. STRUCTURE AND COMPONENT

1.1	General Education Courses	30	credits
1.2	Major Compulsory Courses	103	credits
1.3	Free Elective Courses	6	credits
	Total	**139**	**credits**

2. DETAILS OF THE CURRICULUM

2.1		General Education Courses		30	credits
Part I		**University Compulsory and Prescribed Courses**		**21**	**credits**
	TU 110	Integrated Humanities	3		credits
	TU 120	Integrated Social Sciences	3		credits
	TU 130	Integrated Sciences and Technology	3		credits
	TU 154	Foundation of Mathematics	3		credits
	TH 161	Thai Usage	3		credits
	EL 171	English Course 2	3		credits
	EL 172	English Course 3	3		credits
Part II		**Department Compulsory and Prescribed Courses**		**9**	
	PY 228	Psychology of Interpersonal Relations	3		credits
	EC 210	Introductory Economics	3		credits
	And select 3 credits from the following courses :				
	BA 291	Introduction of Business	3		credits
	EL 296	English for Science and Technology	3		credits
	HO 201	Principle of Management	3		credits

2.2.1	Basic Science Courses		12	credits
SC 113	General Biology	3		credits
SC 163	General Biology Laboratory	1		credits
SC 123	Fundamental Chemistry	3		credits
SC 173	Fundamental Chemistry Laboratory	1		credits
SC 135	General Physics	3		credits
SC 185	General Physics Laboratory	1		credits

2.2.2	Compulsory Courses		46	credits
MA 211	Calculus 1	3		credits
MA 212	Calculus 2	3		credits
MA 213	Calculus 3	3		credits
MA 221	Elementary Logic and Set Theory	3		credits
MA 313	Ordinary Differential Equations	3		credits
MA 315	Mathematics Analysis 1	3		credits
MA 332	Linear Algebra	3		credits
MA 351	Numerical Methods	3		credits
AM 200	Discrete Mathematical	3		credits
AM 411	Problem Solving	3		credits
AM 455	Seminar	1		credit
ST 211	Statistics 1	3		credits
ST 321	Probability Theory 1	3		credits
CS 103	Introduction to Computer Programming	3		credits
EG 221	Reading for Information			
or		3		credits
EL 295	Academic English 1			
EG 241	Listening-Speaking 1			
or		3		credits
EL 395	Academic English 2			

* Students are required to earn at least a C grade in the following 7 courses :
MA 211, MA 212, MA 313, MA 332, AM 200, AM 411, AM 455

2.2.3	Technical Elective Courses		27	credits
	2.2.3.1 Choose 9 credits from			
MA 316	Vector Analysis	3		credits
MA 317	Advanced Calculus	3		credits
MA 318	Partial Differential Equations	3		credits
MA 327	Set Theory	3		credits

MA 331	Abstract Algebra 1	3	credits
MA 337	Number Theory	3	credits
MA 346	Projective Geometry	3	credits
MA 412	Functions of Complex Variables	3	credits
MA 416	Mathematical Analysis 2	3	credits
MA 426	Elementary Topology	3	credits
MA 436	Abstract Algebra 2	3	credits
MA 446	Differential Geometry	3	credits
MA 447	Transformational Geometry	3	credits
MA 476	Mathematics Packages	3	credits

2.2.3.2 Choose 18 credits from

AM 246	Data Structure and Fundamental Algorithms	3	credits
AM 316	Applied Ordinary Differential Equations	3	credits
AM 317	Numerical Solutions of Partial Differential Equations	3	credits
AM 318	Mathematical Models and Applications	3	credits
AM 319	Mathematical Programming I	3	credits
AM 326	Graph Theory and Applications	3	credits
AM 327	Combinatorial Theory and Applications	3	credits
AM 336	Management Science	3	credits
AM 346	Elementary Computational Theory	3	credits
AM 347	Formal Language	3	credits
AM 348	Algorithm designs and Analysis	3	credits
AM 416	Mathematical Programming II	3	credits
AM 418	Optimization Technique	3	credits
AM 436	Methods of Applied Mathematics	3	credits
AM 437	Decision Making and Simulation	3	credits
AM 438	Fuzzy Sets and Fuzzy Logic	3	credits
AM 446	Mathematics of Computer Graphics	3	credits
AM 447	Knowledge Base Systems	3	credits
AM 448	Introduction to Artificial Intelligence	3	credits
AM 449	Image Processing and Pattern Recognition	3	credits
AM 456	Special Topics	3	credits
AM 457	Special Projects	3	credits

2.2.4	**Minor or Elective Courses**	18	credits

Student may choose one of the two options

2.2.4.1 Minor Courses

Student may choose to take a minor course from the faculty or from other faculties.

2.2.4.2 Elective Courses

Student may choose to take any courses that offered in the university and not more than 3 majors, not less than 18 credits.

2.3	**Free Elective Courses**	6	credits

A student may choose free elective courses from the faculty or from other faculties and may include any of the foreign languages offered in the University General Education Courses.

Student can not choose to take the following courses
to be free Elective courses

1. All General Basic Courses and Basic Courses in Science and Mathematics

2. All General Education Courses mentioned above include every TU coded courses and TH162 (Thai Language 2)

3. THE MINOR IN APPLIED MATHEMATICS

The minimum requirement is an accumulation of 21 credits, and the following condition is to be fulfilled :

3.1 Having taken 15 credits in the following courses:

MA 211	Calculus 1	3	credits
MA 212	Calculus 2	3	credits
MA 213	Calculus 3	3	credits
MA 313	Ordinary Differential Equations	3	credits
AM 200	Discrete Mathematical	3	credits

*** A student not in majors of statistics, mathematics or applied mathematics who has taken MA216 and MA217 or MA218 and MA219 or MA111 and MA112 as compulsory subject and obtain grades of C or better can use MA216 and MA217 or MA218 and MA219 or MA111 and MA112 in replace of MA211 and MA212

3.2 Not less than 6 credits of elective courses in applied mathematics.

*** AM200 cannot be counted one more here

4.	Associate Degree in Applied Mathematics		
	A Student with an accumulation of not less than 90 credits in pursuit of courses in the university are entitled to an Associate Degree in Applied Mathematics under the following conditions:		
4.1	Having maintained a grade point average not less than 2.00.		
4.2	Having been registered as a full-time student for at least five semesters.		
4.3	Having fulfilled the University General Education Courses of 30 credits.		
4.4	Having taken 12 credits in basic sciences and not less than 45 credits as following:		
	4.4.1 Having taken the following courses:		
	MA 211 Calculus 1	3	credits
	MA 212 Calculus 2	3	credits
	MA 213 Calculus 3	3	credits
	MA 221 Elementary Logic and Set Theory	3	credits
	MA 313 Ordinary Differential Equations	3	credits
	MA 332 Linear Algebra	3	credits
	MA 351 Numerical Methods	3	credits
	AM 200 Discrete Mathematical	3	credits
	EG 221 Reading for Information or EL 295 English for Mathematics, Statistics and Computer science 1	3	credits
	EG 241 Listening – Speaking 1 or EL 395 English for Mathematics, Statistics and Computer science 2	3	credits
	4.4.2 Having taken not less than 15 credits of courses in applied mathematics and/or including the following courses:		
	ST 211 Statistics 1	3	credits
	ST 321 Introduction to Probability Theory	3	credits
4.5	An elective course of not less than 3 credits is required.		

5.		Applied Mathematics Courses	
NO.	CODE	COURSE NAME	CREDITS
1	AM 200	Discrete Mathematical	3
2	AM 246	Data Structure and Fundamental Algorithms	3
3	AM 316	Applied Ordinary Differential Equations	3
4	AM 317	Numerical Solutions of Partial Differential Equations	3
5	AM 318	Mathematical Models and Applications	3
6	AM 319	Mathematical Programming I	3
7	AM 326	Graph Theory and Applications	3
8	AM 327	Combinatorial Theory and Applications	3
9	AM 336	Management Science	3
10	AM 346	Elementary Computational Theory	3
11	AM 347	Formal Language	3
12	AM 348	Algorithm designs and Analysis	3
13	AM 411	Problem Solving	3
14	AM 416	Mathematical Programming II	3
15	AM 418	Optimization Technique	3
16	AM 436	Methods of Applied Mathematics	3
17	AM 437	Decision Making and Simulation	3
18	AM 438	Fuzzy Sets and Fuzzy Logic	3
19	AM 446	Mathematics of Computer Graphics	3
20	AM 447	Knowledge Base Systems	3
21	AM 448	Introduction to Artificial Intelligence	3
22	AM 449	Image Processing and Pattern Recognition	3
23	AM 455	Seminar	1
24	AM 456	Special Topics	3
25	AM 457	Special Projects	3

6. Study Plan

First Year

First Semester		Credit	Second Semester		credits
SC 135	General Physics	3	SC 113	General Biology	3
SC 185	General Physics Laboratory	1	SC 163	General Biology Laboratory	1
MA 211	Calculus 1	3	SC 123	Fundamental Chemistry	3
ST 211	Statistics 1	3	SC 173	Fundamental Chemistry Laboratory	1
TU 154	Foundation of Mathematics	3	TU 110	Integrated Humanities	3
TH 161	Thai Usage 1	3	TU 130	Integrated Sciences and Technology	3
EL 171	English Course 2	3	MA 212	Calculus 2	3
			EL 172	English Course 3	3
Total		19	Total		20

Second Year

First Semester		Credit	Second Semester		credits
AM 200	Discrete Mathematical	3	EC 210	Introduction Economics	3
MA 213	Calculus 3	3	TU 120	Integrated Social Science	3
MA 221	Elementary Logic and Set Theory	3	PY 228	Psychology of Interpersonal Relations	3
CS 103	Introduction to Computer Programming	3	MA 332	Linear Algebra	3
EG 221 or	Reading for Information	3	EL 241 or	Listening – Speaking 1	3
EL 295	English for Mathematics, Statistics and Computer Science 1		EL 395	English for Mathematics, Statistics and Computer Science 2	
General Education Course Part II		3	Minor or Elective Course		3
Minor or Elective Course		3			
Total		21	Total		18

Third Year

First Semester		Credit	Second Semester		credits
MA 313	Ordinary Differential Equations	3	MA 351	Numerical Methods	3
MA 315	Mathematical Analysis 1	3	ST 321	Probability Theory 1	3
Technical Elective Course		9	Technical Elective Course		9
Minor or Elective Course		3	Minor or Elective Course		3
Total		18	Total		18

Fourth Year

First Semester		Credit	Second Semester		credits
AM 411	Problem Solving	3	Minor or Elective Course		3
AM 455	Seminar	1	Free Elective Courses		6
Technical Elective Course		9			
Minor or Elective Course		3			
Total		16	Total		9

7. COURSE DESCRIPTIONS

AM 200	Discrete Mathematical	3 credits
Prerequisite	: -	

Logic, algebra of sets, binary number system and equivalence of binary system, counting and recurrence relations, graph, trees and directed graphs, Boolean algebra and Switching algebra, applications to machine, group, homomorphism, congruence.

Notes : 1. This course equivalent to CS101 Discrete Structure

          2. There is no credit for students who studying or passed CS101

AM 246	Data Structure and Fundamental Algorithms	3 credits
Prerequisite	CS 103	

Data structure, programming, basic data structures: stacks, queues, linked list, trees, graphs, recursion, sorting and searching algorithm.

AM 316	Applied Ordinary Differential Equations	3 credits
Prerequisite	: MA 313	

Series solutions of ordinary differential equations and some applications, autonomous systems, stability of linear systems, special functions: Bessel functions, Legendre function, Hypergeometric functions, Fourier series, Fourier integrals and Fourier transforms, selected problems of applications.

AM 317	Numerical Solutions of Partial Differential Equations	3 credits
Prerequisite	: MA 351	

Introduce partial differential equations, finite difference methods, finite elements methods, methods of line integral and integral equations, Navier-Stoke's equations.

AM 318	Mathematical Models and Applications	3 credits
Prerequisite	: MA 313 and MA 332	

Principle and formulation of mathematical models, elementary and advanced methods in formulation of linear and nonlinear mathematical models for discrete and continuous solutions.

AM 319	**Mathematical Programming I**	**3 credits**

Prerequisite   : MA 332

Linear programming, simplex method both algebraically and geometrically, duality theorem, sensitivity analysis, the upper bound technique, revised simplex method, applications of linear programming.

Note : There is no credit for students who studying or passed ST 366.

AM 326	**Graph Theory and Applications**	**3 credits**

Prerequisite   : AM 200 or CS 101

Basic concepts of graph theory, connectivity, planar graphs, coloring of graphs, matchings, networks, selected problems of applications.

AM 327	**Combinatorial Theory and Applications**	**3 credits**

Prerequisite   : AM 200 or CS 101

Elementary Combinatorics with applications, recurrence relations, generating functions, combinatorial designs, Polya's theory of enumeration.

AM 336	**Management Science**	**3 credits**

Prerequisite   : AM 319

Introduction to operational research, basic of linear programming and sensitivity analysis, dynamics programming, critical path method(CPM), network modeling, inventory control, optimization modeling in business sectors, vehicle routing and scheduling etc.

AM 346	**Elementary Computational Theory**	**3 credits**

Prerequisite   : AM 200 or CS 101

Finite state machines, regular languages, context-free languages, context-free grammars, pushdown automata, Turing machine, decidable and undecidable problems, halting problems.

AM 347	**Formal Language**	**3 credits**

Prerequisite   : -

Languages from an abstract point of view as defined by formal grammars and by families of abstract machines, the Chomsky hierarchy and associated automata context free languages with mathematical definitions and proofs stressed throughout.

AM 348	Algorithm designs and Analysis	3 credits
Prerequisite	: AM 246 or CS 213	

Algorithm definition, asymptotic notations, techniques for design and analysis algorithms: divide-and-conquer, greedy algorithms branch and bound.

AM 411	Problem Solving	3 credits
Prerequisite	: -	

Study of definition, spaces and set models of problems, constructions of alternatives: sensitivity analysis, dynamics programming, decision making theories, principles of cost-benefit analysis and planning.

AM 416	Mathematical Programming II	3 credits
Prerequisite	: AM 319	

Advance topic in linear programming, dynamic programming and integer programming, network modeling, game theory, basic nonlinear programming, Heuristic technique, software for linear and nonlinear programming.

AM 418	Optimization Technique	3 credits
Prerequisite	: MA 213	

Unconstrained optimization for one and several variables, Hessian matrix, constrained optimization, Lagrange multiplier, transformation of constrained optimization to unconstrained optimization, Kuhn-tucker conditions, convex programming, numerical method.

AM 436	Methods of Applied Mathematics	3 credits
Prerequisite	: MA 313	

Various methods of calculus in solving problems in physical science, intitial and boundary value problems of simple partial differential equations, Green's function, Rayleigh and Ritz's variational techniques, Sturm-Liouville's equation system, distribution theory.

AM 437	Decision Making and Simulation	3 credits
Prerequisite	: ST 321	

Distributions in statistic, expected value, decision making theories, decision making models under certainty and uncertainty, Markov analysis, queue theory, simulation and application, forcasting models.

AM 438	Fuzzy Sets and Fuzzy Logic	3 credits
Prerequisite	: MA 221 and ST 321	

Basic concept of fuzzy sets, ordinary sets and fuzzy sets, basic operations on fuzzy sets, fuzzy numbers and operations, fuzzy relations, fuzzy logic, topics for discussions and applications may be appropriately selected.

AM 446	Mathematics of Computer Graphics	3 credits
Prerequisite	: 1. AM 246 or CS 213 and 2. MA 332	

Graphic devices and mathematical coordinate devices, fundamental aspects of image processing, image reduction, image magnification, 2D and 3D rotation and motion, line and surface algorithm, hidden image, computer animation, 3D projection into 2D graphic devices.

AM 447	Knowledge Base Systems	3 credits
Prerequisite	: 1. AM 200 or CS 101 and 2. MA 221	

Formation of mathematical formal language, definitions of the though of "truth" and "probability", relations between "truth" and "probability" of formal sentences, comparability and limitation of first order language, alternative formal systems, knowledge representation by predicate logic and other logics, knowledge representation structure.

AM 448	Introduction to Artificial Intelligence	3 credits
Prerequisite	: AM 246 or CS 213	

Work behavior and solving problem in artificial intelligence system, fundamental problems such as problem solving, game playing, natural language understanding, vision, robot control and program synthesis.

AM 449	**Image Processing and Pattern Recognition**	**3 credits**

Prerequisite : ST 321 and MA 317

Techniques and algorithms for manipulation of binary and grey scale images including image enhancement, segmentation, feature extraction, classification, shape and texture analysis.

AM 455	**Seminar**	**1 credit**

Prerequisite : 4th year standing

Seminar on current interesting topics in mathematics or applied mathematics, students are required to write a report and present the selected topics.

AM 456	**Special Topics**	**3 credits**

Prerequisite : 4th year standing

Topics to be studied are by approval of the department, students are required to write report on the selected topics studied.

AM 457	**Special Projects**	**3 credits**

Prerequisite : 4th year standing

Integration theory and analysis for mathematics and applied mathematics for solving problems.