MASTER OF ENGINEERING (HYDRAULIC & HYDROLOGY)

PROGRAMME SPECIFICATIONS

1. Programme Name	Masters of Engineering (Hydraulic & Hydrology)
2. Final Award	Masters of Engineering (Hydraulic & Hydrology)
3. Awarding Institution	UTM
4. Teaching Institution	UTM
5. Programme Code	MKAG
6. Professional or Statutory Body of Accreditation	MQA
7. Language(s) of Instruction	English
8. Mode of Study (Conventional, distance learning, etc)	Conventional
9. Mode of operation (Franchise, self-govern, etc)	Self-governing
10. Study Duration (per semester)	14 weeks
11. Study Duration (semester)	**Full time**
Minimum	3
Maximum	8

12. Programme Educational Objectives (PEO)

1. Mastery of competencies and integration of knowledge required in the engineering profession.
2. An appreciation of the value of lifelong learning and possessing enthusiasm and strong commitment to continued acquisition of new knowledge and skills.
3. Advanced leadership and team working skills that allow environmental engineers and professionals to become visionary and inspirational leaders.
4. Highly developed oral and written communications skills that fit at all level, appropriate to the field
5. of engineering.
   An appreciation of the ethics and integrity in management, leadership and good governance.

13. Programme Learning Outcomes (PLO)

Code	Intended Learning Outcomes	Teaching and Learning Methods	Assessment
(a)Technical Knowledge and Competencies			
PLO1	**Advanced Knowledge** Graduates are able to incorporate in-depth relevant knowledge in professional practices for the benefits of both national and international communities. Graduates are able to apply their knowledge and skills in the planning, analysis, design and supervision of works related to the civil engineering discipline.	Lectures, seminars, projects, directed reading, tutorials independent study, active learning	Examinations, group and individual project reports, presentations, assignments, problem-based exercises
PLO2	**Research Skills** Graduates are able to formulate hyphothesis, design and perform experiments/research scientifically to solve and explain observed phenomena.	Lectures, seminars, projects, directed reading, tutorials independent study, active learning	Examinations, presentations, assignments, problem-based exercises, project reports, design tasks, simulation exercises
PLO3	**Critical Thinking & Problem Solving** Graduates are able to manage conducive working environment qualities problem	Computer hands-on sessions, laboratory/field works, lectures, independent study, seminars, active learning,	Examinations, presentations, assignments, problem-based exercises, project reports, design tasks, simulation exercises

	solving and higher order thinking skills. Graduate are technically competent in solving problems logically, analytically and creatively based on sound facts and ideas.	projects	
(b) Generic Skills			
PLO4	**Ethics, Values and Professionalism** Graduates are able to balance professional and ethical responsibilities including contemporary issues and environmental awareness.	Pre-Projects and Masters Project, lectures, tutorials, group projects, independent study	Masters Project thesis, project reports, design tasks, examinations, presentations, assignments
PLO5	**Communication** Graduates are able to apply a wide range of relevant knowledge through effective oral and written communication. Graduate are able to communicate effectively across a range of contexts and audiences.	Lectures, tutorials, directed reading, simulation exercises, group project, independent study, problem-based learning, projects	Masters Project thesis, project reports, design tasks, examinations, presentations, assignments
PLO6	**Lifelong Learning** Graduates are able to adopt the latest relevant knowledge and cutting-edge technologies through life-long learning process.	Group projects, independent study, field trips	Oral presentations, project reports

14. Classification of Subjects

No.	Classification	Credit Hours	Percentage
1.	University	6	13%
2.	Programme Core	28	61%
3.	Programme Electives	6	13%
4.	Free Electives	6	13%
	TOTAL	**46**	**100%**

For engineering programme please fill up the following classification. (Others please refer to the Statutory Body guidelines)

A.	Engineering Subjects (a) Lecture/Project/Design studio (b) Masters Thesis Project	30 10	87%
	Total credit hours for Part A	**40**	
B.	Related Subjects (a) Management/Law/Humanities/Ethics	6	13%
	Total credit hours for Part B	**6**	
	Total Credit Hours for Parts A	46	100%

and B		
15. Total credit hours to graduate	**46 credit hours**	

16. Programme structures and features, curriculum and award requirements

The course is offered on full-time mode and is based on a 2-Semester Academic Session with several subjects being delivered and assessed in each Semester. Assessment is based on final examination and coursework conducted throughout the semester.

Award requirements:
To graduate, students should:
- Attain a total of no less than 46 credit hours with minimum CPA of 3.0.
- Complete and pass the Master Project.

17. Mapping of Programme Learning Outcomes to Subjects

CORE & ELECTIVE ENGINEERING SUBJECTS OFFERED		LEARNING OUTCOME						
Code	**Course**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	
Core Course								
MKAG 1113	Advanced Hydraulics	√		√			√	
MKAG 1123	Hydraulic Structures	√		√		√		
MKAG 1133	Coastal Engineering	√		√		√		
MKAG 1213	Advanced Hydrology	√		√			√	
MKAG 1223	Integrated Water Resources Management	√		√		√	√	
MKAG 1233	Urban Stormwater Management	√		√			√	
MKAG 1514	Master Project 1	√	√	√	√	√	√	
MKAG 1526	Master Project 2	√	√	√	√	√	√	

CORE & ELECTIVE ENGINEERING SUBJECTS OFFERED		LEARNING OUTCOME						
Code	**Course**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	
Elective Course								
MKAG 1143	River and Estuarine Hydrodynamics and Transport	√		√		√		
MKAG 1153	Fluvial Hydraulics	√		√				
MKAG 1163	Computational Environmental Hydraulics	√		√				
MKAG 1173	Water Supply Engineering	√		√			√	
MKAG 1183	Coastal Structures	√		√				
MKAG 1193	Port and Harbour Engineering	√		√		√		
MKAG 1243	Ground Water Hydrology	√		√		√		
MKAG 1253	Ground Water Modelling	√		√		√		
MKAG 1263	Irrigation Engineering	√		√			√	
MKAG 1273	Statistical Hydrology	√		√				
MKAG 1313	Computational Fluid Mechanics	√		√				

18. Our Uniqueness

1. No. of graduates
2. Employability rate
3. Leaders in industry
4. Diversity of lecturers
5. Biggest Civil Engineering Faculty in the world
6. One of the biggest Civil Engineering lab/facilities in the region

19. Career Prospects and Career Path

Graduates of the programme can work as an Engineer in hydraulics and hyrology field.

20. Facilities available

List of laboratories:
1. Hydraulics and Hydrology laboratory
2. Computer Laboratory
3. Surveying Unit

CURRICULUM STRUCTURE

University's General Elective Courses(Total : 5 credits)		
UABA 0013	University's General Elective Courses	3 credits
UAPA 0013	Research Methodology	3 credits
Core Courses (Total : 18 credits)		
MKAG 1113	Advanced Hydraulics	3 credits
MKAG 1123	Hydraulic Structures	3 credits
MKAG1133	Coastal Engineering	3 credits
MKAG1213	Advanced Hydrology	3 credits
MKAG1223	Water Resources Management	3 credits
MKAG1233	Urban Stormwater Management	3 credits
Elective Courses – Choose any two from the following list (Total : 6 credits)		
MKAG 1143	River and Estuarine Hydrodynamics and Transport	3 credits
MKAG 1153	Fluvial Hydraulics	3 credits
MKAG 1163	Computational Environmental Hydraulics	3 credits
MKAG 1173	Water Supply Engineering	3 credits
MKAG 1183	Coastal Structures	3 credits
MKAG 1193	Port and Harbour Engineering	3 credits
MKAG 1243	Ground Water Hydrology	3 credits
MKAG 1253	Ground Water Modelling	3 credits
MKAG 1263	Irrigation Engineering	3 credits
MKAG 1273	Statistical Hydrology	3 credits
MKAG 1313	Computational Fluid Mechanics	3 credits
Free Elective Courses (Total : 6 credits)		
Choose any two subjects offered by other programmes, faculties or from the above elective subjects		6 credits
Masters Project (Total : 7 credits)		
MKAG 1514	Masters Project 1	3 credits
MKAG 1526	Masters Project 2	4 credits
TOTAL CREDITS		**46 credits**
Duration of Study		
Full Time	: 3 – 6 semester	

COURSE SYNOPSIS

CORE COURSES

MKAG 1113 - Advanced Hydraulics
This course is designed to introduce advanced concepts of fluid mechanics in relation to viscous flows. It covers laminar flows, transition to turbulence and turbulent flows and will be taught with civil engineering applications in mind. The students should understand the topics of open channel flow, friction and sediment transport from the fundamental point of view. In this course, unsteady flow in open channels and pipes - topics of specific interest to civil engineers – will also be covered.

MKAG 1123 - Hydraulic Structure
This course covers common types of hydraulic structures that are designed to control, or transmit and to maintain water levels in stream or channels. These structures include dam, dam outlet works, spillways, energy dissipators, intake structures, river diversion works, weirs, barrages, hydropower and pumping stations. It is related to fluid mechanics and hydraulics and the understanding on subject matters will be further enhanced through refined information and procedures that are detailed out in relevant standard code of practice and design manual.

MKAG 1133 - Coastal Engineering
The course covers theoretical and fundamental principles of coastal hydrodynamics and processes. It gives background knowledge of the various hydrodynamic parameters acting in the coastal region due to waves, tides and currents. Sediment transport mechanism in the littoral zone leading to the understanding of coastal morphology, erosion and accretion processes are described. Underlying principles of coastal engineering works, coastal erosion management and implications from implementing coastal structures in the coastal environment are delivered. Emphasis in solving and tackling coastal engineering problems adopts the use of established analytical techniques. The application of state-of-the-art computational techniques as a tool in several aspects of coastal engineering and management works are introduced. At the end of the course, students should be able to describe and analyse the various coastal processes and the effect of these forces on the coastal zone. The students should be able to quantify coastal environmental parameters. They should also be capable of proposing methods to manage and control the coastal processes when applied to solve coastal engineering problems.

MKAG 1213 - Advanced Hydrology
The study in hydrological processes and systems, include the rainfall, evapotranspiration, infiltration, soil water processes and overland flow. Aspect of rainfall-runoff processes and hydrologic routing are discussed and how these are modelled for use in flood estimation. Various rainfall-runoff models are reviewed. The surface water quality aspect also covered.

MKAG 1223 - Water Resources Management
This course covers an integrated water resources perspective including social, economic, environmental and reservoir management and design Knowledge

and expertise will be developed in relevant topics which include: water resources issues, water resource development, water law, policy and institutions, water resource planning, reservoir yield and operation, river basin management, water resources system analysis, risk and reliability analysis.

MKAG 1233 - Urban Stormwater Management
The subject mainly covers the theoretical aspects and design of urban storm water drainage system. This includes drainage planning process, non-structural planning, control option for flow reduction and pollution minimization. Importance and impacts of best management practices of urban storm water management are also covered throughout the topics. At the end of the course, the students are being exposed to design elements in urban drainage and flood control systems that comply with Malaysian design criteria. The students will also realize the importance of urban storm water management and be exposed to real projects examples.

ELECTIVE COURSES

MKAG 1143 - River and Estuarine Hydrodynamics and Transport
This course is designed to expose the students to surface water modelling including an overview of the present state-of-the-art of modelling and analysis of hydrodynamics, eutrophication, and toxic materials (organic chemicals and metals) and review of recent trends in river and estuarine. This course will cover the hydrodynamics consideration as well as sediment transport.

MKAG 1153 - Fluvial Hydraulics
This course is formulated largely to give an overall view of the mechanics of sediment transport in open channel, river and coastal areas. Local erosion, particularly around bridge piers, important from the point of view of structural integrity is treated. Also included in the course is some treatment of physical modelling. The various properties of cohesive and non-cohesive soils are considered in the course where sediment motion for cohesive soils is more complicated. An element of design is added to the course to apply the various principles studied to a typical engineering problem. Report writing is given importance. Fluvial Hydraulics is basically a course for engineers who want to come to terms with the field of sediment transport.

MKAG 1163 - Computational Environmental Hydraulics
This course covers the environmental aspects in the field of hydraulics. Environmental Hydraulics is the hydrodynamic aspects of water quality management in natural body of water. This course will consist of the examination of the physical, chemical and biological attributes of flowing water, with the objective of protecting and enhancing the quality of the environment. Environmental hydraulics include coastal ecosystem, river and flood management, dam break, chemical and oil spill migration, water quality and pollutant transport, sediment transport including shoreline erosion and dredged spoil disposal, aquaculture management and environmental

information systems

MKAG 1173 – Water Suppy Engineering
The course discusses broad range of topics that include water uses and demand, water demand forecasting, sources of water supply, water distribution and transmission systems, water treatment processes, water quality criteria and safe drinking water act, water tariff and non-revenue water (NRW)

MKAG 1183 – Coastal Structure
The course is designed to provide a detailed understanding of the design of the design process of coastal engineering structures such as breakwaters, revetments, groynes, etc as well as an introduction to soft engineering approaches including beach drainage systems and biotechnical methods. Statistical distribution and analysis of wave data will also be highlighted in order to derive the design wave parameters

MKAG 1193 - Port and Harbour Engineering
This course introduces students to the fundamentals and functional requirements of port planning and design, ranging from small craft harbours to large commercial ports. The course will focus on both hydrodynamic concerns and construction aspects such as breakwater design, berthing layout, land reclamation and dredging. Students are also introduced to the design procedures for a variety of structure types, including bulkheads and piers, fender and mooring systems, breakwaters and revetments. Special considerations of sedimentation in navigation channels and in turning basins are also discussed. Examples of case studies are presented and students will be required to apply the knowledge gained in the class to plan and design a 'hypothetical' port.

MKAG 1243 – Ground Water Hydrology
The course has been prepared for hydrologists and engineers interested in learning groundwater exploration, exploitation, quality control and management. The course gives emphasis on basic hydrogeology and nature of groundwater, groundwater occurrence, groundwater movement, groundwater investigation and development, well hydraulics, evaluation of groundwater resources, contamination of groundwater resources, mass transport and subsurface contaminants

MKAG 1253 – Ground Water Modelling
The course introduces the methods commonly used to model groundwater flow and solute transport in the subsurface of the Earth. The course is designed to focus on the applications of finite difference and finite element methods for hydrogeological modeling. The course covers analytical and numerical procedures, one- and two-dimensional steady state and transient flow modeling, solute transport modeling, and multi-phase solute transport modeling.

MKAG 1263 – Irrigation Engineering
Presents the relevant topics on irrigation engineering that covers the soil-water relationship, factors influencing crop production. Economic analysis, crop water requirements, irrigation scheduling, planning and design procedure for surface and pressurized irrigation system, canal design and water control structures.

MKAG 1273 - Statistical Hydrology
This course has been prepared for hydrologists and engineers interested in learning how statistical models and methods can be valuable tools in the analysis and solution of many hydrologic and engineering problems. The random variability of hydrologic variables such as stream flow, precipitation, and groundwater level has been recognized for centuries. Hydrology is one of the areas of science and engineering to use statistical concepts in an effort to analyse natural phenomena. The course introduces statistics, probability, and time series, and their application to problems in hydrology. This includes parametric and non-parametric methods of uncertainty analysis, trend analysis, hypothesis test, correlational analysis, regression analysis as well as probability distribution, frequency analysis, stochastic analysis, and time series modelling.

MKAG 1313 – Computational Fluid Mechanics
The course provides relevant topics in fundamental of matrix algebra, numerical solution of ordinary and partial differential equation, elliptic and parabolic partial differential equation, finite difference method, finite element method and application in fluid mechanics. The students will write some simple program to appreciate the method of solution