UNIVERSITY of TECHNOLOGY, MAURITIUS

School of Innovative Technologies & Engineering

Department of Industrial Systems Engineering

BEng (Hons) Civil Engineering (Top-Up)

PROGRAMME DOCUMENT

VERSION 2.5
BECE v 2.5
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University of Technology, Mauritius
La Tour Koenig, Pointe aux Sables, Mauritius
Tel: (230) 207 5250 *Fax:* (230) 234 1747 *Email:* site@umail.utm.ac.mu
Website: www.utm.ac.mu

BEng (Hons) Civil Engineering (Top-Up)

A. Programme Information

This programme is a top-up BEng degree and is designed to integrate a wider variety of study areas such as in engineering, research, development, planning, design and construction modules which will equip graduates to be the engineers of tomorrow. Graduates will fully develop their professional qualities and skills as civil engineer and they will also acquire more technical tools and abilities required for effective professional practice.

In Levels 3 and 4 of the programme, the students will gain advanced knowledge as a preparation to work in a real environment. Also, the students will have a higher degree of freedom to select some specific engineering modules specialising their fields of study. The students will also have to undertake an industrial attachment and to complete a final year project to be qualified for the BEng (Hons) Award.

The Bridge Modules

The bridge modules are introduced in the programme and the aims is to provide an introduction to fundamental and important topics such as foundation and engineering maths, principles of engineering, material science, construction, concrete technology and engineering management amongst others in order to ensure that the students have sufficient knowledge and aptitude to cope with the more advanced modules that follow as well as to ensure that they have same knowledge and skills as full time students who are following Four-year BEng programme in order to be able to apply their engineering skills, combining theory and experience, and to use other relevant knowledge and skills which include knowledge of characteristics of particular materials, equipment, processes, or products, workshop and laboratory skills, knowledge of quality issues, knowledge of codes of practice and industry standards, ability to work with technical uncertainty etc.

Research Methods Seminar for Engineers

The aim is to present a 2-day seminar (12 hours) on scientific approaches to research in engineering (with a specific emphasis on the difference between research and implementation). The seminar will help the students to acquire knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline. The students will be able to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs and to comprehend the broad picture and thus work with an appropriate level of detail in engineering fields.

B. Programme Aims

The programme aims to provide the students with:

- A curriculum which provides a broader range of subjects to facilitate the development of skills, abilities, pursuit of interest and promotion of career development
- The ability to contribute to the new and modern developments and maintenance of infrastructural facilities and systems
- The confidence to design, build and manage more advanced building and structural systems
- A wider range of transferable and marketable skills and knowledge leading to a variety of employment opportunities within the design and wider associated engineering industries
- Teaching and learning techniques which place emphasis on active and participative education
- The ability to apply modern technologies to solve various areas of engineering

C. Programme Objectives

After successful completion of the programme, students should be able to

- apply knowledge of science modules and engineering
- design and conduct experiments in various engineering areas such as environmental engineering, transportation engineering and geotechnical engineering
- design civil engineering system or process to meet specified performance, cost, time and safety
- identify, formulate and solve various civil engineering problems
- apply knowledge to produce engineering solutions
- meet the expectations of the professional environment in relation to their intended careers

PART I - Regulations

D. General Entry Requirements

As per UTM'S Admission Regulations, and 'Admission to Programmes of Study at Degree Level'.

E. Programme Entry Requirements

(i) Holding an HSC with "A" Level in Mathematics and one of the following subjects: Physics, Chemistry, Physics with Chemistry, Design and Technology, or any other applied science subject acceptable to APL/APEL committee at HSC, GCE "A" Level, or Baccalaureate.

(ii) Holding an Advanced or Higher Diploma or Higher National Diplomas or Brevet de Technicien Superieur of the MITD or Full Technological Diploma of the City and Guilds of London Institute, in Civil Engineering, or any other diplomas in the relevant field acceptable to APL/APEL committee UTM and CRPE.

Following are the Diploma courses Eligible for Entering into the Programmes:

1. Diploma in Civil Engineering (IST).
2. Diploma in Civil Engineering (MITD).
3. Full Technological Diploma in Civil Engineering (City & Guilds).

F. Programme Mode and Duration

Full Time:	2.5 years (5 Semesters)
Part Time:	3.5 years (7 Semesters)

G. Teaching and Learning Strategies

- Lectures, Tutorial and Practical
- Tests and Assignments
- Workshops and Seminars
- The student would be expected to perform a substantial amount of self learning both for the theoretical and practical part of the modules.

H. Student Support and Guidance

- Intensive tutoring conducted during Week 8 of the semester.

I. Attendance Requirements

As per UTM's Regulations and Policy.

J. Credit System

1 module = 3 or 4 or 6 credits
Final Year Project = 9 credits

K. Student Progress and Assessment

For the award of the degree, all modules must be passed overall with passes in the examinations, coursework and other forms of assessment. All modules will carry 100 marks and will be assessed as follows (*unless otherwise specified*):

(i) Written examinations inclusive reading time shall be of duration of 2-3 hours for 3-credit modules and not less than 3 hours for 4-credit modules and above.

(ii) Continuous assessment may vary up to a maximum of 100% of the total module marks. Continuous assessment can be based on a combination of assignments, field study, workshops and class tests.

(iii) The overall pass mark for a module is 40%.

Grading

Grade	*Marks x(%)*
A	$x \geq 70$
B	$60 \leq x < 70$
C	$50 \leq x < 60$
D	$40 \leq x < 50$
F	$x < 40$
A - D	Pass
F	Fail

L. Evaluation of Performance

The percentage mark at Level 3 contributes a 40% weighting towards the degree classification.

The percentage mark at Level 4 contributes a 60% weighting towards the degree classification.

The maximum marks attainable for each level are:

Level 3: 1200

Level 4: 1300

M. Award Classification

Overall weighted mark y (%)	**Classification**
$y \geq 70$	1st Class Honours
$60 \leq y < 70$	2nd Class 1st Division Honours
$50 \leq y < 60$	2nd Class 2nd Division Honours
$45 \leq y < 50$	3rd Class Honours
$40 \leq y < 45$	Pass Degree
$y < 40$	No Award

N. Programme Organisation and Management

Programme Director & Coordinator: Mr Dudley Tse Kai Wai

Contact Details:

- Room: G2.26
- Telephone Number: 207 5250
- Email: dtse@umail.utm.ac.mu

UTM-JSSA Liaison Officer : Dr V. Armoogum (varmoogum@utm.intnet.mu)

PART II -Programme Structure

O. BEng (Hons) Civil Engineering (Top Up) – Full Time (Version 2.1)

YEAR 1 (Level 3)							
Semester 1				***Semester 2***			
Code	**Modules**	**L+T/P+DS**	**Credits**	**Code**	**Modules**	**L+T/P+DS**	**Credits**
MATH1201	*Foundation Mathematics (Bridge module)*	*2+2+0*	*4*	*CIV3107*	*Concrete Technology*	2+1+0	3
ASE1103	*Principles of Civil Engineering (Bridge module)*	*2+1+1*	3	*CIV3124*	*Structural Design of Concrete Structures*	2+1+0	3
CIV3105	*Materials and Building Construction (Bridge module)*	*2+1+1*	3	*CIV3103*	*Quantity Survey and Estimation*	2+2+0	4
CIV3108	*Design and Drawing of Steel Structures*	2+2+0	4	*CIV3126*	*Structural Analysis*	2+1+0	3
CIV3101	*Environmental Engineering (Part 1)*	2+1+0	-	*CIV3101*	*Environmental Engineering (Part 2)*	2+1+0	6
CIV3102	*Transportation Engineering (Part 1)*	2+1+0	-	*CIV3102*	*Transportation Engineering (Part 2)*	2+1+0	6

YEAR 2 (Level 4)							
Semester 3				***Semester 4***			
Code	**Modules**	**L+T/P+DS**	**Credits**	**Code**	**Modules**	**L+T/P+DS**	**Credits**
CIV4101	*Advanced Surveying*	2+1+0	3	*PROJ4109*	*Industrial Attachment*		3
CIV4102	*Advanced Design of Steel Structures*	2+1+0	3		*Elective 1*		3
CIV4103	*Highway Geometric Design*	2+1+0	3				
CIV4104	*Design of Hydraulic Structures*	2+1+0	3				
SEM3107	*Project Management for Engineers (Bridge module)*	*2+1+0*	*3*				
CIV4125	*Geotechnical Engineering*	2+1+0	3	*PROJ3112*	*Final Year Project*		-

Inter Level Activity (at the end of Level 3)			
Code	**Seminar**	**Hrs/Wk**	**Credits**
-	Research methods	12 hours (2-day workshop)	No credit, but Compulsory

YEAR 3 (Level 4)							
Semester 5							
Code	**Modules**	**L+T/P+DS**	**Credits**				
CIV4106	*Advanced Design of RC Structure*	2+1+0	3				
	Elective 2		3				
PROJ3112	*Final Year Project*		9				

P. BEng (Hons) Civil Engineering (Top Up) – Part Time (Version 2.1)

YEAR 1 (Level 3)							
	Semester 1				***Semester 2***		
Code	**Modules**	**L+T/P+DS**	**Credits**	**Code**	**Modules**	**L+T/P+DS**	**Credits**
MATH1201	*Foundation Mathematics (Bridge module)*	*2+2+0*	*4*	*CIV3108*	*Design and Drawing of Steel Structures*	2+2+0	4
ASE1103	*Principles of Civil Engineering (Bridge module)*	*2+1+1*	3	*CIV3107*	*Concrete Technology*	2+1+0	3
CIV3105	*Materials and Building Construction (Bridge module)*	*2+1+1*	3	*CIV3104*	*Structural Design of Concrete Structures*	2+1+0	3
CIV3101	*Environmental Engineering (Part 1)*	2+1+0	-	*CIV3101*	*Environmental Engineering (Part 2)*	2+1+0	6

YEAR 2 (Levels 3 & 4)							
Semester 3				***Semester 4***			
Code	**Modules**	**L+T/P+DS**	**Credits**	**Code**	**Modules**	**L+T/P+DS**	**Credits**
CIV3103	*Quantity Survey and Estimation*	2+2+0	4	*CIV3126*	*Structural Analysis*	2+1+0	3
CIV4101	*Advanced Surveying*	2+1+0	3	*CIV4104*	*Design of Hydraulic Structures*	2+1+0	3
CIV3102	*Transportation Engineering (Part 1)*	2+1+0	-	*CIV3102*	*Transportation Engineering (Part 2)*	2+1+0	6
SEM3107	*Project Management for Engineers (Bridge module)*	*2+1+0*	*3*	*PROJ4109*	*Industrial Attachment*	-	3

Inter Level Activity (at the end of Level 3)			
Code	**Seminar**	**Hrs/Wk**	**Credits**
-	Research methods	12 hours (2-day workshop)	No credit, but Compulsory

YEAR 3 (Level 4)							
Semester 5				***Semester 6***			
Code	**Modules**	**L+T/P+DS**	**Credits**	**Code**	**Modules**	**L+T/P+DS**	**Credits**
CIV4103	*Highway Geometric Design*	2+1+0	3	*CIV4106*	*Advanced Design of RC Structure*	2+1+0	3
CIV4102	*Advanced Design of Steel Structures*	2+1+0	3		*Elective1*		3
CIV4125	*Geotechnical Engineering*	2+1+0	3				
PROJ3112	*Final Year Project*		-	*PROJ3112*	*Final Year Project*		-

YEAR 3 (Level 4)			
Semester 7			
Code	**Modules**	**L+T/P+DS**	**Credits**
	Elective 2		3
PROJ3112	*Final Year Project*		9

List of Electives			
Code	**Modules**	**L+T/P+DS**	**Credits**
CIV4107	*Environmental Impact Assessment*	2+1+0	3
CIV4108	*Numerical Methods in Civil Engineering*	2+1+0	3
CIV4109	*Quality Management System in Civil Engineering*	2+1+0	3
CIV4110	*Sustainable Development and Green Construction*	2+1+0	3
CIV4111	*Traffic Engineering*	2+1+0	3
CIV4105	*Geographic Information System*	2+1+0	3

Q. MODULE OUTLINE

MATH1201: Foundation Mathematics (2+2+0) – Bridge Module

Differentiation – Integration - Matrices – Vectors – Determinants - Complex numbers -Polar coordinates - Hyperbolic functions – Limits - Partial derivatives - First-order ordinary differential equations - Linear ordinary differential equations of second and higher order - Probability theory - Bayes' theorem - Random variables and distribution functions - Mathematical expectation and generating functions

ASE1103: Principles of Civil Engineering (2+1+1) – Bridge Module

fundamental characteristics of civil engineering projects, including how civil engineers model projects, the tools used to model design problems, how to approach the design process, and the societal concerns that constrain our engineering designs.

CIV3105: Materials and Building Construction (2+1+1) – Bridge Module

Tensile strength, wrought iron, cast iron, modulus of elasticity, Portland cement, annealing, briquettes, shearing stress, manganese, tensile stress, phosphorus, ductility, open-hearth process, mortar, Bessemer process, silica, tracheids, red-shortness, specific gravity, compressive stress, Investigation of soil, Bearing capacity of soil, different types of foundations, masonry footings, definition of terms used in masonry, joints in stone masonry, masonry arches, method of constructions, balcony, functions, types of flooring, polished granite, types and technical terms in stairs, paneled and glazed doors, plastering and painting, purpose of plastering, materials of plastering, cement mortar methods of plastering, pre fabrication techniques, pre cast doors and windows, precast roofing elements.

SEM3107: Project Management for Engineers (2+1+0) – Bridge Module

Project Management Fundamentals, Feasibility Study for large technical projects, Project Planning, Project organization, Techniques for Project Scheduling, Resource management, Risk management, Budgeting & Cost Management, Communications management, Procurement management, Project Monitoring, Managing technical people, Project Evaluation and Termination

CIV3101 – ENVIRONMENTAL ENGINEERING

Human activities and environmental pollution, Demand of water: types of water demands , domestic/institutional/commercial water demand – Sources: surface and subsurface sources - Quality of water: objectives of quality of water management, concept of safe water- Water treatment: treatment flow chart, aeration, types of aerators – Filtration: mechanism, theory of filtration, types of filters – Disinfection: theory and types of disinfection, chlorination, use o bleaching powder, Softening: methods of removal of hardness by lime soda – Miscellaneous Treatment: removal of colour, odour and taste – Distributed Systems: System of supply, service reservoirs and their capacity determination.

CIV3102– TRANSPORTATION ENGINEERING

Principles of transportation engineering, Importance of Transportation, Different modes of Transportation - Highway development and planning: Road types and classification, road patterns, planning surveys, master plan, saturation system of road planning – Highway Alignment and Surveys: Ideal alignment, factors affecting alignment – Highway geometric design: Sight distance, types and importance - Pavement materials and Design: properties and requirements of road aggregates, types of pavement, design factors.

CIV3103– QUANTITY SURVEY AND ESTIMATION

Estimation: study of various drawing with estimates, units of measurements – Estimates: different types of estimates, approximate methods of estimating buildings, cost of materials – Specifications: definition of specification, objective of writing specification - Rate analysis: working out quantities and rates for standard items of works – Contracts: types of contracts, essentials of contract agreement, legal aspects, penal provisions on breach of contract, tender, earnest money deposit, duties and liabilities, termination of contract.

CIV3124– STRUTURAL DESIGN OF CONCRETE STRUTURES

Design of Reinforced Concrete Elements. Introduction to reinforced concrete structures, types of slabs, beams and columns. Limit state design philosophy. Stress/strain properties for concrete and reinforcement. Design for flexure including moment curvature, ductility and redistribution of bending moments. Empirical methods for checking Serviceability (ie cracking and deflection). Design of shear reinforcement. Design of columns for axial load and bending moment

CIV3126– STRUCTURAL ANALYSIS

Rolling load and Influence Lines. Slope Deflection Method. Moment Distribution Method. Sway Analysis. Kanis Methods. Flexibility Matrix Method of Analysis.

CIV3107–CONCRETE TECHNOLOGY

Chemical Admixtures: mechanism of Chemical Admixtures, plasticizers and super plasticizers - Mineral Admixtures: fly ash, silica fume - Mix Design: factors affecting mix design, design concrete mix by BIS method using IS10262 and current American (ACI0/British (BS) method - Durability of concrete: permeability of concrete, chemical attack, acid attack, corrosion in concrete – Fiber reinforced concrete, fibers types and properties - lightweight concrete.

CIV3108– DESIGN AND DRAWING OF STEEL STRUCTURES

Connections: bolted and welded, bem-beam, beam-column, seated – Columns: Splices, column-column of same and different sections – Columns Bases: slab base and gusseted base, grillage foundation – Design and drawing of bolted and welded plate girder, roof truss and gantry girder.

CIV4125– GEOTECHNICAL ENGINEERING

Introduction. Index Properties of solids and their determination. Classification of soils. Clay mineralogy and soil structure. Flow of water through soils. Compaction of soils. Consolidation of soils. Shear strength of soils.

CIV4110– SUSTAINABLE DEVELOPMENT AND GREEN CONSTRUCTION

Soil and base stabilization with unconventional and recycled materials - Recycled plastics for soil reinforcement - Recycled aggregate from Construction and Demolition (C&D) wastes - sustainable, energy-efficient building walls

CIV4101– ADVANCED SURVEYING

Theory of Errors and Triangulation Adjustment – Probability distribution function and density function-normal distribution – Method of correlates: triangulation, angle, station and figure adjustment – Electronic Distance Measurement (EDM), Field Astronomy: Earth celestial sphere, solar system position by altitude – Time: sidereal time, day and year-solar time and day-Greenwich mean time-standard time – Hydrographic surveying: methods of soundings – Settingout works: setting out of buildings, bridge, pipeline and sewer.

CIV4102– ADVANCED DESIGN OF STEEL STRUCTURES

Introduction – Basic principles of design – Stress Strain relationship for mild steel, evaluation of full plastic moment for mild steel beams, plastic hinges, shapes factors and plastic moment – Statement of theorems with examples, application of principles of virtual work, partial over collapse, Trial error method, Method of combined mechanisms, plastic moment distribution method and other methods of determining plastic collapse load – Minimum weight theories, Application of theorems and methods of solution, Plastic analysis applied to the design of fixed and continuous beams, portal and gable frames – Design of Built-up beams, Design of encased beams – Design of open web structures, Advantages, Design Methods and Design of beams – Large and Small moment resistant connections, Semi-rigid and behaviour of semi-rigid connections, Beam line method – Principal of axes, Maximum stress due to unsymmetrical bending, the Z-polygon, Deflection of beams under unsymmetrical bending – Tubular structures: permissible stresses, tube columns and compression members, tube tension members, Design of members of tubular roof truss for given member forces and their combination joints in tubular trusses.

CIV4109– QUALITY MANAGEMENT SYSTEM IN CIVIL ENGINEERING

Evolution of Quality Management system, Element of Quality, Concept of process, ISO 9000 Family, Applying ISO 9000 in practice, Importance and benefits of ISO 9000 - Implementing ISO 9001-2000 quality management: ISO 9000 documents content, ISO 9001-2000 Quality Management System Requirements, General and documentation requirements – Preparing a ISO 9001-200 Quality Management System for Civil Engineering – Quality Management System Procedures – Work Instructions - Method Statement – Method Statement – Job Description – Quality Control Plan/Inspection and Test Plans (ITPS) – Quality Record/Formats: Preparation of standard formats, Document Master List, Non-Conformance Report.

CIV4103– HIGHWAY GEOMETRIC DESIGN

Geometric control factors – Cross sectional elements: pavement surface characteristics – Sight distance – Horizontal Alignment: – Vertical Alignment: types of gradients, design criteria of summit and valley curve – Intersection design – Rotary Intersection – Highway Drainage: sub surface drainage, design of cross section, hydrological and hydraulical considerations

CIV4106– ADVANCED DESIGN OF RC STRUCTURE

Design of RCC overhead circular and rectangular water tanks with supporting towers – design of silos, bunkers, design of RCC chimneys – Yield line analysis of slabs by virtual work – Design of grid floors labs by approximate method – design of flat slabs by direct designer method

CIV4104– DESIGN OF HYDRAULIC STRUCTURES

Canal Design: Cross section of an irrigation channel, Schedule of area statistics and channel dimensions, longitudinal section of a channel – Cross Drainage Works: Types of cross drainage works. Design considerations for cross drainage works, Fluming of canal – Gravity Dams: Causes of failure, Design principles, Principal and shear stresses, Elementary profile of a gravity dam – Earth Dams: Causes of failure of earth dams, Preliminary section of an earthen dam, Determination of phreatic line by Casagrande's method and analytical methods – Spillways: Components of spillways, Ogee shaped spillway, Discharge computation for an ogee spillway, Down stream profile and up stream profile of the crest of an Ogee spillway – Canal falls: Types of falls – Design of trapezoidal notch type fall – Canal Regulation Works: Functions of a regulator, Design of a cross regulator and a head regulator, Devices for sediment control.

CIV4107– ENVIRONMENTAL IMPACT ASSESSMENT

Development Activity and Ecological Factors EIA, EIS, FONSI – Step-by-Step procedures for conducting EIA, Limitations of EIA – Frame work of Impact Assessment. Development Projects Environmental Setting, Contents of EIA – Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-Economic Environment – EIA guidelines for development Projects, Rapid and Comprehensive EIA – Public Participation in Environmental Decision Making – Salient Features of the project Activity-Environmental Parameter Activity Relationships-Matrices – EIA for Water resource development projects

CIV4108 – NUMERICAL METHODS IN CIVIL ENGINEERING

Historical development of Numerical techniques, role of investigations, research and design in the field of civil engineering – Application of solution of linear system of equations to Civil Engineering Problems – Application of Root Finding to Civil Engineering Problems – Application of Numerical integration for solving simple beam problems – Development of algorithm and application of solution of ordinary differential equation to civil engineering problems by Euler's method and Runge Kutta – Application of Finite difference technique in structural mechanics.

CIV4109 – TRAFFIC ENGINEERING

Traffic characteristics and studies, Traffic flow theories, Statistical analysis, Traffic regulation and control

PROJ4109: INDUSTRIAL ATTACHMENT (15 WEEKS)

Students will be attached to a company or organization for a period of at least 15 weeks.

Students will have the opportunity to apply theoretical knowledge to solve real world problems in Civil Engineering. This module is compulsory and students therefore have to perform satisfactorily in this module before qualifying for the award of the degree. A UTM Civil Engineering Industrial Attachment Handbook will be provided to the students.

PROJ3112: FINAL YEAR PROJECT

Project allows the student to work independently to put the knowledge of civil engineering theory and other knowledge into practice. The final year project allows students to deepen their knowledge and specialize in an area/topic of their choice and in which they can prove themselves. It is an opportunity for developing analytical and problem solving skills in addition to other skills that cannot be taught in classrooms. The student will prepare and submit a report on the project. A detailed Civil Engineering Project Handbook will be provided to students before starting the projects.

RESEARCH SEMINAR: RESEARCH METHODS (12 hours)

The importance of carrying out a proper literature review in the appropriate field will be emphasized. Students will be exposed to major sources of literature in the engineering field and they will be taught how to spot quality sources in their relevant fields. Different research methods will be presented to students. They will learn how to choose the appropriate research method for solving a research problem. The main data collection methods will be introduced. Students will be taught how to design questionnaires, prepare interviews and design experiments. Finally, students will be taught how to present, analyze and interpret their findings. Students should at the end of this module be able to prepare a research proposal for their programme.