UNIVERSITY of TECHNOLOGY, MAURITIUS

School of Innovative Technologies and Engineering

Department of Industrial Systems Engineering

BSc (Hons) Computer Aided Design

PROGRAMME DOCUMENT

VERSION 3.0
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BSc (Hons) Computer Aided Design

A. Programme Information

The BSc (Hons) Computer Aided Design combines a study of the advanced computer technologies of visualisation for design and concept evaluations, including virtual modelling, simulation and analysis. Moreover, students will gain a sound theoretical and practical understanding of modern engineering technologies and their application to design, develop simulate and manufacture a wide range of engineering products and systems. Successful graduates will be versatile, adaptable, technically literate and creative, with practical skills relevant to the specification, design, simulation and analysis of design solutions.

Developing an understanding of computer technology is essential for all construction professionals. Computer Aided Design (CAD) is an increasingly important part of the construction process. From initial design to interior layout, students will develop the skills to participate in the total design process. The application of design technologies has almost infinite scope, from everyday consumable products to large passenger aircraft. Almost every manufactured product will have been conceived using computer-aided design tools, providing an extremely varied range of career opportunities.

Students will have to undergo a work placement in the second semester of level 3 so as to obtain a greater understanding of the practical applications of elements learned in the courses and to gain experience in a workplace industrial environment. In lieu of Work-Placement, part-time students in employment are required to submit a port-folio, as per the 'Requirements for Port-folio Submission'.

B. Programme Aims

The programme aims to provide the students with:

- A curriculum which provides a broad range of subjects to facilitate the development of skills, abilities, pursuit of interest and promotion of career development
- A course of study that develops students' intellectual and creative abilities by combining knowledge of creative design, technology and business to play a central role in shaping products, processes and services in the design industry
- A wide range of transferable and marketable skills and knowledge leading to a variety of employment opportunities within the design and wider associated engineering industries
- The ability to apply modelling and simulation tools and techniques to the validation of a design
- Teaching and learning techniques which place emphasis on active and participative education
- A fundamental understanding of the major elements of the design process
- An understanding of the factors and parameters which drive design
- The ability to critically analyse a product and the associated development process

- The ability to apply modern computer-based technologies to the product development process
- An understanding of the latest manufacturing processes and procedures

Employment Prospects

On completion of the degree course, the graduates will be highly employable and will be able to find appropriate positions in the industrial or commercial sectors, working in such areas as CAD-modelling and design, product development and testing, manufacturing, quality management, operations management, industrial/professional sales and marketing and education.

C. Programme Objectives

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

- understand the importance and relevance of modelling engineering systems before embarking on detailed designs
- understand the principles of optimising the behaviour of a system
- gain confidence in the use of software packages
- be experienced in the use of software as a design aid in a wide range of engineering problems.
- develop detailed knowledge and understanding of the most recent advances in 3D design, simulation and manufacturing
- design changes can be made quickly and cost effectively during the product development process
- 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

Any two 'A' Level with at least one science subject

F. Programme Mode and Duration

Full Time: 3 years (6 Semesters)
Part Time: 4 ½ years (8 Semesters)

G. Teaching and Learning Strategies

- Lectures, Tutorial and Practical
- Class tests and Assignments
- Workshops / Seminars / Lab Sessions
- Structured Discussions & Self Study
- 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

- Academic Tutoring: 3 hours per week per module

I. Attendance Requirements

As per UTM's Regulations and Policy

J. Credit System

1 module = 3 or 4 credits

Prototyping 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):

- Written examination, inclusive of reading time, of duration of 2 - 3 hours for modules carrying 3 credits and not less than 3 hours for modules carrying 4 credits, and continuous assessment carrying up to 40% of total marks.
- Seminars are assessed on continuous assessment only. Each seminar must consist of a ***minimum of two*** assessments.
- Continuous assessment can be based on workshops, practical labs or/and assignments or class tests.

In the third year, the students will have to carry out a prototyping project which will carry 300 marks.

L. Evaluation of Performance

The percentage mark at Level 1 contributes a 20% weighting towards the degree classification.
The percentage mark at Level 2 contributes a 30% weighting towards the degree classification.
The percentage mark at Level 3 contributes a 50% weighting towards the degree classification.

Module grading structure:

Grade	Marks x (%)
A	$70 \leq x$
B	$60 \leq x < 70$
C	$50 \leq x < 60$
D	$40 \leq x < 50$
F	$x < 40$

A-D	Pass
F	Fail

M. ward 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 and Coordinator: Mr. Dudley Tse Kai Wai

Contact Details:

- Room: G2.26
- Telephone Number: 207 5252
- Email: dtse@umail.utm.ac.mu

PART II -Programme Structure

O. BSc (Hons) Computer Aided Design – Full Time (Version 3.0)

YEAR 1 (Level 1)							
Semester 1				***Semester 2***			
Code	**Modules**	**Hrs/Wk** L T/P	**Credits**	**Code**	**Modules**	**Hrs/Wk** L T/P	**Credits**
PROG1XXXC	*Computer Programming Paradigm I*	2+2	4		*3D Animation and Programming*	2+2	4
	Industrial Drawing	2+2	4		*Computer Aided Engineering*	2+2	4
CAD1101C	*CAD Fundamentals*	2+2	4		*Design Elements and Methods*	2+2	4
MATHXXXXC	*Decision Mathematics*	2+1	3		*Engineering Fundamentals*	2+1	3
SEM1XXXC	*Professional Practice Seminar*	2+1	3		*Materials and Manufacture*	2+1	3

YEAR 2 (Level 2)							
Semester 1				***Semester 2***			
Code	**Modules**	**Hrs/Wk** L T/P	**Credits**	**Code**	**Modules**	**Hrs/Wk** L T/P	**Credits**
CAD2102C	*Advanced CAD*	2+2	4		*Visual Engineering*	2+2	4
	Manufacturing Essentials and Technology	2+1	3		*Advanced 3D Animation and Programming*	2+2	4
	Modelling Practice	2+2	4		*Computer Aided Manufacturing*	2+2	4
	Computer-Aided Engineering Mathematics	2+1	3	*MATHXXXXC*	*Geometry*	2+1	3
	Design Theory	2+1	3		*Advanced Manufacturing*	2+2	4

YEAR 3 (Level 3)							
Semester 1				***Semester 2***			
Code	**Modules**	**Hrs/Wk** L T/P	**Credits**	**Code**	**Modules**	**Hrs/Wk** L T/P	**Credits**
MANU1104C	*Product Design and Development*	2+2	4		*Work Placement*		10
	Creative Modelling	2+2	4				
	Prototyping	2+2	4				
PROJXXXC	*Prototyping Project*						9

P. BSc (Hons) Computer Aided Design – Part Time (Version 3.0)

YEAR 1							
→ *Start of Level 1*							
Semester 1				***Semester 2***			
Code	**Modules**	**Hrs/Wk** L T/P	**Credits**	**Code**	**Modules**	**Hrs/Wk** L T/P	**Credits**
PROG1XXXC	*Computer Programming Paradigm I*	2+2	4		*3D Animation and Programming*	2+2	4
	Industrial Drawing	2+2	4		*Engineering Fundamentals*	2+1	3
CAD1101C	*CAD Fundamentals*	2+2	4	SEM1XXXC	*Professional Practice Seminar*	2+1	3
MATHXXXXC	*Decision Mathematics*	2+1	3				

YEAR 2							
				→ *Start of Level 2*			
Semester 1				***Semester 2***			
Code	**Modules**	**Hrs/Wk** L T/P	**Credits**	**Code**	**Modules**	**Hrs/Wk** L T/P	**Credits**
	Design Elements and Methods	2+2	4	*CAD2102C*	*Advanced CAD*	2+2	4
	Computer Aided Engineering	2+2	4		*Manufacturing Essentials and Technology*	2+1	3
	Materials and Manufacture				*Computer-Aided Engineering Mathematics*	2+1	3
End of Level 1 →							

YEAR 3							
Semester 1				***Semester 2***			
Code	**Modules**	**Hrs/Wk** L T/P	**Credits**	**Code**	**Modules**	**Hrs/Wk** L T/P	**Credits**
	Advanced 3D Animation and Programming	2+2	4		*Visual Engineering*	2+2	4
	Modelling Practice	2+2	4		*Computer Aided Manufacturing*	2+2	4
	Design Theory	2+1	3		*Geometry*	2+1	3
End of Level 2 →							

YEAR 4

➔ *Start of Level 3*

Semester 1				***Semester 2***			
Code	**Modules**	**Hrs/Wk** L T/P	**Credits**	**Code**	**Modules**	**Hrs/Wk** L T/P	**Credits**
MANU1104C	*Product Design and Development*	2+2	4		*Prototyping*	2+2	4
	Advanced Manufacturing	2+2	4		*Portfolio*		10
	Creative Modelling	2+2	4				
PROJXXXC	*Prototyping Project*			PROJXXXC	*Prototyping Project*		9

Q. MODULE OUTLINE

MATHXXXXC: DECISION MATHEMATICS

- Algorithms – Sorting, Bin-packing and binary-search algorithms
- Graphs and networks - Mathematical modelling, Graph representations, Special graphs
- Algorithms on graphs - Minimum spanning tree, Kruskal's, Prim's and Dijkstra's algorithms
- The route inspection algorithm
- Critical path analysis
- Linear programming involving two variables – Formulation, Graphical solution, Feasible and optimal solutions, Integer-valued problems
- Network flows - Sources, sinks and flows, Flow-augmenting paths, Maximum flows and minimum cuts, Multiple sources and sinks
- Sets - Set operations and identities, Computer representation of sets
- Probability - Axioms of probability, Discrete and continuous random variables, Probability density function and cumulative distribution function, Expectation and variance

CAD1101C: CAD FUNDAMENTALS

- Historical development of CAD Systems
- Types of drawing in product design
- Creation of 2D and 3D models
- Technical report using a combination of CAD and IT tools

PROG1XXXC: COMPUTER PROGRAMMING PARADIGM I

- C Language basics
- C Fundamental data types
- Loops & Iterations
- Data input & output
- Arrays & Pointers

SEM1XXX C: PROFESSIONAL PRACTICE SEMINAR

- Organization Structure and role of ICT in organizations
- Ethics in ICT Profession
- Health & Safety Issues in ICT
- IT Contracts
- Intellectual Property – copyright & patents
- Data Protection
- Computer Misuse
- Electronic Transactions
- Green Issues
- Professional communication
    - Carry out presentations
    - Participate and organize meetings
    - Electronic communication

XXXXX-INDUSTRIAL DRAWING

Geometric: Isometric and Perspective

- Plano metric
- Line of intersection
- Bending moment
- Forces diagram
- Piping, hydraulic and bearing

XXXX- ENGINEERING FUNDAMENTALS

- Solve a range of mechanics, dynamics and kinematics problems and make use of the underlying concepts and principles
- Introduction to mechanical engineering fundamentals
    - Basic applied mechanics
    - Statics
    - Friction
    - Loading of beams
    - Stress & strain
    - Stress in beams and shafts
    - Motion of bodies
    - Newton's laws, impulse and momentum

XXXX- MATERIALS AND MANUFACTURE

- Materials properties and characteristics
- Mechanical testing methods
- Materials selection methods
- Manufacturing processes
- Characteristics of polymers and composites
- Polymer and other processing techniques
- Surface modification techniques
- Origin and identification of common defects

XXXXX: 3D ANIMATION AND PROGRAMMING

- Transformation of objects in 3D space
- Pivot points
- Animating a hierarchy of objects
- Setting and modifying a key-frame
- Copying and looping animation
- Understanding function curves
- Previewing an animation
- Using curves to animate objects
- Rendering a sequence of high-resolution images

XXXX- DESIGN ELEMENTS AND METHODS

- Mechanisms, design and redesign, concepts, materials and manufacturing processes, component selection, joining methods, ergonomics, presentation of design solutions
- Design for manufacture, problem solving, economic decision making

XXXX- COMPUTER AIDED ENGINEERING

- Introduction to geometric modelling technology and associated computational geometry
- A study of data exchange issues related to analysis and simulation
- An examination of rapid prototyping and rapid tooling
- An overview of sensitivity studies and shape optimisation
- An insight into the analysis and simulation of plastic and composite components

CAD2102C- ADVANCED CAD

- Part modelling
- Assembly Modelling
- Engineering Drawing
- Photo-realistic rendering
- Complex object modelling
- Designing with CAD
- Customization

MATHXXXXC: COMPUTER-AIDED ENGINEERING MATHEMATICS

- Sets, relations and functions
- Cartesian coordinates
- Lines in plane
- Graphing relations
- Trigonometry
- Polar coordinates
- Radians arcs and sectors
- Rotation and translation in a plane
- Cartesian coordinates in 3D
- Vector and matrix algebra
- Scalar and cross products
- Direction cosines and direction ratios
- Equation of a straight line in space
- Equation of a plane
- Distance of a point from a plane
- Systems of linear equations
- Direct methods for solving linear systems of equations
- Cylinders and spheres
- Differentiation and integration
- Surfaces of revolutions

XXXXXX: ADVANCED 3D ANIMATION AND PROGRAMMING

- Advanced 3D animation techniques and tools
- Advanced design and artistic
- 3D technical processes

XXXX- DESIGN THEORY

- Visual perception and visual theory
- Aesthetics of design and product semantics
- Form and function, colour theory and practice, surface attributes
- The process of design, the design brief, problem identification, analysis and solving, objective setting, creative thinking, concept generation and evaluation, concept development and finalisation, communication techniques

MATH 1XXXC: GEOMETRY

- The Geometry of Numbers
- Coordinate Geometry
- The Geometry of the Euclidean Plane
- The Geometry of Complex Numbers
- Solid Geometry
- Projective Geometry
- Conics and Quadric Surfaces
- Spherical Geometry
- Quaternions and Octonions

XXXX- COMPUTER AIDED MANUFACTURING

- Failure of materials – ductile and brittle failure, fatigue, creep, corrosion, friction and wear, metal cutting, sheet and metal work
- CNC machines and programs, CAD/CAM systems, flexible and dedicated automation, work holding systems, tooling systems and management, performance testing

XXXX- MODELLING PRACTICE

- Documentation of the design process
- How a product develops from initial ideas
- Visual development of ideas through sketching and rendering
- Examples of communication methods and styles according to audience
- Line thickness, shading, freehand isometric and orthographic projection
- Equipment and materials required
- Avoiding costs by using standard equipment efficiently
- Annotation and detailing sketch drawings
- Aesthetics and Ergonomics
- Form and function
- Making products that work and look good
- Using colour and shadows
- Bringing the product to life
- Health and Safety issues in the workshop
- Tools, materials and associated hazards
- Shaping in Styrofoam using hand tools
- Learning about materials
- Scale modelling
- Full size or less
- Creating appearance models using resistant materials
- Detailing and finishing
- Buttons, split lines and coating effects

XXXX- MANUFACTURING ESSENTIALS AND TECHNOLGY

- Development of manufacturing philosophies
- Introduction to the fundamentals methods of forming, joining and assembling manufactured products
- Manufacturing planning and costing of simple manufactured products
- Deepened knowledge of materials and manufacturing technologies within the range of vehicle and/or automobile construction is to be acquired
- Acquisition of knowledge of current developments
- Mediation of the fundamentals of mounting techniques and robotics and the sheet metal working in the construction of vehicles

XXXX- VISUAL ENGINEERING

- Computer Aided Design systems
- CAD/CAM
- Rapid prototyping

MANU1104- PRODUCT DESIGN AND DEVELOPMENT

- Product Development Approach
- Concurrent engineering models
- Design process with customer involvement
- Rapid prototyping systems

XXXX- CREATIVE MODELLING

- CAD as an advanced design and visualisation tool, wireframe, formwork, surfacing, shading, rendering, applied graphics, creating CAD models of engineering/design solutions
- Surface modelling and solid modelling systems
- Colour, texture, reflections, shadows
- Constructing large complex assemblies

XXXX- ADVANCED MANUFACTURING

- Manufacturing planning and organisation for inventory control
- Assembly processes, assembly strategies, assembly automation
- The influence of product design and the use of modern materials and manufacturing processes
- Current industrial robot systems are reviewed together with aspects of advanced robotics including force and vision sensor systems

XXXX- PROTOTYPING

- Inspection - Linear dimensions, Diametric Dimensions, Angular Dimensions
- Computer Aided Part Programming - Machine Definition, Tooling Definition, Tool path Creation, Post processing, Program upload
- Rapid Prototyping

XXXXC: PROTOTYPING PROJECT

- The objective of this prototyping project is to consolidate and to put into practice what the students have learned. The project will consists of four main components principally the modelling phase, design phase, implementation phase and testing phase.