

**2011-2012**

## **MSC(ENG) IN BUILDING SERVICES ENGINEERING**

### **Programme Objectives**

The programme provides advanced education in the fields of design, management and operation of modern building services engineering systems to practising engineers or related professionals who wish to acquire new knowledge and keep abreast of technical developments in the building services industry.

### **Modes of Study**

There are two modes of study available: full-time or part-time. Classes will normally be arranged in the evening on weekdays and in the morning on Saturdays. For the full-time students, some courses may also be taught in the daytime on weekdays.

The full-time programme requires a student to satisfactorily complete 8 modules and a project within a study period of 1 to 2 years. For the students enrolled in the part-time programme, they may opt to either satisfactorily complete 12 modules or 8 modules plus a project within a study period of 2 to 3 years.

### **Study Modules**

The following study modules are the core courses of the programme. A number of these core courses will be selected for offer to students in each academic year. A student who does not undertake a project must complete at least 8 core courses whereas a student who undertakes a project must complete at least 5 core courses. Optional courses are available from other MSc programmes in the Faculty of Engineering for selection by students.

The following list is not final and some courses may not be offered every year.

#### **MEBS6000. Utility services**

Cold and hot water supply: water distribution systems, patterns of usage, estimation of requirements, simultaneous demand, storage capacity, pumping arrangements, calorifiers and water heaters; steam systems: low and high pressure systems, boilers and heat exchangers, steam supply piping and condensate return, insulation, steam trapping; drainage systems and sewage disposal: stormwater and sanitary drainage systems, rainfall intensity, simultaneous sanitary discharge, sizing of drains and sewers, methods of sewage disposal, primary and secondary treatments; types of electric motors; electromagnetism for utilities; lifts, escalators and conveyors: lift traffic analysis, design calculation, electrical and mechanical features, code of practice; electric heating; design challenges in futuristic buildings.

---

#### **MEBS6001. Electrical installations**

Supply rules, standards and codes of practice; types of electrical systems; distribution in buildings; factory built assemblies; protective devices and safety interlocks; overcurrent and fault protection; installation design principles; protective earthing and equipotential bonding arrangements; standby generators; electrical safety; distribution transformers; switchgear and fuses; motor control gears; selection of electrical equipment and conductors; electromagnetic interference; lightning protection.

---

#### **MEBS6002. Lighting engineering**

Lighting physics; vision and light measurements; human perception; photometry and spectrophotometry; colorimetry; calculations of photometric data; glare control; guidelines for lighting design. Light production; artificial light sources and luminaires; daylighting; daylight factor; split flux formula; optical control; interior lighting; maintained illuminance; uniformity; colour rendering; utilization factors; polar curves; vector/scalar ratio; lighting for safety; lighting for workplaces; floodlighting; illuminance as vector; illuminance in complex situations.

---

### **MEBS6003. Project management**

Tendering procedure, contract documents and contract strategy, insurance; project planning, scheduling and control. Management and organization theory and practice; human resources development: motivation; leadership, organization structures, quality management; safety management; environmental issues; communication; disputes; delay analysis.

---

### **MEBS6004. Built environment**

External environment: human factors, climatology; internal design criteria; thermal environment (heat): insulation for energy conservation, heat transmission, e.g. solar contribution; visual environment (light): eye and vision, light production, levels of illumination; aural environment (sound or noise): noise criteria for buildings, sources of noise and vibration, noise and vibration control; functional requirement of buildings.

---

### **MEBS6005. Building automation systems**

Principles of building automation systems: system configurations; distributed processing and intelligence; types of input and output points; integrated control; direct digital control; energy, security and maintenance management. Microprocessor fundamentals: signal conditioning, processing and transmission; hardware and software development. Field devices; structured cabling; networking; interoperability; home automation. Current development; selection criteria; cost, reliability and system maintenance.

---

### **MEBS6006. Environmental services I**

Different forms of energy supply to buildings: electricity, fuel oil, solar; heating and cooling systems: psychrometry, thermal comfort, heating and cooling load estimation, boilers, furnaces and other heating devices, associated equipment including piping, ducting work; refrigeration; air conditioning and ventilation: fresh air requirement, air contamination, fume and dust removal, air conditioning system design, control devices.

---

### **MEBS6008. Environmental services II**

Fans and pumps: types and characteristics, parallel and series operation, system effects; complex fluid network analysis: graphical and iterative methods of solution, application to air and water systems and analysis of building air infiltration; room air diffusion: design strategies, application of computational fluid dynamics; sea water cooling systems: design and operation, water treatment; thermal storage systems: applications, system design and economic analysis; acoustic treatment and vibration isolation: basic principles, need for control, types and methods of control.

---

---

**MEBS6009. Fire services design (2 modules)**

Characteristics and behaviour of fire, fire hazards of materials and buildings, fire hazards of building services and processes; smoke production and properties, smoke management principles, zone smoke control, smoke extraction and smoke vent design, staircase pressurisation, design and computational analysis; legal aspects of fire safety management and statutory regulations – COP, LPC rules and N.F.P.A. codes; fire protection strategies, architectural and structural designs, means of escape, fire detection and alarm systems, water-based fire extinguishing systems, gas-based fire extinguishing systems, special building facilities for fire safety; fire protection and design principles for special hazardous areas; hydraulic analysis; performance-based fire codes and approaches, installation and commissioning; maintenance requirements.

---

**MEBS6010. Indoor air quality**

Concept of indoor air quality, health requirements, sick building syndrome, building related illnesses, indoor air quality indicators, types, sources, characterization and health effects of pollutants, concentration, individual and population exposure, dose-response relationships, measurement and monitoring methods, ventilation, filtration, indoor air quality assessment and control, operation and maintenance, legislation and public policy issues, energy and cost implications.

---

**MEBS6011. Maintenance and management of building facilities**

Areas of facilities management; security of facilities; strategies and philosophies of maintenance; optimum control and operation; fault detection and analysis; building pathology; energy management; safety and environmental maintenance. Operational techniques in maintenance: decision making techniques; spares inventory control; resource management; computerized maintenance; measures of maintenance effectiveness. Plant availability, maintainability and reliability.

---

**MEBS6012. Project (4 modules)**

---

**MEBS6013. Testing and commissioning**

The commissioning process: design provisions, specification, documentation, planning and management, contractual responsibilities; setting to work; measurement methods: fundamentals, instrumentation, calibration, methodology, sources of error; commissioning tests on electrical and mechanical plants; balancing of fluid networks; performance testing; post construction evaluation.

---

**MEBS6014. Computer modelling and simulation**

Mathematical modelling: modelling of systems; subsystems and components, deterministic and stochastic modelling, steady-state and dynamic modelling, model format, accuracy and validation, applications to thermofluid systems for design, performance evaluation and economic analysis.

Computer simulation: computer implementation of simulation models, simulation methods by successive substitution and Newton-Raphson approach for univariate and multivariate problems, steady-state simulations for system analysis at off-design conditions, dynamic simulations for transient analysis, techniques for simulation of large systems and use of modular computer simulation packages.

---

### **MEBS6015. Natural and hybrid ventilation of buildings**

Concepts of natural ventilation and hybrid ventilation, mixed-mode air conditioning, purposes of natural ventilation, driving forces, natural ventilation strategies for simple and complex buildings, design methods and guidelines, wind tunnel and small-scale testing, design processes and life-cycle analyses.

---

### **MEBS6016. Energy performance of buildings**

Energy terms and concepts; energy use in buildings; energy efficient building design and operation; energy efficient technologies; building energy standards and codes; building energy analysis techniques; energy auditing of buildings; economic and financial analyses.

### **MEBS6017. Building intelligence**

Fundamental concepts of intelligent building systems; whole building intelligence; evaluation of building intelligence; needs of occupants, cost effectiveness, economic benefits; engineering intelligence into buildings; information technology; building energy management and control systems; intelligent building design; intelligent controls; expert systems, artificial neural networks, genetic algorithms, fuzzy logic; potential and direction of future developments.

---

### **MEBS6018 Clean electrical energy and smart-grids for buildings**

Smart-grid and micro-grid models for communities; clean energy sources for smart-grids, disturbance, noise and pollution in smart-grids; power quality regeneration: power conditioning and uninterruptible power supply; interconnection of smart-grids; smart meter management; power factor correction and tariff consideration; building energy codes; lightning protection.

---

### **MEBS6019 Extra-low-voltage electrical systems in buildings**

Extra-low-voltage electrical systems: roles, transmission medium and network, modeling, fixed and movable systems; types. Applications in building services: electrical safety; public address system, communication, cable and satellite television, conference and interpretive systems, audio and visual systems; service integration and automation; system monitoring. Applications in property management: fire and life-saving management equipment, electronic patrol, car park management, efficiency management, CCTV, security system, access and security control, electronic receptionist. Disturbance; electromagnetic interference and protective measures.

---

### **MEBS6020 Sustainable building design**

Sustainable building concepts; energy and environmental design; green building assessment methods; sustainable masterplanning; analysis methods for sustainable building projects; practical examples.

---