

Applicable to students admitted to the curriculum before the academic year 2014-2015 MSC(ENG) IN BUILDING SERVICES ENGINEERING

Objectives

The aim of the curriculum is to provide advanced postgraduate 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.

The full-time curriculum requires a student to satisfactorily complete 8 modules and a project within a study period of 1 to 2 years. For students enrolled in the part-time curriculum, 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 modules of the curriculum. A number of these core modules 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 modules whereas a student who undertakes a project must complete at least 5 core modules. Students can select Taught Postgraduate level modules offered by other curricula in the Faculty of Engineering as electives.

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

All modules are assessed through examination (0%-100%) and/or coursework assessment (0%-100%).

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; security system planning and design; security devices.

MEBS6001. Electrical installations

This module covers the following topics: 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; 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: objectives and functions; system configurations; central processor and outstations; transducers, sensors and actuators; distributed processing and intelligence; network architecture; hardware and software. Control fundamentals: Laplace and Z transforms, direct digital PID control; control valve performance Microprocessor and electronics fundamentals: architecture of microprocessor systems; digital-to-analog and analog-to-digital conversions; data sampling. Open systems and interoperability: LonWorks; BACnet; IIOT. Implementation and future development: commissioning; maintenance; integration; building emulator; future development trends.

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.

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)

This module involves undertaking a dissertation or report on a topic consisting of design, experimental or analytical investigation by individual students.

The module objectives are to: (1) simulate a realistic working experience for students; (2) provide them an experience of applying engineering principles, engineering economics, business or management skills; and (3) train students to work independently to obtain an effective and acceptable solution to industry-related or research-type problems.

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.

Students who have taken and passed ELEC6095 will not be allowed to take MEBS6018.

MEBS6019 Extra-low-voltage electrical systems in buildings

This module focuses on 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 system, audio and visual system; 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.

MEBS6021 Fire services design I

Fire detection and alarm systems; water-based fire extinguishing systems: automatic sprinkler systems, fire hydrant and hose reel systems, drencher systems; gas-based fire extinguishing systems: CO₂ and clean agent systems; special fire extinguishing systems; portable fire extinguishers; means of fire escape; statutory regulations governing fire services installations: LPC rules, NFPA codes and local Codes of Practice; installation and commissioning; maintenance requirements.

Students who have taken and passed MEBS6009 will not be allowed to take MEBS6021.

MEBS6022 Fire services design II

Characteristics and behavior of fire; fire hazards of materials and buildings; fire hazards of building services and processes; means of fire escape; smoke control; staircase pressurization; smoke vents; statutory regulations governing fire services installations: LPC rules, NFPA codes and local Codes of Practice; installation and commissioning; maintenance requirements.

Students who have taken and passed MECH6009 will not be allowed to take MEBS6021.

MEBS7010. Vertical transportation and drive

Types of vertical transportation systems: lifts, escalators and passenger conveyors; their construction and features of lifts and lift-wells. Mechanical drives of systems: traction, hydraulic, and single/double-wrap. Electrical drives of systems: alternating current versus direct current. Illumination, power and ventilation requirement. Potential hazards and safety management. Prevention of overload and overspeed. Special systems: fireman lift, service lift, stairlift, fireman lift, observation lift, inclined lift, multi-deck lift, public-service escalator, parabolic escalator, and gondola. Traffic calculation and simulation model. Remote monitoring and protocols. Control and adaptive algorithm. Layout of multiple-lift and multiple-escalator. Energy management. Examination, certification and notification.

MEBS7011. Communication technology in building services

Analogue and digital signal encoding; signal transmission systems in buildings; baseband vs broadband; topologies, LAN/MAN/WAN; OSI model, TCP/IP model; wireline and wireless networks; PSTN; key lines, PABX, VoIP; ISDN, DSL, cable modems, FTTH; ISP, voice/data/video convergence; structured cabling; coordination with architects and structural engineers.

MEBS7012. Air conditioning and refrigeration

Advanced psychrometry, thermal comfort, load estimation and energy calculation, air conditioning cycles, air conditioning systems: all-air systems, air-water systems, all-water systems; refrigeration: vapour compression cycle, absorption cycle, heat pump cycle; heat rejection: air-cooling, evaporative cooling, cooling tower; ventilation: fresh air requirement, air contamination, fume and dust removal.

Students who have taken and passed MEBS6006 will not be allowed to take MEBS7012.

MEBS7013. Fire service installations

Fire detection and alarm systems; water-based fire extinguishing systems: automatic sprinkler systems, fire hydrant and hose reel systems, drencher systems; gas-based fire extinguishing systems: CO₂ and clean agent systems; special fire extinguishing systems; portable fire extinguishers; means of fire escape; fire resisting construction; statutory regulations governing fire services installations: BS Standards, LPC rules, NFPA codes and local codes of practice; installation, acceptance testing and commissioning.

Students who have taken and passed MEBS6009 or MEBS6021 will not be allowed to take MEBS7013.

MEBS7014. Advanced HVAC applications

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.

Students who have taken and passed MEBS6008 will not be allowed to take MEBS7014.

MEBS7015. Fire science and smoke control

Characteristics and behavior of fire; compartment fire: heat release rate, pre-flashover, flashover, post-flashover phases; fire hazards of materials and buildings; means of fire escape; smoke control: active and passive smoke extraction, staircase pressurization, smoke venting, atrium smoke control; statutory regulations governing smoke control installations: BS Standards, NFPA codes and local codes of practice; installation, acceptance testing and commissioning.

Students who have taken and passed MEBS6009 or MEBS6022 will not be allowed to take MEBS7015.