



**UNIVERSITY OF PERADENIYA  
DEPARTMENT OF MECHANICAL ENGINEERING**

**POSTGRADUATE PROGRAMME IN BUILDING SERVICES ENGINEERING  
YEAR 2014**

## **INTRODUCTION**

Over the last decades, anthropogenic uses of energy have caused irreparable damages to global environment and threatened sustainability of global eco system through devastating causes such as the depletion of stratospheric ozone layer and global warming. Certain damages, such as those to the ozone layer, could be mitigated if determined efforts are put in place at the present, though it would likely to take thousands of years to recover and restore. Sensible and rational use of energy has become a necessity because of the intricate interconnectivity between the energy use and the environment and there is a great need for capacity and awareness building, especially among the practicing engineers, to ensure the sustainability of the global system.

The building industry consists of two major engineering activities; those relating to creating the built environment, and those relating to maintaining safe, comfortable, hygienically acceptable interior built environment. Though very much an essential part of human existence, building industry is one major user of energy in the form of resources and energy consumption during construction and, mainly energy consumption in maintaining internal built environment throughout its useful lifespan. Both pre and post construction phases and activities of building industry are responsible for substantial levels of environmental damages; contributing for about 50% of all carbon emissions and depletion of natural resources.

Building services engineering is very much connected with construction industry during planning and pre-construction activities; architectural aspects, structural engineering and quantity surveying etc. All these influence the architecture of a building and play a significant role on the energy demand of a building. Within building services engineering, new roles are emerging in the areas of renewable energy, sustainability, low carbon technologies and energy management.

This programme focuses on introducing the concepts and methods of reducing the environmental burden of activities related to the interior built environment. The students will have an opportunity to expose themselves to latest knowledge and practice guidelines etc of building service engineering design, refrigeration, heating, ventilation and air conditioning technologies, electrical, electronic control engineering technology in designing safe and sustainable buildings with efficient building utility systems.

Since there are overlapping interests and topics with certain themes of civil engineering, the proposed postgraduate programme in BSE, conducted by the Mechanical Engineering dept, shares some courses with the proposed postgraduate program in Sustainable built environment of Civil Engineering, University of Peradeniya. The students have the option of registering either for a postgraduate diploma or a masters' degree. The course consists of taught courses, industrial assignments, laboratory and design exercises and a research project.

The Faculty of Engineering, University of Peradeniya, has excellent physical facilities and a team of highly qualified academic staff to conduct the programme. Further, visiting experts from industry and academia will contribute as resource personnel.

### **PROGRAMME OBJECTIVES**

- Capacity building in the area of Building Services Engineering.
- Establishing an academic and research culture in the area of Building Services Engineering in Sri Lanka.
- Awareness building among the stakeholders on the need for incorporating concepts of sustainability and efficient building utility concepts in the practice of building planning and construction
- Training engineering professionals to carry out activities related to the interior built environments efficiently and effectively.

### **TEACHING PANEL**

Staff of the Faculty of Engineering, teaching the subjects of the postgraduate course are:

Prof. L. Rajapaksha, BScEng, MEng, PhD, CEng, MIE (SL), MImechE(UK)  
 Mr. S. K. Seneviratne BScEng, MSc  
 Dr. P. B. Boyagoda BScEng, MEng, DEng  
 Dr. S.D.G.S. P. Gunawardane, BScEng, MEng, PhD  
 Dr. A. C. Ratnaweera BScEng, PhD *Melbourne*  
 Dr. S. Maithripala BScEng, MPhil, MSc, PhD  
 Dr. W. P. D. Fenando, BScEng, MEng, PhD

Prof. P. B. R. Dissanayake, BScEng, MEng, PhD, CEng, MIE (SL)  
 Prof. M. A. R. M. Fernando, BscEng., Lic.Tech., PhD, CEng., MIESL, SMIEEE  
 Dr. D. G. G. P. Karunaratne, BScEng, MEng, PhD  
 Dr. G. B. B. Herath, BScEng, MEng, PhD  
 Dr. S. G. Aberathne, BScEng, MSc, PhD, MIEE  
 Dr. C. S. Kalpage, BScEng, PhD  
 Dr. K. B. S. N. Jinadasa, BScEng, MEng, PhD  
 Dr. J. R. S. S. Kumara, BScEng, PhD  
 Dr. P. J. Binduhewa, BScEng, PhD  
 Dr. (Mrs.) K. G. N. Nanayakkara, BScEng, MEng, PhD

Some visiting lecturers from the industry

Eng. Piyasiri Kalubowila, DGM, CEB  
 Eng. D. U. Amarasinghe, Chief Engineer-Lifts Branch, CEB  
 Eng. Indradeva Mendis, Senior Manager, Overseas Realty (Cey) PLC  
 Eng. Janaka Gunathilake, Manager Engineering, Energy Management Systems (Pvt.) Ltd.

## ELIGIBILITY

- a) BScEng degree in Mechanical/Electrical/Chemical and Processes Engineering from University of Peradeniya or equivalent subjected to the guideline provided by the general regulations for the postgraduate programmes in the Faculty of Engineering University of Peradeniya, Sri Lanka.

OR

- a) BScEng degree or equivalent with two years of experience in the field of Building Services Engineering subjected to the guideline provided by the general regulations for the postgraduate programmes in the Faculty of Engineering University of Peradeniya, Sri Lanka.

For general regulations and more information visit: [www.pdn.ac.lk/eng/cerps](http://www.pdn.ac.lk/eng/cerps)

## COURSE FEE

Total course fee is Rs. 200,000.00 for the MScEng. programme

- Rs.150,000/= for the first academic year of the programme
- Rs. 50,000/= for the second academic year of MSc. programme

Payment can be made in instalments.

## COURSE STRUCTURE

The programme leading to postgraduate degree on Building Services Engineering will be conducted according to the approved rules and regulations of the post graduate programmes in the Faculty of Engineering, University of Peradeniya.

Course code	Course title		Credit Rating
ME 610	Building services management	Core	3
ME 611	Building HVAC and refrigeration systems	Core	3
ME 612	Electrical services and lighting design	Core	3
ME 613	Acoustics, Fire and Lifts	Core	3
ME 614	Building utility supply systems	Core	3
ME 615	Independent design	Core	2
CE 694	Green <sup>SL</sup> rating system for built environment*	Elective	3
CE 695	Sustainable design of buildings*	Elective	3
ME 710	Building management systems	Elective	3
ME 711	Building energy systems	Elective	3
ME 711	Seminars and case studies in building services engineering	Elective	1

In addition to the above courses students should conduct an **advanced research project** related Building Services Engineering worth of 6 credits.

\* Offered under postgraduate programme on Sustainable Built Environment under Dept. of Civil Engineering, University of Peradeniya.

## **COURSE DESCRIPTIONS**

### **ME610 Building services management (Core, 3 Credits)**

*Building economics and energy management:* Building economics and life cycle analysis of the BSE systems. Building utility and energy management systems.

*Facilities Management:* Facility management models and systems; strategic facility management; user need evaluation; procurement; building utility and energy management; case studies.

*Asset Management and Maintenance:* decision making techniques; inventory control; resource management; computerized maintenance; maintenance effectiveness; procurement

### **ME 611: Building HVAC and refrigeration systems (Core 3, Credits)**

*Introduction:* Psychrometry, thermal comfort, heating and cooling load estimation

*Ventilation and indoor air quality:* fresh air requirement, air changes, air contamination, fume and dust removal, and applicable local and global standards. Building thermal performance and heat transfer characteristics.

*Refrigeration and air conditioning systems design:* Air distribution system design, control strategies and equipment selection, utilization of relevant ASHRE, BS, ISO, SLSI standards (health and hygiene, safety, local specifications and equipment design)

### **ME612 Electrical Services and Lighting Design (Core, 3 Credits)**

Electrical Services covers aspects of electrical energy supply, electricity tariffs, Guidelines for lighting design, artificial light sources and luminaries, day lighting, interior lighting, exterior lighting, colour rendering, Design of electrical installations to satisfy IEE Wiring Regulations, Principles of electrical machines and power electronic devices used in building services applications.

### **ME 613 Acoustics, Fire and Lifts (Core, 3 Credits)**

*Acoustics:* basics of sound power and intensity, propagation of noise, architectural acoustics, sound generation in services systems, introduction to noise isolation design and materials, vibration isolation, legal requirements and noise standards.

*Lifts:* lift and escalator design, maintenance and operation.

*Fire:* characteristics and behaviour of fire, fire hazards of materials and buildings, fire protection strategies, smoke management principles, fire detection and alarm systems, fire extinguishing systems, building facilities for fire safety; fire protection and design principles for special hazardous areas; fire codes and approaches, installation and commissioning; maintenance

**ME 614 Building utility supply systems (Core, 3 credits)**

*Characteristics and design of different utility services:* cold, hot and flushing water supply systems, sanitary and storm water drainage systems; steam and gas supply system; water treatment; thermal storage systems, system design and economic analysis; preparation of schematics and P&IDs.

*Fans, pumps and heat exchangers and line components:* types and characteristics, parallel and series operation, system effects;

*Fluid network analysis:* air and water systems, application of computational fluid dynamics, design and operation, preparation of schematics and P&IDs.

**ME 615 Independent Design (Core, 2 Credits)**

Formulation and carrying out of an individual research or design project on sustainable built environment under the guidance of a supervisor. At the completion of the project each student submits a technical report and presents the results orally.

**ME 710 Building management systems (elective -3 credits)**

Introduction to Building Automation System (BAS): configurations; field devices; sensors and actuators; interfacing and protocols.

Principles of building management: components and controls, applications, integration, operation and maintenance.

*Signal communication:* principles of signal interfacing, protocols, standards and codes of practice, and real time data transfer.

*Building control architectures:* Centralized control, De-centralized control and Distributed Control Building control implementation.

*Energy and security management using SCADA (supervisory control and data acquisition) systems:* Human-machine interface (HMI); Programmable logic controller; Power line carriers.

*System optimization and control:* integrated control; direct digital control; concepts of distributed computer-based monitoring and control.

**ME 711 Building energy systems (elective -2 credits)**

*Introduction:* Energy terms and concepts; energy use in buildings;

*Energy efficient building design:* planning and operation; energy efficient technologies; building energy standards and codes (global and local);

*Building energy analysis techniques:* energy management and auditing of buildings

*Energy Conversion power cycles:* combined heat and power, combustion processes, boiler plant, thermal energy storage, waste heat recovery, refrigeration/heat pumps systems and environmental impacts of plant operation.

*Renewable energy:* Integration of renewable energy technologies in buildings.

**ME 712 Seminars and case studies in building services engineering (1credit)**

Conducting guest lectures on selected topics in building services engineering, Case studies in sustainable building services engineering, Industry visits and individual presentations.

**CE694 Green<sup>SL</sup> Rating System for Built Environment\* (3 credits)**

Management of building systems, Sustainable sites of building systems, Water efficiency, Energy and atmosphere, Materials and resources, Indoor environmental quality, Innovation and design process, Society and Cultural awareness, Industrial case studies.

**CE695 Sustainable Design of Buildings\* (3 credits)**

Current and future building regulation requirements, Renewable and recyclable materials, Space efficiency of buildings, Economical design, Code of Practice for Energy-Efficient Buildings in Sri Lanka, Building models and modelling tools, Codes for sustainable buildings and – infrastructure, Water systems design and efficiency, The preparation of a sustainable design brief.

\* Offered under post graduate course on Sustainable Built Environment under Dept. of Civil Engineering, University of Peradeniya