<p align="center">**Subject Description Form**</p>

Subject Code	**BSE4510**
Subject Title	**Building Automation and Control**
Credit Value	3
Level	4
Pre-requisite Co-requisite Exclusion	BSE2122 Electrical Technology and BSE3225 HVACR I Nil BSE3510 Building Automation and Control
Objectives	The Building Automation (BA) system is an essential system of smart buildings. Dynamic performance and control of building services systems are important for the systems to meet the design objectives. This subject provides students with an opportunity to understand the principles and application of Building Automation system and building process control, so that they can explore the relevant knowledge and applications of the Building Automation system and the control of building services systems in smart buildings. Lecture and student-centred learning, such as seminar, laboratory tests, etc., are used allowing the student to be explored on the following issues: • The network of building automation (BA) and intelligent building (IB) systems, and the configuration of BA and IB systems. • Interfacing BA system with building services systems. • The dynamic performance of building processes/systems, control fundamentals and building process control. • Control strategies for better energy efficiency and building environmental performance.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) undertake architectural design and specify the requirements for building automation systems and intelligent building technologies taking into account successful integration and flexibility to meet future demands; b) assess the impact of using different architectures, LAN protocols/standards in BA system design and selection; c) design and analyze the control of typical and non-typical building processes and manage the stability and tuning issues of process control; d) specify supervisory control and management strategies and assess their impact on indoor environmental quality, energy efficiency and reliability of systems and equipment; and e) integrate and apply in-depth understand of the integration/interface of building automation systems with building services systems and integration between different intelligent building systems.
Subject Synopsis/ Indicative Syllabus	Concepts and features of intelligent building: definitions and features of IB; building purpose; functions, flexibility and adaptability, building automation (BA), communication automation (CA) and office automation (OA). **Digital control stations**: binary data, microcomputer, data acquisition, input and output units, processor operation and software, sensor and actuator **LAN and BA network**: LAN and WAN, network architectures, LAN protocols, transceiver, medium interface, LAN interface, signal encoding and decoding, Lontalk, Ethernet, BA communication standards. **System dynamics and feedback control**: dynamic system, transfer function of linear systems, block diagram of dynamic system, open-loop and closed-lop controls, characteristics of feedback control systems, stability of feedback control systems, stability theory of linear feedback control systems. **PID control**: proportional control, integral control and derivative control, tuning of PID loops, open

	loop test method, closed loop test method, digital PID and direct digital control (DDC).
	Local and supervisory control: tuning of local control loops and adaptive control; cascade and sequential control, compensation and sequencing control; on-line temperature and static pressure set-point reset, demand-controlled ventilation and economiser control, chilled water temperature reset, optimal control of heat rejection system, peak demand limiting and demand response control.
Teaching/Learning Methodology	Text books, published journal articles, physical and computer simulation test facilities, etc. are used to explore students to the planning, design, operation and problems of building automation systems, as well as the control and operational performance and problems of building services systems. Students will undertake small projects on relevant topics and practise the online operation and control of building services system in lab besides lectures and tutorials. They will also conduct case studies on real building automation and intelligent building systems and equipment to understand the configuration, architecture, operation and management, interfacing with building services systems, and to identify problem areas and possible solutions.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	
Coursework	40		✓	✓	✓		
End-of-semester examination	60	✓	✓	✓	✓	✓	
Total	100						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The coursework consists of one in-class test, seminar presentation and report. Students are required to undertake small projects on relevant topics. They need to present their findings in the projects in a seminar and submit one report. The in-class test is usually held in the middle of the semester.

Student Study Effort Expected

Class contact:	
▪ Lectures	20 Hrs.
▪ Seminar	4 Hrs.
▪ Tutorial	10 Hrs
▪ In-class test	2 Hrs
Other student study effort:	
▪ Self study	40-60 Hrs.
▪ Preparation for seminar, laboratory report, etc.	40 Hrs.
Total student study effort	120-140 Hrs.

Reading List and References

Wang S.W., Intelligent Buildings and Building Automation, Taylor & Francis (UK), 2009

ASHRAE, ASHRAE Handbook – HVAC Applications 2019.

Boed V., Networking and Integration of Facilities Automation Systems, CRC Press, 2000.

CIBSE Guide H – Building Control Systems, 2009.