Subject Description Form

Subject Code	BSE512
Subject Title	Engineering Intelligent Buildings
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil (recommended background knowledge: engineering background, e.g. building services engineering, mechanical, or electrical, etc., OR facilities management.)
Objectives	To provide practicing engineers and managers with enhanced knowledge of advanced intelligent building technologies, system configuration and standards, system operation and control. The emphasis will be on use of system integration, application of technologies and the operation performances. A critical review of current practices and future needs with a view to developing a total intelligent building system, with integration and co-ordination aspects will be emphasized.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. undertake the architectural design and specify the requirements for building automation systems and intelligent building systems taking into account successful integration and flexibility to meet future demands; b. assess the impacts of using different architectures, LAN protocols/standards and Internet technologies in BAS design; c. integrate and configure building environmental control, lighting control, security and safety control systems themselves and integrate them with building services systems and smart grids using proper technologies; d. specify the supervisory control and management strategies and the required metering and control instrumentation.
Subject Synopsis/ Indicative Syllabus	**Intelligent buildings:** concepts, definitions of intelligent buildings, intelligent architecture and structure, evolution of intelligent buildings, IB assessment criteria. **Building Automation System (BAS):** binary data, digital controller, input and output units, sensors and actuators; architecture and configuration of BAS, BAS outstation and central station, programming environment and platform, monitoring interface and development platform, building energy management functions. **Local Area Network (LAN) and BAS communication standards:** Local Area Network (LAN), protocol standards and OSI model, medium-access schemes, LAN standards, Ethernet, ARCnet, LonTalk, wireless technologies, ZigBee, application s of wireless technologies in BAS. **BAS communication standards:** BACnet and its features, LonWorks and its features, Modbus and its features, PROFIBUS and its features, EIB and its features, compatibility of different open protocol standards, integration at management level. **Internet and IoT technologies and applications in BAS:** Internet and Internet protocols, Internet LAN *vs* WAN, IoT, use of Internet and IoT technologies **Lighting control systems:** purpose of lighting control, basic components of

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<tr><td></td><td>lighting and lighting control systems, analogue control and digital control, DXM512-A, digital addressable lighting interface (DALI), systems based on common automation protocols, energy management and lighting control strategies.

Security and safety control systems: CCTV systems, analogue CCTV systems and IP-surveillance systems; Access control system, different types of access control, intelligent readers and system topologies; Burglar alarm system, functions of burglar alarm systems; Fire alarm systems, typical fire detectors, conventional fire panels, addressable fire panels.

Smart and optimal control of building systems: feedforward control, feedback control and adaptive control; process control and optimal control; different optimal control methods (rule-based control, performance-based optimal control and model-based optimal control).

Smart grid and building demand response: concept and benefit of smart grid, role and contribution of buildings in smart grid, demand limiting and demand response strategies, smart meters.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Evaluating the functions, performance, flexibility and difficulties in IB configuration, design, operation and management; Extensive use of standards, up-to-data IB technologies and development; Exposure to various up-to-date IB systems and technologies in laboratory; Case studies of systems and buildings.

• Lectures and seminars
• Tutorials
• Laboratory experiment
• Independent study (case studies for seminars, technical assignments, assigned reading, self study)</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a.</td><td>b.</td><td>c.</td><td>d.</td><td></td><td></td></tr>
<tr><td>1. Examination</td><td>60%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Continuous Assessment</td><td>40%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The Continuous Assessment will be based on the seminar presentations and mini-project reports on the issues related systems, technologies and their applications. The ability of students in searching and using the information on different systems and technologies for different applications will be assessed.

Examination, typically giving systems, cases or problems, will assess the ability of students in analyzing typical system/technology issues and solving the problems.</td></tr>
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Reading List and References	Atkin, B. (1988) *Intelligent Building*, John Wiley & Sons. Leszek R. (1987) *Introduction to Local Area Networks with Microcomputer Experiments*, Prentice-Hall Inc. Levermore, G.J. (1992) *Building Energy Management Systems*, E&FN Spon. Wang, S.W. (2010) *Intelligent Buildings and Building Automation*, Spon Press (Taylor & Francis), London.