

Subject Description Form

Subject Code	BSE2874/IC274
Subject Title	Comprehensive Building Services Practices
Credit Value	8 Training Credits
Level	2
Pre-requisite	BSE269
Objectives	This subject helps students to relate the academic theories of traditional and advanced building services technologies to real-world practices. This subject also provides students with the knowledge to manage operation of BIM projects. It is aimed for students, upon completion of this subject and BSE269, to attain professional competence equivalent to CIC-accredited BIM Manager (CCBM).
Intended Learning Outcomes	Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> a. apply appropriate practices with intelligent building control technology to building services systems with regards to building operation requirements; b. undertake design, installation, testing and commissioning of building services systems in buildings on the basis of recognizing the engineering standards, regulations and practices; c. compare conceptual design and develop actual work sequences and methods for various electrical and mechanical installations; d. evaluate new building automation/intelligent control schemes to achieve a safe, comfort and efficient building environment; and e. manage BIM uses and processes in construction.
Subject Synopsis/ Indicative Syllabus	<p><u>Integrated Building Systems</u></p> <ul style="list-style-type: none"> • Design of building systems, including lighting control, shutter control, motion control, and heating/cooling ventilation and air-conditioning (HVAC) system • Design and implementation of PID control function loops; • Online and offline program monitoring and integration test; and • Development of self-maintain BMS control system for building services applications. <p><u>Electrical Installation Practice</u></p> <ul style="list-style-type: none"> • Electrical workshop safety; • Code of Practice of Electrical Wiring Regulation; proper use of components; conduit; • Circuit arrangement; fluorescent lamp operation and installation; final circuit installation and arrangement; • Single-phase AC motor installation and control; and • Testing and commissioning for final circuits and sub-distribution circuits; procedures for inspection. <p><u>Low-voltage (LV) Switchboard and Power Monitoring</u></p> <ul style="list-style-type: none"> • Specifications, schematic diagram, standards and requirements of LV switchboard; • LV switchboard installation and operation; installation practice of measuring and protection elements; • Setting and testing of Inverse Definite Minimum Time Lag (IDMTL) and electronic protection relays; system commissioning and maintenance; and

- Power monitoring and analysis, noise and harmonics; active filters and real-time capacitor bank.

Automation and Underground Utilities Detection

- Requirements and necessity of underground utility detection;
- Theories and practices of underground detection and use of equipment including induction and Closed-circuit Television (CCTV) systems;
- Basic programming practice, system configuration and application of Programmable Logic Controller (PLC); and
- Basic application and configuration of Variable Speed Driving Systems.

Air Conditioning (AC) System and AC Control

- Application of basic AC system components;
- Proper use of engineering tools and materials for AC system and AC control system;
- AC system basic calculations;
- Essential operation and maintenance procedures for AC systems;
- Basic installation and operation of AC induction motors; Motor starting characteristics and starting method to minimize the motor start impacts;
- Logic control function implementation in AC control circuits; and
- Testing and commissioning procedures for AC control systems.

Fire Detection and Security Systems

- Basic configuration of auto fire alarm system;
- Use of conventional and addressable fire detectors and alarming devices;
- System configuration of addressable fire alarm system;
- Zoning Design of a typical fire detection system;
- Fire system programming;
- Preliminary risk assessment of security required systems; Proper use of security sensors;
- Design of basic security control with balance consideration of cost and effectiveness; Configuration and programming of security control system; and
- Testing and commissioning of fire detection and security control systems.

Plumbing Practice

- Introduction of plumbing system and its relation related to health and economic issues;
- Plumbing materials in building services engineering, tools and pipe types;
- Derive equipment schedules and installation plan;
- Installation practice of simple sanitary and water systems; defects, tests and maintenance of water systems; and
- Site inspection technique for plumbing and drainage.

BIM Advanced

- BIM technology and applications in construction industry;
- Building information modelling system conventions and standards such as model zone, model coordinate, model hierarchy, data structures, level of development (LOD), LOD responsibility matrix, model division etc.;
- Digital information management, collaboration and integration; and
- Commercial and contractual issues of BIM projects.

Learning Methodology	<p>The subject will be delivered through the following learning methods:</p> <ol style="list-style-type: none"> Mini-lectures – Lectures and demonstrations are used to introduce and explain key concept, definition and application of building services systems and BIM. Multi-media illustrations are used for students to appreciate the good practices, as well as case studies and small group discussions are used to relate these knowledges with real-life practices. Hands-on workshop - Students are arranged to have hands-on workshops to practice installation and system integration under supervision of IC training staff in workshops. A wide range of practices are demonstrated. Hands-on sessions are arranged, if appropriate, for students to practice the industry standards and techniques; Assignments - Individual assignments are arranged to strengthen students’ knowledge on building services and BIM operation; and Self-learning - Independent on-line learning materials are provided for students to broaden their horizon of industry’s latest practices and BIM technology and applications. 						
Assessment Methods in Alignment with Intended Learning Outcomes	Assessment Method	Weighting (%)	Intended Subject Learning Outcomes Assessed				
			a	b	c	d	e
	Assignments	40	✓	✓	✓	✓	✓
	Reports	30	✓	✓	✓	✓	✓
	Tests	30	✓	✓	✓	✓	✓
	<p>Assignments - Students’ performance are assessed continuously by assignments in the form of worksheets.</p> <p>Reports - Students’ reflection on their learning outcomes are captured by their training report.</p> <p>Tests - Multiple-choices and short-question type on-line tests are used to assess students on their declarative knowledge and analytical thinking ability.</p>						
Student Study Effort Required	Class Contact						
	Mini lecture and demonstration	61.5* Hrs					
	Hands-on practice and test	173.5 Hrs					
	Other Study Effort						
	Assignment and report	27 Hrs					
	Self-learning	18 Hrs					
	Total Study Effort: 280 Hrs						
*Remark: The contact hours are designed to satisfy Construction Industry Council (CIC) requirements on BIM Manager.							

<p>Reading List and References</p>	<p>Reading Materials:</p> <ul style="list-style-type: none"> • IC Training Materials and Presentation for Construction Students (http://www2.ic.polyu.edu.hk/bcu/learningmaterialspowerpoints.html) • Construction Industry Council BIM Publications (https://www.bim.cic.hk/en/resources/publications) <p>References:</p> <ul style="list-style-type: none"> • EMSD, Code of Practice for the Electricity (Wiring) regulations, 2015 Edition. • IET wiring regulation, 18th edition. • EMSD, Building Energy Code, 2018 Edition • EMSD, Energy Audit Code, 2018 Edition • James A. Rehg, Glenn J. Sartori., “Programmable logic controllers”, Prentice Hall, 2009 • EMSD, Code of Practice on Working near Electricity Supply Lines, 2018 Edition • EMSD, Application Guide to Variable Speed Drives (VSD) • Bill Whitman, Bill Johnson, John Tomczyk, Eugene Silbersteinm “Refrigeration and Air Conditioning Technology”, 2017 • FSD, Codes of Practice for Minimum Fire Service Installations and Equipment and Inspection, Testing and Maintenance of Installations and Equipment, 2012 • BD, Code of Practice for Fire Safety in Buildings, 2011 • WSD, Technical Requirements for Plumbing Works in Buildings, 2019
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