Subject Description Form

Subject Code	**BSE3321**
Subject Title	**Fire Services**
Credit Value	3
Level	3
Pre-requisite Co-requisite Exclusion	BSE2215 Fluid Mechanics and BSE2216 Engineering Thermodynamics, or equivalent. Nil Nil
Objectives	The subject aims to enable students to: 1. use codes of practices for fire engineering designs; 2. design basic water-based fire engineering systems for buildings in Hong Kong; 3. design gas protection systems; 4. design fire detection and alarm systems; and 5. understand basic passive protection systems in buildings.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) design basic fire services systems for buildings; b) understand and appraise the governing legislation, rules and codes of practices related to the fire services systems; and c) link relevant fundaments with practical design and make rational choices of the systems, materials and equipment based on both economics and performance.
Subject Synopsis/ Indicative Syllabus	**Introduction to building fires and fire services systems:** Fundamental concepts of fire, fire triangle, properties of fuel, fire load, fire extinguishing mechanisms, fire fighting agents, fire process, ignition, fire growth, flashover, and heat transfer. **Fire safety provisions and code requirements:** Laws of Hong Kong, building regulations, provisions of fire service installations, code of practice for fire safety in buildings, etc. **Water-based systems:** Sprinkler heads, sprinkler systems, fire hydrant and hose reel systems; wet, dry, pre-action, and drencher systems etc.; system components, source of water supply, design hazard classifications, water discharge density, pipe sizing methods, pump duty, system pressure and flow characteristics, high-rise systems, operation and maintenance, case studies and the fundamental design skills. **Gas protection systems:** Halon and halon alternatives, FM200 systems, Carbon Dioxide (CO_2) systems, inert gases, methods of application, system components, operation and maintenance. **Fire detection and alarm systems:** application of codes; fire, smoke, energy release and gas signatures; system components; operating principles and selection of detectors, stratification, beam detection systems; conventional and addressable systems, system signalling; system design process, detection and alarm zones, audibility of fire alarm; and false alarm **Passive fire protection systems:** Design of passive fire safety measures; fire resistance and fire resisting construction; means of access for firefighting and rescue; compartmentation, building evacuation; and refuge floor.
Teaching/Learning Methodology	Teaching approach includes lectures, tutorials, a mini design project, laboratory work, in-class test, and end-of-semester examination to facilitate learning. Designs of fire services systems, applications of technical data, regulations, standards, and circular letters prepared by various statutory bodies and others will be discussed in lectures with all intended learning outcomes to be achieved. Tutorials will be used to support lectures, including discussions on problem areas and tutorial problem sheets to solve numerical problems. Student participation is expected in solving selected examples in tutorial work, including examination questions and longer open-ended problems. In

addition, visual aids such as films and slides will be shown and discussion will be held during tutorials in order to develop a better understanding of the subject. These will facilitate learning to achieve all intended learning outcomes.

The mini design project allows students to practice design of the fire services systems, through a student-centered learning approach. Students should base on related local design codes, make rational choices and design suitable fire services systems, choose proper materials and equipment based on both economics and performance. All these enable students to carry out the basic fire services systems design competently on basis of adequate understanding of the function and working principles of those systems learnt from the lectures.

Related laboratory work is an integral part of this subject, to serve as a vehicle for contrasting theory with practice, and provide students familiarity with equipment and testing techniques. The two 3-hour laboratory sessions include:

- Investigation of the characteristics of water mist system
- Scale modelling studies of fire-induced flow using a water tank
- Operation mechanisms and performance of components of fire alarm systems

In-class test and end-of–semester examination will evaluate student's understanding of the knowledge being taught.

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			
Coursework							
• Laboratory work	10	✓	✓				
• In-class test	15	✓	✓	✓			
• Mini design project	15	✓					
Coursework*	60	✓	✓	✓			
Total	100						

* For details, please refer to the 2020/21 Semester 1 Subject teaching scheme/schedule.

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

Laboratory work allows students to understand and practice application of theories to fire protection system designs.

In-class test, usually in the format of closed book test, is delivered with questions to evaluate the students' abilities and understanding on various aspects.

Mini design project includes tasks on the design and performance evaluation of the fire services systems.

The end-of-semester examination is the final assessment for students to ensure their understanding and learning abilities in solving real problems by applying their knowledge of various fire services systems.

Student Study Effort Expected	Class contact:	
	• Lecture	21 Hrs.
	• Tutorials	7 Hrs.
	• Mini design project	3 Hrs.
	• Laboratory	6 Hrs.
	• In class test	2 Hrs.
	Other student study effort:	
	• Self-preparation and self-study	11 Hrs.
	• Tutorial problems	16 Hrs.
	• Mini design project	15 Hrs.
	• Preparing laboratory work and reports	9 Hrs.
	• Test preparation	10 Hrs.
	• Exam preparation	20 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	Chartered Institution of Building Services Engineers (CIBSE) Guide E: Fire Safety Engineering, 4th edition, CIBSE, London, UK, 2019. Code of Practice for Fire Safety in Buildings 2011, Buildings Department, Hong Kong Special Administrative Region (HKSAR), the latest version. Codes of Practice for Minimum Fire Service Installations and Equipment and Inspection, Testing and Maintenance of Installations and Equipment, Fire Services Department (FSD), HKSAR, the latest version. List of FSD Circular Letters, FSD, HKSAR, at http://www.hkfsd.gov.hk/eng/circular.html. British Standard BS EN 12845 – Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance, LPC, UK, 2015.	