Subject Description Form

Subject Code	**BSE1201**
Subject Title	**Thermofluids**
Credit Value	3
Level	1
Pre-requisite Co-requisite Exclusion	Nil Nil Nil
Objectives	This subject is intended to allow students to acquire basic knowledge about fluid static and fluid dynamics in buildings and in building services. Focus is put on applications of the knowledge to the analysis of piped/ducted systems, open channel flow, flow around buildings, building related turbo-machinery and flow measurements.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) appreciate the basic principles and fundamentals in fluid mechanics; b) analyze and evaluate fluid flow problems related building and environmental applications; and c) understand the pressure and fluid flow in air ducts and water pipes, duty and power demand of fans and pumps in HVACR systems taking into consideration energy loss and efficiency of the system.
Subject Synopsis/ Indicative Syllabus	**Fundamentals of Fluid Mechanics**: fluid properties and flow phenomena, fluid statics, fluid flow concepts and basic fluid mechanics equations. Similarity and Dimensional analysis. Ideal fluid flow, velocity potential and stream function. Introduction to turbulence. Flow around obstacles and flow visualization. **Steady flow of incompressible fluid in pipes and open channel**: character of flow in pipes, and pressure losses in pipe flow. Darcy formula, and friction factor; Poiseuille formula, laminar and turbulent flows, boundary layer effects, Reynolds experiments and Reynolds number; effect of surface roughness in pipes. Pressure losses due to pipe fittings. Hydraulic and total energy gradients. Use of Moody chart. Open channel flow. **Transport of fluid in HVAC systems**: system resistance and characteristic curves; resistances in series, in parallel and equivalent circuits; fans and pumps as drivers of air and water flow through ducting and piping systems; fan and pump characteristics; concepts of operating point, efficiency and fan and pump power; introduction to fan/pump laws and their applications. **Flow Measurements**: Pressure and velocity measurement devices (pitot tube, orifice, venture meter and etc.) and their working principles. The laser Doppler and hot wire anemometry, measurement of turbulence. **Related Laboratory Work** Measurement of air flow rates (A05) Investigation of characteristics of fans (A20)
Teaching/Learning Methodology	There will be 12 lectures to illustrate the fundamental principles, demonstrate the application of the theory with real-life problems, and explain the relevance to the professional jobs. There will be 9 tutorial sessions in half of the class size, during which students are expected to work on solutions of real-life problems via discussion with lecture and among themselves. Students will be required to do assigned-readings, particularly on the fundamentals, before attending lecturers and tutorials. The assigned readings will be detailed in the teaching scheme to be distributed to students at the beginning of the Semester. In additions there are two lab sessions for students of a group of 4, undertaking a prescribed set of measurements, analyzing the correlations, check against the theories learnt in the class.
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			
In class test	20	✓	✓	✓			
Coursework*	60	✓	✓	✓			
Lab experiments and report	20	✓	✓	✓			
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:

a) Building Services Engineers are expected to undertake on-site measurements, sophisticated quantitative analysis and design calculations, for problem identification and design optimization purposes.

b) The written test and exam serve to examine the students' learning outcome in the problem analysis and solving capabilities.

c) The lab sessions prepare the students for site measurements and data acquisition capabilities.

Student Study Effort Expected		
	Class contact:	
	▪ Lectures	20 Hrs.
	▪ Tutorials	9 Hrs.
	▪ In class written test	4 Hrs.
	▪ Laboratory (In groups of 4 students)	6 Hrs.
	Other student study effort:	
	▪ Reading and working on given exercises	69 Hrs.
	▪ Lab Preparation and Report	12 Hrs.
	Total student study effort	120 Hrs.

Reading List and References	
	TEXTBOOK
	Douglas JF, Gasiorek JM, Swaffield JA, Fluid mechanics. NJ: Prentice Hall, 2001.
	OTHER REFERENCE BOOKS
	Cengel YA, Turner RH, Cimbala JM Fundamentals of Thermo-fluid sciences, McGraw Hill. 2008.
	Streeter VL, Wylie EB, Bedford KW, Fluid mechanics. McGraw Hill, 1998.
	Anderson JD, Fundamentals of aerodynamics. McGraw Hill, 2011.
	McQuiston FC, Parker JD, Spitler JD, Heating, ventilating and air-conditioning analysis and design, 5th ed. New York: John Wiley & Sons, Inc., 2000.