Subject Description Form

Subject Code	**BSE2201**
Subject Title	**Air Conditioning I**
Credit Value	3
Level	2
Pre-requisite Co-requisite Exclusion	BSE1201 Thermofluids Nil Nil
Objectives	1. To provide knowledge of cooling load calculation method and design criteria. 2. To provide knowledge of various air-conditioning processes, components and systems. 3. To provide a basic understanding of ventilation principles and systems
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) determine and estimate heat gains/losses in buildings and cooling load calculation with understanding of the principles of dynamic heat transfer; b) analyze thermal properties of moist air and analyze different basic air-conditioning processes on psychrometric chart; c) appraise and select proper air conditioning and ventilation components (e.g. coils, fitters, fans and ducts) and systems, e.g. FCU, CAV, VAV and mechanical ventilation systems, considering different types of buildings and building users; d) use theories and engineering calculations for design of air-side systems and equipment selection; e) critically review performance of air-side systems in terms of energy efficiency, thermal comfort and indoor air quality.
Subject Synopsis/ Indicative Syllabus	**An introduction to ACV systems**: introduction to air-conditioning & ventilation systems and equipments, and their functions. **Heat transfer in building envelope**: thermal properties of building materials, temperature gradient across building envelope and surfaces, condensation, vapour barriers, heat transfer due to solar heat gain through walls and fenestration. **Cooling load calculation method**: review of design conditions, heat gain components, conduction, solar radiation, infiltration, internal heat gains, ventilation, peak and simultaneous cooling requirements in buildings, sensible and latent loads. **Psychrometry and air-conditioning processes**: properties of moist air, basic air conditioning processes, psychrometric chart, determination of supply air conditions and flow rate as well as cooling coil load. **Basic air-conditioning components and systems:** fan-coil-unit (FCU) system, constant air volume (CAV) system, variable air volume (VAV) system, filters, fans, coils. **Ventilation principles and components:** principles of natural and mechanical ventilation, fresh air requirements, air change rates, statutory requirements, supply and exhaust system. Fan-duct systems: types of fans, fan characteristics and performance, fan selection and duct sizing, air-side schematic.
Teaching/Learning Methodology	The subject is supported by an intensive tutorial scheme, which aims to ensure proficiency in standard calculations, and to develop the basic knowledge and skills for an air-conditioning and ventilation system design. Lectures will be supported by site visits to provide some practical experience for students.

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	
Lab	15	✓	✓	✓			
Group project and assignment	25	✓	✓	✓	✓	✓	
End-of-semester examination	60	✓	✓	✓	✓		
Total	100						

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

The students will be briefed in the first lecture for the expected subject outcomes. The teaching and learning (T&L) methods adopt to achieve the expected outcomes include interactive lectures, supplemented by worked examples, tutorials, assignment and group project. Lecture notes, worked examples and tutorial problems are issued to students at the appropriate time to enhance learning.

Student Study Effort Expected

Class contact:	
▪ Lecture	20 Hrs.
▪ Tutorial	10 Hrs.
▪ Lab & fieldwork	6 Hrs.
▪ In-class presentation	2 Hrs.
Other student study effort:	
▪ Self study	40 Hrs.
▪ Lab report	12 Hrs.
▪ In-class presentation preparation	10 Hrs.
▪ Examination preparation	20 Hrs.
Total student study effort	120 Hrs.

Reading List and References

Jones, W.P. Air conditioning engineering, 5th ed. Oxford: Butterworth-Heinemann, 2001.

McQuiston, F.C., Parker, J.D. and Spitler, J.D. Heating, ventilating and air-conditioning analysis and design, 6th ed. New York: John Wiley & Sons, Inc., 2005.

McQuiston, F.C. and Jeffrey D. Spitler, J.D. Cooling and heating load calculation manual, 2nd ed. New York : ASHRAE, 1992.

Wang S.K. Handbook of air conditioning and refrigeration, 2nd ed. NY: McGraw-Hill, 2001.

Kreider J.F., Curtiss P.S. and Rabl A. Heating and cooling of buildings: Design for efficiency, CRC Press/Taylor & Francis, 2010.

Pita E.G. Air conditioning principles and systems, 4th ed. Prentice Hall, 2002.

ASHRAE Handbook 2009 Fundamentals (Chapter 1; 14-24; 34-39). Atlanta: American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc., 2009.