

Subject Description Form

Subject Code	ME44001
Subject Title	Air Conditioning for Indoor Thermal and Environmental Quality
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics or ME34003 Thermofluid Mechanics
Objectives	To provide students with the fundamental knowledge of air conditioning for indoor thermal and environmental quality.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> a. Appreciate and understand the concepts and components of air conditioning and refrigeration systems and applications. b. Applied the general knowledge of indoor thermal comfort and environmental health. c. Applied the knowledge of moist air properties and conditioning processes. d. Apply the knowledge of heating and cooling load required for a building. e. Applied the knowledge of refrigeration systems and cycles.
Subject Synopsis/ Indicative Syllabus	<p><i>Introduction of Air Conditioning and Refrigeration Systems and Applications</i> - Basic components of air conditioning and refrigeration systems. The complete air conditioning system. Central mechanical equipment. All-air systems, air-and-water systems, all-water systems. Unitary air conditioners. Heat pumps. Heat recovery systems. Thermal storage.</p> <p><i>Moist Air Properties and Conditioning Processes</i> - Moist air and standard atmosphere. Fundamental parameters. Adiabatic saturation. Wet bulb temperature and the Psychrometric chart. Space air conditioning- design and off-design conditions.</p> <p><i>Space Heating and Cooling Loads</i> - Outdoor and Indoor design conditions. Heat transmission in building structures. Infiltration. Heat losses from air ducts. Auxiliary heat sources. Supply air for space heating. Source media for space heating. Heat gain, cooling load and heat extraction rate. Solar radiation. Outside and interior surface heat balance. Zone air heat balance. Implementation of the heat balance method.</p> <p><i>Refrigeration</i> - Refrigerants. Mechanical vapour-compression refrigeration cycles. Modifications to basic cycles. Reciprocating compressors. Cooling towers.</p> <p><i>Indoor Thermal Comfort</i> - Physiological considerations. Thermal comfort indices and conditions. Hot and humid, and extreme cold environments.</p> <p><i>Indoor Environmental Health</i> - Terminology and standards. Health sciences. The basic concerns of indoor air quality (IAQ). Prediction of indoor air quality model. Physical agents. Methods to control contaminants. Gas and particulate removal applications.</p>

<p>Teaching/Learning Methodology</p>	<p>1. The subject intends to equip students with fundamental knowledge of air conditioning for indoor thermal and environmental quality. Systematic lectures are required to achieve such foundation building coupled with assignments (outcomes a, b, c, d and e).</p> <p>2. Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a, b, c, d and e).</p> <p>It is intended to make use of these teaching/learning methodologies to achieve the intended subject learning outcomes as indicated in the following table:</p> <table border="1" data-bbox="440 521 1404 734"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>					Teaching/Learning Methodology	Outcomes					a	b	c	d	e	Lecture	√	√	√	√	√	Tutorial	√	√	√	√	√																	
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<p>Assessment Methods in Alignment with Intended Learning Outcomes</p>	<table border="1" data-bbox="440 779 1423 1131"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Assignment</td> <td>30%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Test</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment: $0.50 \times \text{Examination} + 0.50 \times \text{Continuous Assessment}$</p> <p>1. The continuous assessment will comprise two components: assignments (30%) and tests (20%). The assignments are aimed at evaluating the progress of students study, assisting them in fulfilling the respective subject learning outcomes, and enhancing the integration of their knowledge learnt. The mid-term test which covers the first half of the subject material provides useful feedback to both lecturer and students on the learnt topics.</p> <p>2. The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.</p>					Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					a	b	c	d	e	1. Assignment	30%	√	√	√	√	√	2. Test	20%	√	√	√			3. Examination	50%	√	√	√	√	√	Total	100%					
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Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Coursework	33 Hrs.
	▪ Self-study/	33 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	<ol style="list-style-type: none"> 1. ASHRAE Handbooks on HVAC Systems and Equipment, Fundamentals, Refrigeration, and HVAC Applications, latest edition. 2. F.C. McQuiston, J.D. Parker and J.D. Spitler, Heating, Ventilating and Air Conditioning- Analysis and Design, John Wiley & Sons, Inc., latest edition. 3. W.T. Grondzik W.T.; J.S. Reynolds ; B. Stein; A.G. Kwok Mechanical and Electrical Equipment for Buildings, John Wiley & Sons, latest edition. 	

Revised July 2014