Subject Description Form

Subject Code	ME5510
Subject Title	Thermal Engineering
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Students should have basic knowledge in Thermofluids
Objectives	To provide students with knowledge of engineering thermodynamics and heat transfer; to enable the students the ability of modeling, analyzing and solving the practical problems in thermal engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. possess state-of-the-art knowledge and skills in the area of thermal science and engineering, be able to apply their knowledge and skills in designing and developing products or engineering systems; b. think critically and holistically in dealing with thermal problems, and generate practical solutions; and c. recognize the need for, and engage in life-long learning.
Subject Synopsis/ Indicative Syllabus	***Engineering Thermodynamics:*** Re-examination of engineering thermodynamics; temperature; entropy; exergy; fundamental laws; energy analysis; second law analysis. ***Heat Transfer:*** Heat and heat transfer; conduction (fundamental laws, thermal conductivity, heat conduction equation); convection (governing laws, convective heat-transfer coefficient, scaling analysis, nondimensional governing numbers); radiation; heat exchangers (overall heat-transfer coefficient, thermal design). ***Computational Fluid Mechanics:*** Governing equations of fluid flow and heat transfer; finite element method; finite difference method; finite volume method; other numerical techniques. ***Case Study 1:*** Design of coffee/tea cups. ***Case Study 2:*** Design of rice cookers. ***Case Study 3:*** Flow and heat transfer in rotating machinery. ***Case Study 4:*** Flow and heat transfer in thermal management systems of electronic equipment. ***Case Study 5:*** Room ventilation design.
Teaching/Learning Methodology	1. The teaching and learning methods include lectures/tutorial sessions, homework assignments, test, case study report and examination. 2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for thermal science and engineering. 3. Technical/practical examples and problems are raised and discussed in class/tutorial sessions.

Teaching/Learning Methodology	Intended subject learning outcomes		
	a	b	c
1. Lecture	√	√	√
2. Tutorial	√	√	√
3. Homework assignment	√	√	√
4. Case study report and presentation	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Homework assignment	20%	√	√	√
2. Test	20%	√	√	
3. Case study report and Presentation	20%	√	√	√
4. Examination	40%	√	√	√
Total	100%			

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

Overall Assessment:

0.40 × End of Subject Examination + 0.60 × Continuous Assessment

The continuous assessment consists of three components: homework assignments, test, and case study report & presentation. They are aimed at evaluating the progress of students study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.

The examination is 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.

Student Study Effort Expected

Class contact:	
▪ Lecture	21 Hrs.
▪ Tutorial/Case study	18 Hrs.
Other student study effort:	
▪ Self Study	45 Hrs.
▪ Case study report preparation and presentation	21 Hrs.
Total student study effort	105 Hrs.

Reading List and References

1. Cengel Y. A. and Boles M. A., *Thermodynamics: An Engineering Approach*, McGraw-Hill, latest edition.
2. Holman J. P., *Heat Transfer*, McGraw-Hill, latest edition.
3. Cengel Y. A., *Heat Transfer: A Practical Approach*, McGraw-Hill, latest edition.
4. Morris W. D., *Heat Transfer and Fluid Flow in Rotating Coolant Channels*, Wiley, latest edition.
5. Han J. C., Datta S., Ekkad S., *Gas Turbine Heat Transfer and Cooling Technology*, CRC Press/Taylor & Francis, latest edition.
6. Yeh L.T. and Chu R. C., Thermal Management of Microelectronic Equipment: Heat Transfer Theory, Analysis Methods, and Design Practices, ASME Press, latest edition.
7. Patankar S. V., *Numerical Heat Transfer and Fluid Flow*, McGraw-Hill, latest edition.
8. Fletcher C. A. J., Computational Techniques for Fluid Dynamics: A Solutions Manual, Springer-Verlag, latest edition.