Subject Description Form

Subject Code	ME34003
Subject Title	Thermofluid Mechanics
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: AP10005 Physics I
Objectives	1. To provide fundamental concepts and knowledge of fluid mechanics, acoustics and heat transfer. 2. To provide fundamental concepts and knowledge of internal and external flow systems, pump and fan systems, heating and cooling systems and their applications to product design.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate and solve fluid-mechanic/heat-transfer/acoustic problems by applying knowledge of thermofluids, heat transfer, acoustics and mathematics. b. Complete a design project of a thermofluid system by applying knowledge acquired in the subject with the aid of computer technology. c. Analyze and interpret data obtained from experiments in fluid mechanics, acoustics and heat transfer. d. Search for updated technology in thermofluid engineering in completing a design project of a thermofluid system. e. Communicate effectively in completing written reports of laboratory work and design project.
Subject Synopsis/ Indicative Syllabus	***Fluid Mechanics –*** Basic concepts. Fluid pressure and manometers. Bernoulli, energy and momentum equations. Pitot tubes. Laminar and turbulent flow in pipes. Moody chart, frictional and minor losses. Design for pipes in parallel and in series. Pump matching in pipe flow system. Parallel flow over flat plates, flow over cylinders and spheres. Dimensional Analysis. Buckingham π theorem. Flow similarity and modeling. ***Flow Generation –*** Conservation of angular momentum and working principles of fluid machinery. Performance characteristics of fans, pumps and blowers and their design selections. Engineering estimates of the working point of the fluid machines in products. ***Heat Transfer –*** Revision: basic heat transfer modes; one-dimensional steady state heat conduction in plane walls and cylinders; electrical analogy method. Thermal insulation. Critical thickness of insulation. Fins. Natural convection over surfaces. Forced convection over flat plates and in pipes. Heat exchangers. Thermal, blackbody and gray body radiations. View factors. Radiative exchange between surfaces in enclosures.

	Noise – Sound pressure and sound power levels. Point source models. Common noise source mechanisms involving flow and vibration and their sound power laws. Simple noise control design. **Experimental Work** There are two 2-hour laboratory sessions with the following typical experiments: 1. Flow pattern at exit of a hair dryer 2. Heat transfer via a heat sink 3. Natural convection and radiation heat transfer 4. Noise control technique
Teaching/Learning Methodology	1. The subject intends to lay a solid scientific foundation for the design and analysis of a product in which thermofluid sciences play a crucial role. Systematic lectures are required to achieve such foundation building coupled with assignments (outcomes a, and b). 2. Tutorials are used to illustrate the applications of fundamental knowledge to practical situations (outcomes a, b, and d). 3. Laboratory works are essential for students to have hands-on experience of the thermofluid systems to be learned (outcomes c and e). 4. The design project aims to integrate the thermofluid sciences to engineering design of a thermofluid system, and this design task provides opportunity to apply knowledge of mathematics, thermofluid sciences and acoustics to design a real-life product (outcomes a, b, d and e). It is intended to make use of these teaching/learning methodologies to achieve the intended subject learning outcomes as indicated in the following table:

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√			
Tutorial	√	√		√	
Experimental Work/Report			√		√
Design Project/Report	√	√		√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	50%	√	√			
2. Test	25%	√	√			
3. Assignments	7.5%	√			√	
3. Design Project/Report	10%	√	√		√	√
4. Laboratory Work/Report	7.5%			√		√
Total	100%					

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

Overall Assessment:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

Examination is adopted to assess students on their overall understanding and ability in applying the concepts and knowledge of thermofluid mechanics. It is supplemented by homework assignments, design project/report and laboratory works/reports. The mid-term test which covers the first half of the course materials provides useful timely feedback to both lecturer and the students on the topics.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial/laboratory	6 Hrs.
Other student study effort:	
▪ Coursework (Assignments, Design Project/ Laboratory Works and Reports)	39 Hrs.
▪ Self Study	39 Hrs.
Total student study effort	117 Hrs.

Reading List and References

1. Cengel Y.A., Turner R. H. and Cimbala J. M., Fundamentals of thermal-fluid sciences. McGraw Hill, latest edition.
2. Holman J. P., Heat Transfer, McGraw Hill, latest edition.
3. Wright T., Fluid machinery: performance, analysis, and design, CRC Press, latest edition.
4. Munson B. R., Young D. F., Okiishi T. H., Huebsch W. W., Fundamentals of Fluid Mechanics, John Wiley, latest edition.
5. Barron, R. F., Industrial Noise Control and Acoustics, Marcel Dekker Inc., latest edition.

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