Subject Description Form

<table>
<tr><td>Subject Code</td><td>ME576</td></tr>
<tr><td>Subject Title</td><td>Turbulent Flows and Aerodynamics</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>5</td></tr>
<tr><td>Pre-requisite/
Co-requisite/
Exclusion</td><td>Students should have basic knowledge in fundamental fluid mechanics.

Exclusion: ME568 Flow System Design and Analysis</td></tr>
<tr><td>Objectives</td><td>To provide students with knowledge of advanced fluid mechanics and aerodynamics knowledge.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a. possess state-of-the-art knowledge in the area of advanced fluid dynamics, typical engineering flows and aerodynamics;
b. apply their knowledge, skills and hand-on experience, gained from the subject, to the design and analysis of engineering flow and aeronautical systems;
c. extend their knowledge of mechanical engineering to different situations of engineering context and professional practice; and
d. have recognition of the need for, and an ability to engage in life-long learning.</td></tr>
<tr><td>Subject Synopsis/
Indicative Syllabus</td><td>A Review of Kinematics and Dynamics of Flow Fields: Eulerian and Lanrangian descriptions; rotational and irrotational flows; acceleration of a fluid particle; Euler’s equation; Bernoulli’s equation; conservation equations of mass; momentum and energy.

Time-averaged Conservation Equations: Reynolds-averaged equations of mass; momentum and energy conservations; turbulence modelling: large-eddy simulation, eddy-viscosity hypothesis, mixing length models and two equation transport models.

Typical Turbulent Flows: Wakes of bluff bodies, plane and round jets, mixing layers, boundary layers, pipe and channel flows.

Compressible Flows: Subsonic compressible flows. Transonic, supersonic and hypersonic flows. Stagnation properties; one-dimensional isentropic flow; isentropic flow through nozzles; shock waves and expansion waves.

Aerodynamic Characteristic of Airfoils and Wings: Vortex street; vortex street in thin-airfoil theory; properties of the symmetrical airfoil; properties of the cambered airfoil; flapped airfoil. Wings of finite span: lift, drag, lift/drag ratio.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>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 flow and aerodynamic system design and analysis.
3. Technical/practical examples and problems are raised and discussed in class/tutorial sessions.
<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="4">Intended subject learning outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1. Lecture</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Tutorial</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Homework assignment</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>4. Case study report and presentation</td><td>√</td><td>√</td><td>√</td><td></td></tr>
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Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Homework assignment	20%	√	√	√	√
2. Case study report and presentation	20%	√	√	√	
3. Examination	60%	√	√	√	√
Total	100%				

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

Overall Assessment:

$0.60 \times$ End of Subject Examination + $0.40 \times$ Continuous Assessment

The continuous assessment consists of three components: homework assignments 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	24 Hrs.
▪ Tutorial/Case study/Laboratory	15 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, Cimbala J M, *Fluid Mechanics: Fundamentals and Applications*. McGraw Hill, latest edition.
2. Kuethe A M, Chow C-Y, *Fundamentals of Aerodynamics: Bases of Aerodynamic Design*, John Wiley & Sons, Inc. latest edition.
3. Rathakrishnan E, *Gas Dynamics*, PHI Learning Private Ltd., latest edition.