Subject Description Form

Subject Code	AAE2003
Subject Title	Introduction to Aircraft Systems
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To develop students' knowledge and skill in the operation and design of essential mechanical and electrical systems in transport aircrafts.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the configurations and operating principles of essential aircraft systems; and b. Apply basic engineering skills to draft preliminary designs of essential aircraft systems.
Subject Synopsis/ Indicative Syllabus	**Atmospheric Condition** – Properties of air; The Earth's atmosphere; Standard atmosphere; Atmospheric wind and turbulence. **Hydraulic Systems** – Flight control and utility functions; Emergency power sources; Landing-gear system. Braking and anti-skid; System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Filters; Pressure Control; Power distribution. **Pneumatic Systems** – Pitot-static systems; Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services; Use of engine bleed air; Bleed air control; Thrust reversers. **Electrical Systems** – Characteristics of civil aircraft electrical system; Batteries Installation and Operation; DC power generation; AC power generation, Electrical loads and Voltage regulation; Emergency power generation; Power distribution; Inverters, transformers and rectifiers; Circuit protection; External / Ground power. **Flight Control Systems** – Principles of flight control; Operation and effect of primary and secondary flight control systems, including ailerons and spoilers, elevators, stabilators, variable incidence stabilizers and canards, rudder, rudder limiter, high lift devices, drag inducing devices, trim tabs, servo tabs and control surface bias. **Powerplant** – Constructional arrangement and operation of turbojet, turbofan, turboshaft and turbo-prop engines; Types and basic performance of Inlet, compressors, combustion section, turbine section and exhaust; Fuel efficiency; Effect of specific thrust; Specific fuel consumption and flight speed; Engine cycle and performance.

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Propeller – Fundamentals of Blade element theory. High / low blade angle, reverse angle, angle of attack, rotational speed; Propeller slip; Aerodynamic, centrifugal, and thrust forces; Torque; Relative airflow on blade angle of attack; Vibration and resonance; Speed control and pitch change methods.

Fuel Systems – Characteristics of aircraft fuel systems. Fuel system components. Aircraft mass and payload. System lay-out; Fuel tanks; Supply systems; Dumping, venting and draining.

Landing Gear – Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and auto braking; Tires; Steering; Air-ground sensing.

Environmental Control Systems – The need for cabin and equipment conditioning; Pressurization systems and Environmental control system design; Control and indication including control and safety valves; Cabin pressure controllers; Air distribution systems.

Air Conditioning System – Air cycle and vapour cycle machines; Distribution systems; Flow, temperature and humidity control system.

Fire and Oxygen Emergency Systems – Warning systems. Fire and smoke detection and warning systems; Fire extinguishing systems; Portable fire extinguisher. Emergency oxygen- System lay-out: cockpit and cabin; Sources, indications and warnings.

Ice and Rain Protection Systems – Ice formation, classification and detection; Anti-icing systems: electrical, hot air and chemical; De-icing systems: electrical, hot air pneumatic and chemical.

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<tr><td>Teaching/Learning Methodology</td><td>

Lectures and tutorials are used to deliver the fundamental knowledge in relation to various aircraft systems.

Tutorials will also be used to provide supervised self-study and consultation to students' enquiries.

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<tr><td rowspan="2">Teaching / Learning Methodology</td><td colspan="2">Intended subject learning outcomes to be covered</td></tr>
<tr><td>a</td><td>b</td></tr>
<tr><td>1. Lectures</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Tutorials</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
1. Individual assignment	15%	✓	
2. Mid-term test	15%	✓	
3. Group project	20%		✓
4. Final examination	50%	✓	✓
Total	100 %		

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

Overall Assessment:

0.50 × End of Subject Examination + 0.50 × Continuous Assessment

The final examination is adopted to assess students on their overall understanding of the concepts and their ability in applying the concepts. The continuous assessment consists of assignment, test and group project is aimed at enhancing students' comprehension and assimilation of various topics of the syllabus.

Student Study Effort Expected

Class contact:	
▪ Lectures	26 Hrs.
▪ Tutorials	13 Hrs.
Other student study effort:	
▪ Self-study	30 Hrs.
▪ Continuous assessments	39 Hrs.
Total student study effort	108 Hrs.

Reading List and References

I. Moir and A.G. Seabridge, Design and Development of Aircraft Systems AIAA, 2020.

I. Moir and A.G. Seabridge, Aircraft Systems: Mechanical, Electrical, and Avionics Subsystems Integration, 3rd edition, Wiley, 2011.

J. Anderson, Introduction to Flight, 9th edition, McGraw Hill, 2021.