



SAMPLE COURSE OUTLINE

AVIATION
ATAR YEAR 12

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Sample course outline

Aviation – ATAR Year 12

Unit 3 and Unit 4

Semester 1

Week	Key teaching points
1–3	<p>Introduction</p> <ul style="list-style-type: none"> • structure of the syllabus • course outline • assessment outline • school assessment policy <p>Performance and operation: Navigation, meteorology and radio communication</p> <ul style="list-style-type: none"> ▪ general concepts of meteorology <ul style="list-style-type: none"> ▪ cloud formation processes, including calculation of cloud tops and bases and temperatures at various levels ▪ atmospheric stability and instability, adiabatic process, environmental lapse rate ▪ synoptic chart interpretation ▪ seasonal weather conditions in different regions of Australia with respect to visibility, prevailing winds, typical cloud patterns and precipitation, seasonal pressures and frontal systems, and tropical cyclones ▪ the purpose of the current weather forecasts and reports used by general aviation ▪ current aviation terminology describing cloud cover and visibility ▪ occurrence and formation of thunderstorms, low cloud, fog (advection and radiation), poor visibility, turbulence, thermals, dust devils, wind shear, microbursts, tropical cyclones and the nature of the hazard which each poses to aircraft operations <p>Task 1: Meteorology test</p>
4–5	<p>Aviation development</p> <ul style="list-style-type: none"> • factors influencing the ongoing development and/or likely impact of: <ul style="list-style-type: none"> ▪ aircraft capacity and range ▪ power plants (fuel efficiency, electric), alternative fuels ▪ unmanned aerial vehicle (UAV) ▪ aircraft noise ▪ composite materials ▪ ageing general aviation (GA) aircraft fleet, metal fatigue and airframe life extension • issues affecting aviation development and their likely impact on aviation and the community, including: <ul style="list-style-type: none"> ▪ issues of traffic growth in Asia ▪ air traffic congestion in Europe and USA ▪ low-cost carriers <p>Task 2: Investigation – Aviation development research report, followed by an in-class essay</p>
6–9	<p>Performance and operation: Navigation, meteorology and radio communication</p> <ul style="list-style-type: none"> • air navigation terminology, including: indicated air speed, calibrated airspeed, drift, estimated time of departure, actual time of departure, estimated time of arrival, actual time of arrival, estimated time interval, actual time interval, air position, dead reckoning position, track required, track made good, cross wind component • principles of air navigation, including <ul style="list-style-type: none"> ▪ magnetic compasses - review limitations of use in an aviation environment ▪ application of magnetic variation and deviation in the operation of the compass ▪ understanding the relationship between heading/true air speed (TAS), wind speed and direction, and track and ground speed (triangle of velocities). Compute, using a map or a flight computer, one of the velocities, given the other two ▪ determination of drift angle (track made good to track required) and the adjustment required to correct it and return to the track required by a given point, either using a map or the 1 in 60 rule

Week	Key teaching points
	<ul style="list-style-type: none"> ▪ performing speed/time/distance/fuel flow and volume calculations mentally and using flight computer ▪ determining head/tailwind and crosswind components, given a wind velocity and direction ▪ use of flight computer to calculate triangles of velocities, track and ground speed, conversion of calibrated air speed (CAS) to TAS, fuel calculations, conversion of fuel volumes given specific gravity ▪ use of radio navigation aids to obtain position lines and fixes ▪ 10-minute markers • time <ul style="list-style-type: none"> ▪ effects of Earth's rotation and revolution around the Sun in relation to beginning and end of daylight and period of daylight ▪ determination of local mean time from first light and last light tables ▪ effect of changes of longitude on local mean time ▪ calculation of Coordinated Universal Time (UTC) from local mean time <p>Task 3: Navigation test 1</p>
10	<p>Performance and operation: Navigation, meteorology and radio communication</p> <ul style="list-style-type: none"> • flight planning <ul style="list-style-type: none"> ▪ purpose and use of area QNH (mean height above sea level over an area), local QNH (height above sea level at a location, typically at an airport) , QFE (height above the aerodrome reference point) , transition layer, transition level, flight level and altitude ▪ pressure height and density height, and their calculation using a formula or flight computer ▪ planning a visual flight rules (VFR) flight with consideration given to route selection, cruising altitudes, departure time, weather, terrain, aircraft performance, alternative aerodromes, beginning and end of daylight • development of electronic flight information systems (EFIS)/head-up display (HUD) glass cockpit • presentation of information on EFIS and HUD displays, advantages and disadvantages of each on aircraft operations • principles of operation, purpose and limitations of the: <ul style="list-style-type: none"> ▪ inertial navigation system (INS) ▪ global navigation systems (GPS, Galileo, Glonass) ▪ primary surveillance radar (PSR) ▪ secondary surveillance radar (SSR) ▪ instrument landing system (ILS) ▪ automatic dependent surveillance broadcast (ADSB) • visual approach slope guidance systems (T-VASIS, VASIS, PAPI) <p>Task 4: Navigation test 2</p>
11–12	<p>Aviation skills: Practical flight skills</p> <ul style="list-style-type: none"> • use of Microsoft Flight Simulator – Cessna 172 to demonstrate general handling of aircraft • demonstrate homing to a station using an ADF, and demonstrating station passage <p>Aviation skills: Process skills</p> <ul style="list-style-type: none"> • identify potential safety hazards • communicate effectively with others in verbal or written forms • record observations verbally and graphically • research and extract relevant information • make reliable measurements and accurately record data • operate and interpret indications on aviation navigation equipment • devise accurate flight plans <p>Task 5: Semester 1 Practical examination</p>

Week	Key teaching points
13–15	<p>Aerodynamics: Principles of flight</p> <ul style="list-style-type: none"> • review disposition of forces of an aircraft in level flight, a climb with power, descent, glide and turn • aerodynamic characteristics of stalling and spinning • wing loading and load factor calculations and consequent increase in stall speed • factors affecting directional stability: position of centre of gravity, size of the fin and rudder movement • factors affecting lateral stability: high and low wing configurations, dihedral configurations, sweepback • factors affecting longitudinal stability: position of centre of gravity, movement of centre of pressure, changes in thrust, tailplane movement • spiral instability, static and dynamic stability • purpose and operation of trim tabs, stability • controllability during ground operation • purpose and function of aerodynamic design features: anhedral, spoilers, speed brakes • purpose and function of unconventional controls: stabilators, ruddervators, elevons, flaperons, canards, and speed brakes • vortex generators and boundary layer control, high lift devices <p>Task 6: Semester 1 Written examination</p>

Semester 2

Week	Key teaching points
1–3	<p>Aerodynamics: Principles of flight</p> <ul style="list-style-type: none"> • rotary wing <ul style="list-style-type: none"> ▪ principles of lift and drag ▪ flight manoeuvres – hovering, transition and translational lift, cruise, descent, vertical ascent and descent (autorotation) ▪ principles associated with helicopter operation, including gyroscopic precession, retreating blade stall, coning, Coriolis effect, tail rotor drift ▪ forces acting on helicopters in flight ▪ helicopter controls • high speed aerodynamics <ul style="list-style-type: none"> ▪ aerodynamic principles related to transonic, supersonic and hypersonic flight regimes ▪ mach number and critical mach number, shock waves ▪ aerodynamic structures incorporated into the design of transonic and supersonic aircraft <p>Task 7: Principles of flight test</p>
4–6	<p>Performance and operation: Aircraft performance</p> <ul style="list-style-type: none"> • airspeed limitations: normal operating speed (V_{no}), never exceed speed (V_{ne}), maximum manoeuvring speed (V_a), turbulence penetration speed (V_b), flap operating speed (V_{fo}), flap extension speed (V_{fe}), stall speed (V_s) in clean and landing configuration • configuring an aircraft for maximum range or maximum endurance • the effect of altitude on engine performance • design and operation of turbochargers and superchargers • purpose, components and operation of basic aircraft electrical, hydraulic, pressurisation, and de-icing systems • principles of operation of constant speed propeller engine • coordinated use of throttle and propeller pitch to maintain a desired power setting • variation of propeller design, including full feathering and reverse pitch • correct use of mixture control, manifold air pressure, and engine RPM controls • purpose of engine manifold air pressure gauge • principles and operation of turbine engines; Newton's Third Law of Motion

Week	Key teaching points
	<ul style="list-style-type: none"> • differences between turbofan, turbojet and turboprop engines, and their individual advantages and limitations • thrust reversal systems • issues associated with the operation of jet engines, including environmental issues • using the Piper Turbo Lance aircraft as an example of an advanced light aircraft, determine, under a range of parameters: <ul style="list-style-type: none"> ▪ fuel use, time and distance to climb and descend ▪ TAS, cruise power settings and associated rates of climb ▪ calculation and adjustment of position of centre of gravity ▪ take-off and landing distances ▪ weight and balance <p>Task 8: Investigation – Quantitative analysis of secondhand data (using the Piper Turbo Lance aircraft as an example of an advanced light aircraft, determine, under a range of parameters: fuel use, time and distance to climb and descend; TAS, cruise power settings and associated rates of climb)</p>
7–10	<p>Human factors: Human performance</p> <ul style="list-style-type: none"> • causes, symptoms and remedies of hypoxia and hyperventilation • causes and effects of decompression sickness after scuba diving and its relation to flight • role of the semi-circular canals in visual meteorological conditions (VMC) and instrument meteorological conditions (IMC) • physiological effects of noise • effects and dangers of spatial disorientation • effect on visual acuity of acceleration forces, dietary deficiencies, hypoxia, and carbon monoxide poisoning • problems in flight associated with colour blindness, smoking, drugs, flicker vertigo, night operations • effects of colour vision defects in aviators • effects of common eye deficiencies, including myopia, hypermetropia, astigmatism and presbyopia, on flight, if uncorrected • common visual illusions that affect aircrew • sources, symptoms and effects of carbon monoxide poisoning, and the effect of breathing air contaminated by other noxious products, including fuel • effects on pilot performance of smoking, alcohol and drugs, including both medical and illegal drugs • regulations pertaining to drugs and alcohol in aviation • causes, symptoms and treatment for motion sickness <p>Task 9: Human performance test</p>
11–12	<p>Aviation skills: Practical flight skills</p> <ul style="list-style-type: none"> • use of Microsoft Flight Simulator – Cessna 172 to demonstrate general handling of aircraft • demonstrate homing to a station using an ADF, and demonstrating station passage interpretation of the information displayed by the automatic direction finder (ADF), VHF omnidirectional radio beacons (VOR), instrument landing system (ILS), visual approach slope indicator system (T-VASIS, PAPI) and distance measuring equipment (DME) <p>Aviation skills: Process skills</p> <ul style="list-style-type: none"> • identify potential safety hazards • communicate effectively with others in verbal or written forms • record observations verbally and graphically • research and extract relevant information • make reliable measurements and accurately record data • operate and interpret indications on aviation navigation equipment • devise accurate flight plans <p>Task 10: Semester 2 Practical examination</p>

Week	Key teaching points
13–15	<p>Human factors: Human performance</p> <ul style="list-style-type: none"> • effects on the human body due to positive and negative accelerations (g-forces) • gravity-induced loss of consciousness (G-LOC) and methods of reducing adverse effects of G-LOC, such as pressure suits • stages leading to G-LOC <p>Human factors: Aviation safety</p> <ul style="list-style-type: none"> • common causes of general aviation aircraft accidents • effects on aviation safety of human factors, including stress, training, fatigue, communication skills, assertiveness and judgement, cockpit culture • effects on aviation safety of aircraft design, ergonomics, maintenance, air traffic control and meteorological factors • the importance of situational awareness on decision making associated with safe flight • the development of TEM today • the integration of TEM into flight crew training • reasons for incorporating threat and error management into aircraft operations <p>Task 11: Semester 2 Written examination</p>