Aviation Course Handbook
2013
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Flying at Melville Senior High School

General Information

Years 8-10
Air Experience Flights (AEF) with Melville SHS Flight Instructors

One of the highlights of the MSHS Aviation course is the opportunity for students to participate in practical air experience flights. Air experience flights allow students to experience the sensation of flying as well as learn about aircraft operations. Most students find AEF’s to be highly motivating and personally rewarding experiences that allow them to apply skills and knowledge learned in the classroom in a meaningful and challenging context.

A number of different flights are available depending on the student’s experience and preference. For example, it is usual for a lower school student to undertake a joy flight with other students in a four seater aircraft. The purpose of this is to encourage the student to become comfortable in their new environment and to demonstrate to the student all facets of flight.

Aerobatics flights are available but as they are for one student per flight they are more expensive ($170).

An AEF can be undertaken with a qualified pilot through one of the flight schools at Jandakot airport. Flights can be done as many times as requested at a cost of $70 per student per flight.

Once students have reached the second half of their 15th year of age they can undertake flight lessons with the schools flight instructor.

Some assessment tasks are based the flight experience / lessons and will enhance the students achievements although flights/ flying lessons are not mandatory.

Years 11 and 12
Flying Training

Flying training is a part of the course at MSHS however it is not a requirement of the course.

The advantages of flying with MSHS flight instructor is the savings in the hourly rate to learn to fly. There are no expectations of how much flying should be done by students who undertake flight training whilst at MSHS. It is always beneficial to have hands on experience by flying the aircraft and that is why we say that students should not start flying training until they are 15 ½ years old.

Students who wish to take up flying lessons should allow for a lesson sequence that has no more than 2 weeks in between each lesson else relearning of some sequences will be required in order to attain a good skill level. With that in mind the MSHS flight instructors only have a limited amount of time per week to take students on flight lessons. One instructor can take only 2 students per year for lessons in a sequential manner. We do not just train for the first 5 lessons then stop and start with a new student. It is an on-going process until the student finishes school. Some students have managed to achieve solo in an aircraft by end of year 12, some have not. Those students who go further than solo usually have done flight lessons outside school hours at a higher hourly rate. The decision is yours as to how far you want to go.

Other influences on the frequency of flight training is the weather, school holidays, camps etc and the fact that the student has to ask if he or she wants to go flying. It is not the teacher’s responsibility to chase up students for lessons.

Availability of days for flight in school times is dependent on school time tabling constraints as well.

By law the PPL (private pilot’s license) requires a minimum of 40 hours of training before being tested. Normally we have found this stretches out to 50 hours approx due each student’s capabilities.

The PPL is divided into 2 sections, the GFPT (general flying progress test) and the full PPL.

GFPT normally takes approx 25 hours to complete and needs to be tested to allow students to take passengers flying with them around the
Jandakot airport area and south of Jandakot in the ‘training area’. Further navigation training is then required before they can fly outside that area. These navigation exercises are about 2.5 hours in length and 8 navigation exercises need to be completed before a pre license test and then the actual PPL test.

Students also have to complete external exams for; pre solo, training area solo and basic aeronautical knowledge, before GFPT. After GFPT exams for flight rules, meteorology, navigation, human factors, aircraft performance and operation. All these exams are a CASA (Civil Aviation Safety Authority) requirement not MSHS.

The normal sequence of lessons is;
- Effects of controls
- Straight and level
- Climbing an descending
- Turns
- Stalling ( 2 lessons)
- Circuits – these normally would consist of about 10 lessons in the circuit area. (It is expected that during this time the student will go solo)

Training can continue on after this but is dependant upon the student’s financial status and instructor availability. Most students have been able to achieve ‘solo’ as a minimum and some have gone on to complete the GFPT portion by end of year 12.

It is recommended that the student consult with his / her teacher prior to continuing further training after circuits and/or going solo.

At present cost to train in a 2 seat aircraft is approximately $180 per hour. It is envisaged that students start training at 15 ½ and would at least have gone solo by end of year 12 (approx 15hrs).

Venue:
All air experience flights are conducted from various flight schools at Jandakot Airport.

Transportation:
Transportation to and from Jandakot Airport will be in a private vehicle owned and driven by either Mr Randall Brink or Mr Brendan Wallis. In some cases parents will be asked to pick up the child from Jandakot Airport and occasionally the school bus will be used.

Pilot in Command:
The AEF/ flight lessons will be conducted during school hours by either Mr Brink or Mr Wallis, each of whom hold a current Commercial Pilot’s licence and flight instructor certification. This is dependant upon availability and time tabling restraints. Flights conducted outside of school hours can be done at a higher charge, by any flight school’s flying instructor.

Supervision:
If your child is participating in an AEF or flying lesson during school hours they will be under the direct supervision of the teacher whilst at the airport and in the air.

Emergency:
In the unlikely event of fire or any other emergency, your child will be directed by staff to meet at designated, safe location. In flight if an emergency does occur, appropriate emergency procedures will be followed. Parents will be contacted as soon as possible to arrange transportation home. Please note that the student is covered by public liability insurance from the flight school and ‘Risk Cover’ insurance from the Department of Education.

Contingencies:
In the event of unforeseen circumstances en-route to or from the airport (such as a car break down or accident), every effort will be made to contact a parent/care as soon as possible. If your child’s flight is cancelled (for example due to inclement weather or aircraft unserviceability) they will be returned to school as soon as possible.
Entry to the Aviation Course is only available to those students who have been selected by the testing and/or interview with aviation co-ordinator process.

**Pre Requisites:**

Proven performance in the areas of Maths, Science and English.

For Entry into the Aviation Course of Study (Year 11 and 12) students who achieve a B grade or better at the end of year 10 will be able to enter the Aviation Course of Study in Stages 2A/B in year 11 and 3A/B in year 12. Aviation Course of Study counts towards the WACE score at the end of year 12.

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**Lower School Subject Outline**

### Year 8

**Semester 1**

**AVIATION 1** 8AV81  (COST: TBC)

**MECHANICS OF FLIGHT**

This topic is designed to familiarize students with the components of an aircraft. It then deals with the concepts involved in achieving flight.

Educational objectives covered;
- Parts of an aircraft and their functions
- How an aeroplane flies

**WORLD OF AVIATION**

This topic covers the awareness of the history of flight and the manner in which the aircraft has shaped the world. In addition, the student will discover and appreciate the many roles to which the aeroplane has been committed since its invention.

Educational objectives covered;
- Development of aircraft
- Aviation pioneers
- The jet revolution
- Roles of the aeroplane

**Semester 2**

**AVIATION 2** 8AV82  (COST: TBC)

**STRUCTURE OF THE AIRCRAFT**

This topic involves a study of the manner in which aircraft are constructed, following which students practice these techniques in the construction of models.

Educational objectives covered;
- Aircraft structures
- Stresses
- Controls
- Modelling

**AIRCRAFT AND THE ENVIRONMENT**

The topic involves a study of the environment in which aeroplanes operate. This includes the aerodrome, the atmosphere and the communications and control network with which it is involved.

Educational objectives covered;
- The aerodrome
- The atmosphere
- Air traffic control and communications
Year 9
Semester 1

AVIATION 3  8AV91              (COST: TBC)

BUILT TO FLY
This topic involves building of balsa gliders and a scaled down wood propeller. It builds construction skills and the use of tools to create their models.

Educational objectives covered;
- Interpret and understand diagrams
- Make a propeller
- Make a model glider
- Testing and adjustment scheme

POWER TO FLY
This topic studies the components, method of operation and associated systems of piston engines and reaction engines used to power aircraft.

Educational objectives covered;
- Piston engines
- Propellers
- Reaction engines
- Unconventional engines

Year 10
Semester 1

AVIATION 5  8AVX1              (COST: TBC)

PHYSICS OF FLIGHT
This topic studies the application of many of the laws and principles of physics to the flight of an aircraft.

Educational objectives covered;
- Upthrust
- Laws of motion
- Creation of lift
- Behaviour of gases
- Forces on an aircraft
- Gyroscopic effect
- Stability and Simple machines

HUMAN PERFORMANCE AND LIMITATIONS
This topic examines the human element of aviation. It addresses many of the human factors which affect flight.

Educational objectives covered;
- Stress
- Drugs
- Aviation medicine and physiology
- Pilot fatigue
- Visual perception
- Ergonomics of cockpit design

Semester 2

AVIATION 4  8AV92              (COST: TBC)

AEROPLANE AT WAR
This topic describes the various ways in which the aeroplane has been employed as a weapon of war from its invention to the present day.

Educational objectives covered;
- Fighters
- Bombers
- Transports
- Wartime patrol aircraft
- Helicopters

HUMAN FACTORS IN AVIATION
This topic examines the human element of aviation and how it integrates with the aircraft itself. It addresses many of the human factors which have led to aircraft accidents and incidents.

Educational objectives covered;
- Common causes of aviation accidents
- Accident analysis
- Crew management

Semester 2

AVIATION 6  8AVX2  (COST: TBC)

COMMUNICATIONS IN AVIATION
This topic prepares the students for the use of radio in flying. Its gives the student correct procedural language for communicating in the flight environment.

Educational objectives covered;
- Radio calls in and around Jandakot airport
- Radio calls in a radar controlled environment
- Behaviour of radio waves
- Development and application of radio navigation aids.

FLYING THE AEROPLANE
This topic traces the role of the pilot through various stages of flight in fixed and rotary winged aircraft and gliders.

Educational objectives covered;
- Aircraft performance and operation
- All phases of flight including taxying, take-off, climbing, descending, manoeuvring, landing.
Unit 2AAVN
The focus for this unit is on aviation concepts in contexts related to **flying training: general aviation**. Students understand the aerodynamic principles of Bernoulli, Coanda Effect and Newton; the disposition of forces in specific flight manoeuvres; the various types of aircraft stability; and how aircraft are flown to achieve specific flight characteristics.

Students understand various aircraft systems. They also identify specific flight instruments and examine their purpose, operation and limitation.

Students investigate specific flight instruments and examine their purpose, operation and limitation. The development of the internal combustion aircraft engine and aviation careers are also explored.

Unit 2BAVN
The focus for this unit is on aviation concepts in contexts related to **flying training: general aviation**. Students understand the principles associated with aircraft engines, examining the internal combustion engines and various reaction engines. Students investigate different types of propeller design and their operating limitations and supplementary propulsive devices fitted to reciprocating engines.

Students understand the purpose and necessity of civil aviation publications and identify specific rules and regulations governing flight in and around controlled and uncontrolled aerodromes.

Students understand the principles, purpose and need for radio communications in aviation. Radio telephony is examined.

Students become conversant with an array of loading and performance charts used in the general aviation industry and determine the legal requirements for loading and centre of gravity calculations. Specific aerodynamic principles to achieve specific flight characteristics are examined.

Students investigate the evolution of the specific reaction engines. The evolution of the jet airliner and jet fighter are also explored.

Unit 3AAVN
The focus for this unit is on aviation concepts in contexts related to **flying training: advanced aviation**. Students understand terminology associated with navigation and learn how to prepare a map for visual navigation. They learn about map projections, how to complete flight plans, and navigation principles.

Students explore the formation and interaction of weather on aviation operations and the rules regarding visibility.

Students investigate a number of current aviation issues and their impact on society.

Unit 3BAVN
The focus for this unit is on aviation concepts in contexts related to **flying training: advanced aviation**. In this unit, students further their understanding of principles of flight associated with supersonic and rotary wing.

Students examine human physiology pertinent to flight and the cause and effects of inappropriate consumption of drugs and alcohol. Visual and physiological deficiencies and their implications for flight are also explored. They consider the effects of toxic substances and acceleration forces on flight crew and issues associated with flight crew resource management.

Students examine various aircraft navigation and electronic aids and gain an understanding of how these are used in flight operations.

Students investigate the development of Threat and Error Management (TEM).

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***Students will be required to be assessed on either a stage 2 or stage 3 set of units for ATAR. Melville High school students study stage 2 units in year 11 and stage 3 units in year 12. There is a practical component of each stage that is worth 20% of the overall score which is conducted on a flight simulator via PC. A similar practical component is part of the TEE exam and is conducted at Kent Street high School.***
UNIT 2AAVN

Unit Description
The focus for this unit is on aviation concepts in contexts related to flying training: general aviation. Students understand the aerodynamic principles of Bernoulli, Coanda Effect and Newton; the disposition of forces in specific flight manoeuvres; the various types of aircraft stability; and how aircraft are flown to achieve specific flight characteristics.

Students understand various aircraft systems. They also identify specific flight instruments and examine their purpose, operation and limitation. The development of the internal combustion aircraft engine and aviation careers are also explored.

Unit Content
This unit includes knowledge, understandings and skills with the degree of complexity described below:

Aerodynamics
- components of an aircraft, aircraft terminology
- forces acting on an aircraft in flight
- flight controls
- lift generation using Bernoulli Theory and Newton's Third Law
- manœuvring an aircraft in flight and on the ground
- aircraft stability, wake turbulence.

Terminology
- aerofoil, span, chord, camber, thickness/chord ratio, relative airflow, angle of attack, angle of incidence, wing loading, total reaction, lift, drag, lift/drag ratio, laminar flow, turbulent flow, boundary layer.

Design Features
- purpose of aerodynamic design features: anhedral, dihedral, aspect ratio, sweepback, wash out, spoilers, flaps, vortex generators, trim tabs
- purpose and function of unconventional controls: stabilators, ruddervators, elevons, flaperons, canards, and speedbrakes.

Lift and Drag
- theories of lift generation: Ski Effect, Newton's Third Law, Bernoulli's Theory and Coanda Effect
- lift and drag formulae and terminology: coefficient of lift, coefficient of drag, dynamic pressure, static pressure, total pressure
- graphical representation of total drag: induced, and profile drag
- graphs: maximum drag, maximum lift, best lift/drag ratio speed, best glide range speed.

Flight manoeuvres
- disposition of forces of an aircraft in level flight, climb, descent, turns and glide
- relationship between speed, angle of bank, turn radius and rate of turn in a balanced, level turn
- rule of thumb to determine approximate bank angle for rate one turn
- purpose and use of frise and differential ailerons
- aerodynamic characteristics of stalling and spinning.

Performance Considerations
- flying an aircraft to achieve maximum range and endurance
- using graphs to determine stall speed, best range, best endurance, maximum level flight speed
- calculating load factor and wing loading.

Stability and Control
- effect of position of centre of gravity in relation to longitudinal stability, movement of centre of pressure, changes in thrust, tailplane movement, high and low wing affecting lateral stability, dihedral, sweepback
- effect of centre of gravity position on directional stability, size of the fin and rudder moment
- spiral instability, static and dynamic stability, controllability
- purpose of trim tabs, balance tabs, anti-balance tabs, servo and anti-servo tabs, aerodynamic balance and mass balance
- stability and controllability during ground operation
- propeller torque, slipstream, gyroscopic effect, asymmetrical effect and ground effect.
Performance and Operation

Instruments

Engine Instruments
- purpose and operation of the following instruments: tachometer, oil temperature and pressure gauge, fuel pressure gauge.

Gyrosopic Flight Instruments
- purpose, operation and limitations of the following gyroscopic instruments: attitude indicator, direction indicator, turn co-ordinator.

Pressure Instruments
- purpose, operation and limitations (errors) of the pitot static system including the airspeed indicator, altimeter and vertical speed indicator.

Electronic Flight Information System (EFIS) and Head Up Display (HUD)
- development of EFIS/HUD glass cockpit
- advantages and disadvantages of each on aircraft operations
- presentation of information in EFIS and HUD displays
- ergonomics and flight safety.

Aircraft Systems
- purpose and operation of the following systems: ignition, lubrication, induction, fuel, electrical, hydraulic, carburation, fuel injection.

Engine Malfunctions
- correct and incorrect use of hydraulic, electrical, fuel, ignition and vacuum systems.

Aviation Skills

Practical Flight Skills
- general handling of aircraft
  - straight and level flight
  - climbing, descending
  - medium turn, rate 1 turn
- demonstrate a safe takeoff and landing.

Process Skills
- identify potential safety hazards
- record observations verbally and graphically
- communicate effectively with others in verbal or written forms
- record observations verbally and graphically
- research and extract relevant information.

Aviation Development

Engine Development
- petrol and diesel aircraft engines.

Careers in Aviation
- flying careers: civil and military
- non-flying careers: civil and military.
Unit Description
The focus for this unit is on aviation concepts in the contexts related to flying training: general aviation. Students understand the principles associated with aircraft engines, examining the internal combustion engines and various reaction engines. Students investigate different types of propeller design and their operating limitations and supplementary propulsive devices fitted to reciprocating engines.

Students understand the purpose and necessity of civil aviation publications and identify specific rules and regulations governing flight in and around controlled and uncontrolled aerodromes.

Students understand the principles, purpose and need for radio communications in aviation. Radio telephony is examined.

Students become conversant with an array of loading and performance charts used in the general aviation industry and determine the legal requirements for loading and centre of gravity calculations. Specific aerodynamic principles to achieve specific flight characteristics are examined.

Students investigate the evolution of the specific reaction engines. The evolution of the jet airliner and jet fighter are also explored.

Unit Content
This unit includes knowledge, understandings and skills with the degree of complexity described below:

Performance and Operation

Propulsion

Internal combustion engine
- components of an internal combustion engine
- principle of operation of an internal combustion diesel and petrol engine
- necessity of valve lead, lag and overlap
- engine timing
- variety of internal combustion engines including horizontally opposed, in-line, rotary and radial.

Fixed pitch propeller
- aerodynamic principles associated with fixed pitch propellers
- propeller blade twist or washout
- angle of attack of propeller blades changes during acceleration
- limitations of fixed pitch propellers
- effects of propeller operation including slipstream, torque, gyroscopic and asymmetric.

Superchargers and turbochargers
- function and purpose of superchargers and turbochargers.

Constant Speed Unit
- principles of operation of constant speed unit
- coordinated use of throttle and propeller pitch to maintain a desired power setting
- variation of propeller design including full feathering and reverse pitch.

Engine Handling
- correct operation of start-up and shut down of aircraft engines
- correct use of mixture control, manifold pressure (MAP), engine RPM, and use of incorrect fuel octane
- reading of engine gauges: exhaust gas temperature (EGT), MAP, cylinder head temperature (CHT).

Reaction Engines
- Newton’s Third Law and its application to reaction engines
- operation and development of turbofan, turbojet and turboprop and propfan
- use, advantages and limitations of these engines in current jet transport aircraft
- issues associated with the operation of these engines
- operation of ramjet, pulsejet and rocket engine.

Communications

Radio Wave Propagation
- principles of radio wave propagation including amplitude and cycle
- characteristics associated with radio wave propagation in the ultra high frequency (UHF), very high frequency (VHF) and high frequency (HF) bands
- definitions: frequency, attenuation, reflection, refraction
- determining approximate VHF range using rule of thumb.

Radio Telephony
- phonetic alphabet
- local radio procedures and phraseology for circuit flying and flights to/from the training area
- distress and urgency transmissions
- radio failure procedures.

Basic Radio Controls
- operation of radio controls.

Phraseology
- radio phraseology in relation to operation in the circuit General Aviation Aerodrome Procedures (GAAP) and non-controlled, Common Traffic Advisory Frequency (CTAF) and local training area.

Radio Practical Operation
- obtaining appropriate radio frequencies
- operating a typical light aircraft radio system/s
- use of squelch control to eliminate background noise
- radio phraseology in relation to transmission of time, cloud amounts, aerodrome visibility, readability scale
- urgency and distress messages used in radio communication.
Aviation Law

Documentation
- purpose of the following documents: CAR, CAO, AIP and CAAP, en-route supplement Australia, notice to airmen, aeronautical information circular.

Student pilot licence privileges and limitations
- requirements, recency and limitation of a student pilot’s licence

Aerodromes
- significance of taxiway and runway markings, legs of a circuit
- licensed and unlicensed aerodromes.

Flight rules and conditions of flight
- visual flight rules (VFR) including: VMC and altimetry below 10,000 ft
- regulations pertaining to smoking, drugs and alcohol
- aerodrome operations, separation minima, operation in the vicinity of an aerodrome, light signals.

Air service operations
- pilot responsibilities including: carriage of passengers, fuelling of aircraft, ground operations, passenger pre-flight briefing, authority of pilot in command, pre-flight aircraft inspections.

Emergencies and SAR
- difference between an accident and incident
- terminology: Search and Rescue Time (SARTIME), Uncertainty Phase (INCERFA), Alert Phase (ALERFA), Distress Phase (DETRESFA), extract emergency procedures from En-route Supplement Australia (ERSA).
- emergency locator transmitter (ELT) frequency
- purpose and function of the ELT.

Airspace
- airspace classifications including GAAP and non-controlled aerodromes (towered and non-towered)
- terminology: flight information region, flight information area, flight information service, air traffic control, control area, control zone, controlled airspace, radio reports, broadcasts, VFR lanes of entry, Prohibited, Restricted and Danger (PRD) areas, CTAF, GAAP aerodromes, controlled aerodromes
- operational requirements for CTAF and towered aerodromes.

Aircraft Performance

Airframe Limitations
- speed limitations: normal operating speed (Vno), never exceed speed (Vne), maximum manoeuvre speed (Va), turbulence penetration speed (Vb), flap operating speed (Vfo), flap extension speed (Vfe), limit and design load factors.

Take Off and Landing Performance
- pressure and density height
- factors which affect take-off and landing performance
- take-off and landing distances for a Cessna 172 and a Piper Turbo Lance.

Airworthiness and aircraft equipment
- use and purpose of a maintenance release.

Aircraft Loading
- loading terminology including: arm, moment, datum, station, index unit, centre of gravity (CoG), CoG limits, basic empty weight, zero fuel weight, ramp weight
- Alpha loading system.

Loading Charts
- deriving loading information from loading charts (Alpha, Bravo and Charlie)
- completing loading problems including determining centre of gravity (CoG) position within limits (and possible redistribution if found to be out of limits).

Cessna 172 Performance Charts
- use of Cessna take-off and landing charts to determine either distance required or maximum take-off or landing weight
- use of Cessna performance charts to determine centre of gravity
- aerodynamic performance to achieve maximum endurance and range.

Aviation Skills

Practical Flight Skills
- general handling of aircraft
  - straight and level flight
  - climbing, descending
  - medium turn, rate1 turn
- demonstrate a safe takeoff and landing
- demonstrate accurate rectangular circuit.

Process Skills
- identify potential safety hazards
- record observations verbally and graphically
- communicate effectively with others in verbal or written forms
- record observations verbally and graphically
- research and extract relevant information.

Human Factors

Medical Factors
- conditions leading to sudden incapacitation including heart attack, stroke, food poisoning
- causes and effects of fatigue in flight including noise and vibration
- effects of drugs including cannabis, amphetamines, opiates, aspirin, antihistamines and nasal decongestants, tranquillisers, sedatives, antibiotics and alcohol on aircrew performance
- causes and effects of dehydration
- effect of blood donations on aircrew performance
- aviation legislation relating to the use of alcohol and illicit drugs by aircrew, aircraft maintenance staff and ATC personnel.

Aviation Development
- evolution of the airliner or military combat aircraft (fighter/attack/stealth)
- impact of the jet airliner or military combat aircraft on the world
- current and future development of the airliner or military combat aircraft.
UNIT 3AAVN

Unit Description
The focus for this unit is on aviation concepts in the contexts related to flying training: advanced aviation.

Students understand terminology associated with navigation and learn how to prepare a map for visual navigation. They learn about map projections, how to complete flight plans, and navigation principles.

Students explore the formation and interaction of weather on aviation operations and the rules regarding visibility.

Students investigate a number of current aviation issues and their impact on society.

Unit Content
This unit includes knowledge, understandings and skills with the degree of complexity described below:

Performance and Operation
Navigation
Terminology
- basic navigation terms including: heading, indicated air speed, calibrated airspeed, true air speed, wind velocity, track, ground speed, 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, fix, bearing and relative bearings, position lines and cross wind component.

Maps and Documents
- maps and documents in air navigation: World Aeronautical Chart (WAC), Visual Terminal Chart (VTC), Visual Navigation Chart (VNC), Planning Chart Australia (PCA), En-Route Supplement Australia (ERSA) including Prohibited, Restricted and Danger areas (PRD).

Basic Navigation Principles
- track and distance determination using appropriate navigation equipment
- estimating track and distance without equipment
- performing speed/time/distance/fuel flow calculations mentally and using flight computer
- conversions of units including feet/metres, nautical miles/kilometres, pounds/kilograms, US gallons/litres/kilograms of Avgas
- determining head/tailwind and crosswind components given a wind velocity and direction.

Air Navigation
- principles of operation, characteristics and limitations of magnetic compasses
- use and limitation of the magnetic compass
- applying magnetic variation and deviation to the operation of the compass
- use of flight computer to calculate triangles of velocities, track and ground speed, conversion of calibrated air speed (CAS) to true air speed (TAS), time/distance/speed computations, head/tail/crosswind computations, fuel calculations, conversion of fuel volumes given specific gravity, 1-in-60 rule, calculation of density height and pressure height, altitude correction.

Time
- terms associated with time: Coordinated Universal Time (UTC), local mean time, local standard time, local summer time
- conversions between local mean time, UTC, local standard time and summer time
- effects of Earth's rotation and revolution around the Sun in relation to beginning and end of daylight and period of daylight
- effect of changes of longitude on local mean time.

Map Projections
- properties associated with Mercator and Lamber's conformal conic projections
- difference between great circles and rhumb lines
- locating points on the Earth's surface using parallels of latitudes and meridians of longitude
- difference between geographic and magnetic poles
- magnetic variation and isogonal.

Principles of Map Reading
- map to ground, ground to map, topographical features, 10 minute markers.

Flight Planning
- terminology: area QNH, local QNH, QFE, transition layer, transition level, flight level
- planning a flight and completing a flight plan with considerations given to route selection, cruising altitudes, departure time, weather, terrain aircraft performance, alternate aerodromes, beginning and end of daylight.

Meteorology
Atmospheric and General Wind Conditions
- divisions of the atmosphere and Earth's general wind circulation.

Stability, Cloud and Precipitation
- atmospheric stability and instability, adiabatic process, environmental lapse rate
- humidity, relative humidity, dew point temperature
- cloud formation processes, including calculation of cloud tops and bases and temperatures at various levels
- classification of cloud types
- describing cloud cover measuring in OKTAs.

Pressure Systems and Wind
- variation in atmospheric pressure
- formation of pressure systems
- pressure systems terminology including high, low, medium, ridge, trough, col
- local winds including land and sea breezes, katabatic and anabatic winds, and fohn winds.
UNIT 3 BAVN

Unit Description
The focus for this unit is on aviation concepts in the contexts related to flying training: advanced aviation. In this unit, students further their understanding of principles of flight associated with supersonic and rotary wing.

Students examine human physiology pertinent to flight and the cause and effects of inappropriate consumption of drugs and alcohol. Visual and physiological deficiencies and their implications for flight are also explored. They consider the effects of toxic substances and acceleration forces on flight crew and issues associated with flight crew resource management.

Students examine various aircraft navigation and electronic aids and gain an understanding of how these are used in flight operations.

Students investigate the development of Threat and Error Management (TEM).

Unit Content
This unit includes knowledge, understandings and skills with the degree of complexity described below:

Aerodynamics

Rotary Aerodynamics
- principles of lift and drag
- flight manoeuvres
- principles associated with helicopter operation including gyroscopic precession, retreating blade stall, coning, coriolis effect, tail rotor drift, autorotation
- forces acting on a helicopter in flight and draw comparison with fixed wing aircraft
- helicopter controls
- transition from one stage of flight to another.

Supersonic aerodynamics
- aerodynamic principles related to subsonic, transonic, supersonic and hypersonic flight regimes
- comparison of supersonic and subsonic aerodynamic principles
- Mach Number and Critical Mach Number
- aerodynamic structures incorporated into the design of subsonic and supersonic aircraft.

Performance and Operation
Navigational Aids
- principle of operation, purpose and limitation of the automatic direction finder (ADF) and VHF omni-range (VOR)
- principle of operation, purpose and limitation of the distance measuring equipment (DME), inertial navigation system (INS), Global Positioning System
Performance and Operation of PA32-RT
- use of Piper Turbo Lance take-off and landing charts to determine either distance required or maximum take-off or landing weight
- use of Piper Turbo Lance performance charts to determine fuel, time and distance to climb and descend, TAS, cruise power settings, rate of climb, and centre of gravity
- aerodynamic principles to achieve maximum endurance and range.

Aviation Skills

Practical Flight Skills
- general handling of aircraft
  - straight and level flight
  - climbing, descending
  - medium turn, rate1 turn, steep turn
- demonstrate safe takeoff and landing
- demonstrate accurate rectangular circuit entry and recovery from power off stall
- interpretation and use of the Automatic Direction Finder (ADF), VHF Omnidirectional Radio Beacons (VOR), Instrument Landing System (ILS), Visual Approach Slope Indicator System (VASIS) and Distance Measuring Equipment (DME).

Process Skills
- identify potential safety hazards
- record observations verbally and graphically
- 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
- assemble and manipulate aviation navigation equipment
- devise accurate flight plans.

Human Factors

Physiology
- function of the respiratory and circulatory system
- causes, symptoms and remedies of hypoxia and hyperventilation
- causes and effects of decompression sickness after scuba diving and its relation to flight.

The Ear
- basic physiology of the ear
- 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.

The Eye
- basic physiology of the eye
- standards and effects of visual acuity required of a pilot
- effects of myopia, hypermetropia, astigmatism, presbyopia, acceleration forces, dietary deficiencies, hypoxia, and carbon monoxide poisoning on visual acuity
- problems in flight associated with colour blindness, smoking, drugs and flicker vertigo on night vision
- effects of colour vision defects in aviators
- common visual illusions that affect aircrew.

Toxic Substances
- sources, symptoms and effects of carbon monoxide poisoning, and the effect of breathing air contaminated by other noxious products including fuel.

Airsickness
- causes, symptoms and treatment for motion sickness.

G-LOC and Acceleration Forces
- effects on the human body due to positive and negative accelerations (G-forces)
- G-induced loss of consciousness (G-LOC) and methods of reducing adverse effects of G-LOC, such as pressure suits
- stages leading to G-LOC
- aircraft categories and/or types in which G-LOC is likely to occur.

Threat and Error Management (TEM)
- definition of threats and errors and their effects on safe flight
- factors which affect decision-making and situational awareness e.g. stress, pilot attitude, fatigue, culture, leadership, assertiveness, communication skills, judgement
- threats to safe aviation e.g. aircraft design, maintenance, air traffic control, meteorological factors, quality of training

Aircraft Accident Review
- common causes of aircraft accidents.

Aviation Development

TEM in the Aviation Industry
- explore the development of TEM from the Teneriffe accident in 1977 to present day
- explore how TEM is integrated into flight crew training
- explore why threat and error management is incorporated into aircraft operations.
## Weighting and Exam Structure

### Unit 2A - Task Weightings

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