Australian Government
Civil Aviation Safety Authority

Syllabus of Examination
Aircraft Maintenance Engineer Licences
Mechanical Category

Civil Aviation Safety Authority
Syllabus of Examination – Aircraft Maintenance Engineer Licences
Mechanical Category

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You should always refer to the applicable provisions of the Civil Aviation Act, Civil Aviation Regulations and Civil Aviation Orders, rather than this manual, to ascertain the requirements of, and the obligations imposed by or under, the civil aviation legislation.

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1.1 Introduction

Note: This Introduction is to be read in conjunction with each individual subject syllabus.

Due to the fact that the Regulations governing Airworthiness and Licensing may change from time to time and the need for any Airworthiness examination to be current with the regulations in force at the time, the syllabus for Airworthiness Administration has been removed from this document and placed into Airworthiness Advisory Circular (AAC) 9-1, where it can be amended at the same time as the regulation is amended.

The following are applicable to all core and specific group subject syllabi and examinations:

- Questions will be of the multi-choice type.
- Four questions will be taken from each topic.
- To assist candidates who fail examinations, the topics in which they have answered two or more questions incorrectly will be noted on the result notification.
- Wherever possible, the examination questions will be compiled using terminology contained within the syllabi references.
- Candidate’s attention is drawn to the fact that the syllabus is a Syllabus of Examination. The syllabus is a minimum knowledge requirement.

The following are applicable to all core and specific group subject syllabi and examinations, with the exception of Airworthiness Administration (AA):

- Because the specific group subject examinations replace the need to examine on an individual aircraft type or system within the group, specific group examinations will be compiled from the stated references supplemented by relevant manufacturer’s manual information where necessary.
- Candidates may be required to relate the content of any topic to charts, diagrams, drawings from the stated references, manufacturer’s manuals or other sources.
- Specific type syllabi are written in outline only because each aircraft or engine may require different depths of knowledge or subject materials. The examinations may be of the written, short answer or multi-choice type.

As the AA examination has a finite ‘life’, candidates are advised to attempt this examination last (last examination prior to licence application).
1. Common Core Subjects

1.1. Maintenance Practices and Materials (BA)

Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Aircraft Maintenance Practices

- Describe general jacking procedures, including procedures for levelling an aircraft. State the uses and method of operation of jacking equipment such as single-base, tripod and specialised jacks. Describe the uses of trestles, adaptors and safety devices.
- Describe general towing procedures and associated safety precautions.
- State the safety precautions to be observed whilst jacking aircraft.
- State fire precautions applicable to aircraft maintenance and operation.
- State the reasons for and methods applicable to the external earthing of aircraft and associated equipment during refuelling operations.
- Describe general procedures for refuelling and de-fuelling aircraft including safety precautions.
- Describe the general methods used for ground de-icing of aircraft.
- Identify fluid system pipelines by colour coding, symbols or other markings.
- Describe the types of technical manuals used for aircraft maintenance.
- Describe the ATA 100 system.
- Describe the use of Quality Systems in aircraft maintenance.
- Describe aeronautical and other standards applicable to aviation, including ISO, AN, MS, NAS and MIL.

Topic 2 – General Purpose Tools

- Identify and describe the operation and application of the following tools; state special characteristics, precautions and conditions relating to their care:
  - chisels
  - clamps/vices/presses
  - drill bits
  - files
  - hacksaws
1. Common Core Subjects

1.1. Maintenance Practices and Materials (BA)

- hammers and mallets
- pliers
- punches
- reamers
- screwdrivers
- snips/nibblers
- taps and dies
- wrenches (spanners).

**Topic 3 – General Purpose Power Tools**

- Identify and describe the operation and application of the following tools; state special characteristics, precautions and conditions relating to their care:
  - drills (pneumatic, electric)
  - grinders
  - nibblers
  - riveting guns
  - saws
  - soldering irons.

**Topic 4 – Aircraft Maintenance Measuring Tools**

- Identify the following measuring devices; describe the procedures for their use and state any special characteristics. Discriminate between varieties of a tool and be able to select the correct variety/tool for a given application:
  - bore and depth gauges
  - callipers
  - dial test indicators
  - go/no-go gauges
  - micrometers
  - vernier callipers.
Topic 5 – Torque Wrenches and Torque Loading Practice

- With respect to torque wrenches, state the relationship between applied force, lever length, required and indicated torque and be able to solve problems relating to these factors.
- Identify and describe various types of torque wrench. State special characteristics pertaining to their construction or use.

Topic 6 – Aircraft Fastening Devices – Bolts and Screws

- Identify various forms of aircraft bolts and screws (AN, NAS, MS, Metric) by identification number, thread form, physical characteristics or head design.
- State the uses of these devices.

Topic 7 – Aircraft Fastening Devices – Nuts, Washers and Quick Release Fasteners

- Identify by name and physical characteristics, various forms of nuts, washers and quick-release fasteners.
- State the uses of these devices.

Topic 8 – Locking Devices and Springs

- Describe the various forms of lock nuts and nut plates (anchor nuts) and describe their use.
- Identify miscellaneous safetying devices, such as pins, dowels, keys, circlips, lockrings, locking plates and washers. Describe the correct usage for these devices.
- Describe the methods of applying safety (lock) wire to nuts, bolts, screws, valves, removable caps, connectors and turnbuckles.
- Describe the physical characteristics of springs and be able to state their uses.
Topic 9 – Engineering Drawings and Diagrams.

- From given information (utilising symbols, lines, dimensions and tolerances) interpret the following drawings and diagrams:
  - block
  - blueprint
  - electrical
  - isometric
  - logic flowchart
  - oblique
  - orthographic
  - perspective
  - schematic
  - sectional.

- Identify the following information within a title block:
  - drawing and revision number
  - reference number
  - scale
  - weight.

Topic 10 – Bearings and Gears

- Describe various configurations of the following bearing types:
  - ball
  - plain
  - roller
  - self-aligning.

- State the loads for which each bearing configuration is designed, their uses and materials used in their construction.

- Describe common bearing distress terms and state their causes eg, brinelling, burnishing, galling, spalling.

- Describe the methods used to clean, lubricate, protect or store bearings.
1. Common Core Subjects

1.1. Maintenance Practices and Materials (BA)

- Describe the following gear and gear train types:
  - bevel
  - differential
  - helical
  - hypoid
  - planetary
  - rack and pinion
  - sector
  - spur
  - worm.

- State the uses of the above-listed gears and gear trains and be able to calculate the speed ratios of driven and driving gears.

- State the function of ‘idler’ gears and determine the direction of rotation of individual gears in a gear train.

- Describe typical gear tooth wear patterns and state corrective maintenance action as applicable.

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**Topic 11 – Aircraft Materials – Ferrous**

- State the different characteristics of low, medium and high carbon steels; identify common steels used on aircraft by SAE identification number and state the different characteristics of various alloy steels.

- State the properties, heat treatment and applications of carbon/alloy steels.

- Describe the common methods for testing ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.

---

**Topic 12 – Aircraft Materials – Non-Ferrous**

- Identify common aircraft non-ferrous materials by physical characteristics or identification number.

- Name the common alloying elements for aluminium and magnesium. Name effects of each element on the base metal.

- State the methods used and reasons for the heat-treatment of aluminium alloys, magnesium alloys and titanium. Identify the heat treatment of aluminium alloys by code number.

- Be able to describe the methods of testing non-ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.
Topic 13 – Aircraft Materials – Composite/Non-Metallic

- Identify composite materials commonly used in non-structural aircraft applications: and, identify standard weaves used in fibre ‘cloths’ and describe the properties of various fibre elements.
- Describe the resin matrixes used and state the properties of each.
- Describe the various forms of core material used in sandwich type construction.
- State the type and effect of defects in non-structural composite materials and describe methods used to detect defects.
- Identify the physical characteristics of transparent plastics commonly used in aircraft applications and the sealants and rubbers associated with their uses. State any special precautions for their handling and storage.

Topic 14 – Corrosion

- Describe corrosion formation by the galvanic process.
- Relate the various aircraft structural materials to the electro-chemical series.
- Identify and describe common forms of corrosion, their cause and effect.
- Describe corrosion deposits and the factors affecting corrosion (eg, material type and size, heat treatment etc).

Topic 15 – Aircraft Corrosion Control – Removal and Protection

- Describe the methods used to remove corrosion from common aircraft metals.
- Describe the methods used to treat aircraft parts against corrosion (chemical, sacrificial, mechanical).
- State the methods employed to prevent corrosion from occurring on aircraft.
- Describe the effects on aircraft structure of mercury contamination and the methods used to remove the contamination. State precautions to be observed.
1. Common Core Subjects

1.1. Maintenance Practices and Materials (BA)

Topic 16 – Non-Destructive Testing (NDT) – Penetrant Methods

- Describe the Visible Dye and Fluorescent Penetrant inspection processes. State the methods commonly employed (Water Washable, Post Emulsifiable and Solvent Removable) and conditions relating to each method.
- Interpret the results of inspections. Distinguish between false indications and defect indications.
- State the limitations and advantages of penetrant inspection compared to other forms of NDT.

Topic 17 – Non-Destructive Testing Processes and Weld Inspection.

- Describe in general terms the Magnetic Particle, Eddy Current, Ultrasonic and Radiographic inspection processes and their applications.
- State the applications of electric (metallic, inert gas and resistance) and gas (oxy-acetylene) welding.
- Identify conditions relating to welding techniques eg, bead depth and width, penetration, undercut, spatter.

Topic 18 – Soldering

- From referenced data state the chemical composition of solder and the effect that varying the tin/lead content has on melting point.
- State the types, use and purpose of flux and the reason why flux must be removed after soldering.
- Define “tinning” and describe the effect of excessive tinning on wire. State the tool used to prevent excessive tinning and why soldering iron tips are tinned.
- Describe the differences between “soft” and “silver” soldering and state the advantage of using either. Recognize “cold” joints.
- State the reasons for and uses of heat sinks and solder removing devices eg, suckers, braid.
- Describe correct methods of wrapping to be used on various types of terminals.
Topic 19 – Electrical Cables and Connectors

- Describe the construction, characteristics and identification of electrical cables.
- Identify the various aspects of an electrical connector by its identification code.
- Describe the use of hand operated crimping tools and the precautions to be observed.
- Describe the methods of installing and removing wires from connectors.
- Describe the methods and precautions to be observed during forming, identification, routing and securing of low and high-tension electrical cable in different aircraft environments.
- Describe the methods and precautions associated with attaching connectors to coaxial cables.
Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Atmosphere

- In relation to the atmosphere, state:
  - composition
  - effects of altitude on pressure and temperature distribution
  - effect of humidity, temperature and pressure on density.
- Describe the International Standard Atmosphere (ISA) and its application to aerodynamics.

Topic 2 – Aerodynamic Physics

- State the principles involved and describe their application to aircraft:
  - Archimedes’ Principle
  - Bernoulli’s Theorem
  - Boyles Law
  - Charles Law
  - Dalton’s Law
  - General Gas Laws
  - Newton’s Laws of Motion.

Topic 3 – Airflow

- Describe airflow in relation to a body (at rest or in motion) and be able to define the following terms:
  - Boundary Layer
  - Free stream flow
  - Laminar and Turbulent Flow
  - Relative airflow
  - Stagnation.
  - Upwash and Downwash
  - Vortices.
- Be able to describe the formation, classification and effects of ice on an aircraft.
Topic 4 – Airfoils

- Describe the effects of changes in:
  - angle of attack on the pressure distribution around an airfoil
  - fineness ratio
  - wing shape and aspect ratio.

- Describe the relationships between lift, weight, thrust and drag.

- Explain the following terms and their interaction with related forces:
  - angle of attack
  - angle of incidence
  - camber
  - centre of pressure
  - chord
  - drag coefficient
  - induced drag
  - lift coefficient
  - mean aerodynamic chord (MAC)
  - parasite drag
  - wash in/wash out.

Topic 5 – Conditions of Flight

- Define the term centre of gravity (CG) and describe the effects of movements of the CG.

- Define the following terms:
  - centrifugal force/centripetal force
  - gravitational force
  - sideslip
  - skidding
  - stall
  - wing loading.

- Describe the effects on wing loading and stalling speed with changes in:
  - angle of attack
  - angle of bank
  - weight
  - wing area.

- Relate ground speed (GS) true air speed (TAS) and indicated air speed (IAS).
Topic 6 – Flight Stability

- Define and state applications of the following:
  - anhedral
  - dihedral
  - longitudinal dihedral
  - sweepback
  - taper.
- Define and describe the effect of changes to:
  - asymmetric power/thrust
  - directional stability
  - dynamic stability
  - gyroscopic effect
  - lateral stability
  - longitudinal stability
  - slipstream
  - static stability
  - torque effect.
- In relation to longitudinal, lateral, and directional stability, state the axis about which they apply and the aircraft structural features that provide stability about that axis.
- Describe flutter and the maintenance required to eliminate flutter from within the aircraft’s normal flight envelope.
- Describe Dutch Roll and Pitch Up and state the methods used to control them.

Topic 7 – Flight Controls I

- Describe the operation and effect of control systems:
  - control about two axes (elevons, ruddervators)
  - pitch control (elevators, stabilators, variable incidence stabilisers and canards)
  - roll control (aileron and spoilers)
  - yaw control (rudders including rudder throw limiters).
- Describe the operation and effect of:
  - drag inducing devices (spoilers, lift dumpers and speed brakes)
  - high lift devices (slots, slats and flaps including L/E flaps)
  - artificial feel
  - yaw damper
  - Mach trim
  - gust locks.
Topic 8 – Flight Controls II

- Describe how boundary layer control is achieved using wing fences, saw tooth leading edges, vortex generators, stall wedges (leading edge spoilers).
- Define aerodynamic balancing.
- Describe the operation and effect of:
  - Aerodynamic balance panels
  - Balance (lagging) and Anti balance (leading) tabs
  - Bob weights
  - Control surface bias
  - Servo tabs
  - Spring tabs
  - Trim tabs.
- Describe the principles of operation of fly-by-wire control systems and active load control.
- Describe the principles of operation of stall protection systems.

Topic 9 – High Speed Flight I

- Describe the following and know what factors affect them:
  - critical Mach number
  - Mach cone
  - Mach number
  - speed of sound
  - subsonic flight
  - supersonic flight
  - transonic flight.

Topic 10 – High Speed Flight II

- Describe the following and know what factors affect them:
  - aerodynamic heating
  - area rule
  - compressibility
  - expansion waves
  - shock induced drag
  - shock induced stall
  - shock waves (oblique and normal).
Topic 11 – High-Speed Flight III

- Describe the airflow in engine intakes of high-speed aircraft and the factors that affect it.
- Describe the effects of sweepback and fineness ratio on critical Mach number.
- Describe control problems encountered in transonic and supersonic flight and state the methods used to overcome these problems.

Topic 12 – Mechanical Control Components – Construction and Function

- Describe the following components, their function and where applicable, their adjustment procedures:
  - bellcranks
  - fire and vapour seals for control systems
  - levers
  - push-pull rods, and their end fittings
  - quadrants
  - torque arms and torque tubes
  - universal joints
  - screw jacks.

Topic 13 – Control Cable Systems – Construction, Function and Identification

- Describe the following components, their construction, function and identification:
  - automatic cable tensioning devices
  - cables
  - cable fittings
  - cable guards
  - fairleads
  - pulleys
  - bowden cables and flexible shaft control systems.
Topic 14 – Control Cables – Inspection and Maintenance

- Describe the inspection and maintenance requirements, including wear limits for the following components:
  - cables
  - cable fittings
  - cable guards
  - fairleads
  - pulleys
  - bowden cables and flexible shaft control systems.

Topic 15 – Control Chains – Construction, Identification, Inspection and Maintenance

- Describe the applications, constructional features, and dimensional terms with respect to control chains.
- State the physical features of chain installations that provide correct running in endless and terminating chains, protection against incorrect assembly and jamming on sprocket teeth.
- Describe the methods used to assess wear, and distortion of chains and sprockets.
- State how elongation of chains is assessed.
- State the corrosion protection and storage requirements of chains.

Topic 16 – Typical Aircraft Control Systems

- From given information, be able to:
  - fault find
  - identify components
  - state inspection required
  - state the reaction from a given input action.
- Describe the procedures for rigging a typical control system for freedom, correct range of movement, correct cable tension and know the requirements of duplicate inspections.
1.3 Electrical and Instrument Systems (BC)

**Note:** This subject syllabus is to be read in conjunction with the Introduction.

**Topic 1 – Instrument Basics**

- Define the following instrument related terms:
  - absolute, differential and gauge pressure
  - hysteresis error
  - parallax error.

- In relation to the atmosphere, state the pressure and temperature distribution effects of altitude and temperature on pressure and density.

- Define:
  - International Standard Atmosphere (ISA)
  - QFE as setting the pressure prevailing at an airfield to make the altimeter read zero on landing and take-off
  - QNH as setting the pressure scale to make the altimeter read airfield height above sea level on landing and take-off.

- Be able to convert:
  - Imperial gallons to litres and pounds
  - Litres to Kg and pounds
  - PSI to inches or millimetres of mercury (Hg)
  - US gallons to Imperial gallons.

**Topic 2 – Pitot Static Components**

- Describe the basic constructional features and explain the principles of operation of:
  - airspeed indicators (ASI)
  - pressure type altimeters (ALT)
  - vertical speed indicators (VSI).
Topic 3 – Pitot Static Systems

- Describe the layout of a typical pitot static system and the interconnection of the components within the system.
- Describe the procedure for testing the system and its components, stating the specifications in CAO 108.56.
- From given information, determine the causes of faults and state the rectification required in typical pitot static components and systems.
- Describe the features and maintenance use of pitot static drains and moisture traps.

Topic 4 – Gyroscopic Principles and Components

- With respect to gyroscopes, define the terms rigidity (inertia) and precession and describe the factors that affect them.
- With respect to Turn and Slip Indicators and Turn Coordinators, describe the principles of operation and constructional features. State how information is presented to the pilot on these instruments.

Topic 5 – Gyroscopic Components

- Describe the principles of operation and constructional features of Directional Gyros and Artificial Horizons and state how information is presented to the pilot on these instruments.
- Describe the precautions associated with the handling of gyroscopic instruments.

Topic 6 – Power Systems for Gyroscopic Instruments

- Describe typical system layout, name components, explain the operation and describe the servicing procedures for the following gyroscopic power systems:
  - positive pressure
  - vacuum
  - venturi; and
- From given information identify the causes of faults in typical aircraft systems.
Topic 7 – Engine Instruments

- Describe the principles of operation, installation procedures and the conditions sensed by the following instruments:
  - electrical and mechanical tachometers
  - electrical resistance thermometers
  - manifold pressure gauge
  - oil pressure gauge
  - ratiometer electrical resistance thermometers
  - thermocouple thermometer indicators; and
- From given information identify the causes of faults in typical aircraft systems.

Topic 8 – Fuel Flow and Basic Fuel Quantity Indicating Systems

- Describe the construction, operation and adjustments of fuel flow and fuel indicating systems (float and capacitance types). Describe the effect that changes in temperature have on the system.

CAO 108.56

- Describe the test laid down in CAO 108.56 para 3-4.

Topic 9 – Compasses

- Describe the constructional features, principles of operation and installation procedure of floating magnet type magnetic compasses.

CAO 108.6

- Define the following terms as listed in CAO 108.6 Sub-section 2:
  - calibration
  - compensation
  - deviation
  - direct reading compass
  - standby compass.

CAO 108.56

- State the compass calibration and compensation requirements in accordance with CAO 108.56 Sub-section 3 and 4.
Topic 10 – Compass Swinging

CAO 108.6
- Describe the procedures, conditions for carrying out and recording a compass swing in accordance with CAO 108.6 Sub-section 5, 6, 7 and 8.
- Define algebraically, co-efficient A, B and C.
- Describe the procedure for carrying out compass calibration and compensation in accordance with CAO 108.6 APP.1 para 2.2.
- From given information, be able to make out a compass correction card.

Topic 11 – Lead Acid Batteries

- Define battery capacity and rating and list the factors that affect them.
- State the electrolyte used in lead acid batteries, describe its mixing procedure and state how its specific gravity (SG) is varied. List the safety precautions relating to the mixing procedure.
- Describe the procedure for charging lead acid batteries, using the constant voltage and constant current methods and state the effects that battery internal resistance has on these operations. State the indications of a fully charged battery.
- Explain the causes of gassing and sulphating and describe the detrimental effects sulphating has on battery operation.
- Explain the principles of operation of a hydrometer and how it is used to check batteries.
- Determine a battery’s condition of charge by its electrolyte SG and state the effects of temperature on SG.
- Describe the safety precautions relating to cleaning and maintenance of lead-acid batteries and list the materials that may be used to neutralise spilled electrolyte.

Topic 12 – Nickel Cadmium (Ni-Cad) Batteries

- Name the electrolyte used in Ni-Cad batteries and state the difference between the effects charging and discharging have on the electrolyte’s SG compared with that of a lead acid battery.
- Describe the causes of cell imbalance in Ni-Cad batteries and how it can be remedied.
- Define the term “Thermal Runaway” and list the possible causes of this malfunction.
1. Electrical and Instrument Systems (BC)

- Explain how a Ni-Cad battery’s state of charge is determined.
- Describe the safety precautions relating to cleaning and maintenance of Ni-Cad batteries and list the materials that may be used to neutralise spilled electrolyte.

**Topic 13 – DC Generators**

- Describe the constructional features and principles of operation of shunt and alternator/rectifier type DC generators.
- Describe the inspection and maintenance of a simple belt drive system.

**Topic 14 – Voltage Regulation**

- Describe the principles of operation and methods of adjustment of the following regulators:
  - carbon pile
  - transistor
  - transistorised
  - vibrator (three unit regulator).

**Topic 15 – Electrical Components**

- Identify by name and describe the principles of operation and state the function of the various types of the following components:
  - circuit breakers
  - contactors
  - fuses
  - switches.
- Describe the principles of operation and function of the following components:
  - diodes
  - potentiometers
  - resistors
  - rheostats
  - warning bells.
Topic 16 – DC Motors

- Describe the operation, construction and characteristics of series, shunt and compound motors.
- Describe the methods used for speed and directional control and mechanical and electrodynamic braking.

Topic 17 – Typical System Layout and Requirements

- From given information be able to determine function, identify location and describe operation of components within a typical aircraft electrical system.
- In relation to bonding and screening:
  - state the reasons for and differences between the two, and
  - describe the methods employed.

CAO 108.32
- Be able to list the Sub-sections of CAO 108.32. Describe the requirements of Sub-sections 4 and 8, with respect to circuit control and bonding.

Topic 18 – Typical System Fault Finding

- Describe the use of the following test equipment:
  - ammeters
  - bonding testers
  - meggers
  - multimeters
  - ohmmeters
  - voltmeters; and
- Identify faults and determine serviceability of typical aircraft electrical systems from given information.
Topic 19 – Logic Gates

- State the application of and identify the symbols for the following logic gates:
  - AND
  - NAND
  - OR
  - NOR
  - EXCLUSIVE OR
  - INVERTER; and
- Recognise equivalent circuit diagrams and truth tables.

Topic 20 – Electrostatic Sensitive Devices (ESD)

- State the sources of ESD and the damage that can occur.
- Describe the special handling, identification packaging and protection requirements.
- Identify ESD sensitive devices.
- Identify dangerous situations for generating static charge buildups.

Topic 21 – Autopilot I

- Describe the basic layout of a single axis (roll) automatic flight control system.
- Describe the basic operation of the system in the following modes:
  - basic stabilisation
  - turn command
  - heading hold
  - VOR/LOC.

Topic 22 – Autopilot II

- Describe how roll and roll/yaw error signals are sensed in displacement and rate gyros.
- Describe the construction and operation of electro-pneumatic and electromechanical servomotors. Explain the reason for torque limiting and name the two methods used.
Topic 23 – Fire Detection and Protection

- Describe the three methods of controlling a fire (the fire triangle).
- Describe the construction, operation, testing, troubleshooting and maintenance of the following type of fire detection systems:
  - continuous element or pressure type sensor responder
  - continuous loop (fire wire)
  - infra red
  - thermal switch
  - thermocouple.
- Describe typical fixed fire extinguishing systems.
- Describe typical portable fire extinguishers.
- State the inspection and maintenance requirements of both detection and extinguishing systems.
- State properties of extinguisher agents in relation to toxicity and cleanup.
- Describe the operation of the following smoke detection systems:
  - carbon monoxide
  - photoelectric
  - visual.
2. Airframe Core Subjects

2.1. Auxiliary System Principles (FA)

Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Principles of Hydraulics

- Identify correct statements relating to Pascals Law and use this law to solve problems.
- Know the relationship between Pressure, Force, and Area and use this knowledge to solve problems relating to differential areas, pressures, and mechanical advantage.

Topic 2 – Hydraulic Fluids and Seals

- Identify hydraulic fluids by name, MIL specification or colour; state their properties and the precautions to be observed when using them.
- Identify by colour code the types of seals used with hydraulic fluids, and identify the types of seals by name, state their use, explain the principles of their operation and describe the maintenance practices, and tools used for their installation and removal.

Topic 3 – Hydraulic Fluid Lines and Fittings

- Identify flexible hoses to determine their pressure range, material of construction and what fluid they are compatible with. State what information is printed on hoses.
- Identify by name and state the uses of tube and hose end fittings and their component parts. Describe the procedures, equipment used, and precautions to be observed when fabricating rigid and flexible fluid lines for use in aircraft.
- Identify hydraulic system fittings and attaching parts by name and state their uses in the system.
- Describe serviceability checks on rigid and flexible fluid lines.
- Describe general fluid system maintenance practices.
Topic 4 – Landing Gear Components

● Describe the constructional features and explain the function and maintenance procedures of:
  ○ actuating cylinders
  ○ air-oil oleo struts
  ○ drag braces
  ○ floats and skis
  ○ safety devices and indications
  ○ shimmy dampers
  ○ shock or bungee cords
  ○ spring steel struts
  ○ spring-oleo struts
  ○ tailwheel and tailskid assemblies
  ○ torque links.

Topic 5 – Wheels and Tyres

● Describe the construction of aircraft tyres, identify them by their markings, and state their application.

● Describe the precautions to be observed during inflation of aircraft tyres.

● Identify faults and damage that render tyres unserviceable.

● Describe the various types of wheels used on aircraft and state their application.

Topic 6 – Brakes

● Describe the construction, operation, function, inspection and maintenance of:
  ○ disc brakes (single and multiple)
  ○ expander-tube brakes (hydraulic and pneumatic)
  ○ master cylinders
  ○ single and dual-servo brakes
Topic 7 – Aviation Fuels

- Identify the types of aviation fuels and state their applications.
- Describe the following characteristics of aviation fuels:
  - anti-corrosive and anti fungal properties
  - flash point
  - low temperature additives
  - octane number
  - performance number
  - resistance to gum deposit
  - vapour pressure
  - volatility.
- State the common sources of contamination in fuels, and describe the methods used to ensure purity of fuel both in the aircraft and prior to refuelling.
- State the common fuel additives and their uses.

Topic 8 – Fuel System Components

- Describe the construction, operation, function, inspection and maintenance of:
  - filters
  - fuel heaters
  - primers
  - pumps
  - strainers
  - tanks (rigid, flexible and integral)
  - valves.

Topic 9 – Fuel Systems

- From given information identify the location of basic fuel system components including the instrument and electrical interface.
3. Airframe Specific Group Subjects

3.1 Wooden Structures (FD)

Note: This subject syllabus is to be read in conjunction with the Introduction.

**Topic 1 – Woodworking Tools**

- Identify and describe the operation and application of the following woodworking tools and state their special characteristics, precautions and conditions relating to their care:
  - brace and hand drill
  - clamps
  - drill bits
  - hammers
  - planes
  - rasps
  - saws – hand and power
  - trepanning tools
  - wood chisels.

- Explain the procedures for sharpening saws, drills, planes and chisels, stating angles or features as appropriate.

**Topic 2 – Structural Timbers**

- State common species of wood used for aircraft structures and be able to describe its general characteristics.
- State the maximum allowable grain deviation in structural timbers and describe permissible and non-permissible defects, their causes and identifying characteristics.
- Explain the requirements to determine the moisture content of aircraft timbers prior to use. State tests applicable, sample selection, number of samples and seasoning.
- Describe the effects of high moisture content on wooden aircraft parts.
- Define the following terms:
  - annual rings
  - check
  - compression wood
  - conversion of timber
  - dote
  - grain
  - heartwood
3. Airframe Specific Group Subjects

3.1. Wooden Structures (FD)

- knot
- sapwood
- shake
- springwood.

**Topic 3 – Glues and Gluing**

- Describe the preparation requirements for wood surfaces prior to gluing and tests to determine the presence of oil, grease or wax on the surface.
- State the types of glue used for wooden construction, its properties and special characteristics. Describe the method of application and the time periods that are considered critical to their use.
- State the reasons for the use of pressure whilst gluing, the methods of applying pressure and the recommended pressures for hardwoods and softwoods. State any precautions to be observed during the gluing process.
- Define the following terms:
  - closed assembly
  - open assembly
  - pot life.

**Topic 4 – Inspections I**

- Identify typical water and dirt collection points and describe indications of possible water penetration. Identify areas of dry rot and wood decay by appearance, smell or other physical characteristics. State criteria for the rejection or acceptance of decay affected areas.
- Identify possible defects in fabric-covered plywood by the condition of the outer covering and describe inspection procedures and defects in single and double plywood skin structures.
- Identify compression failures in structural timbers, state causes, typical failure areas and methods of detection. Describe the inspection requirements for bolt holes in load-carrying members.
- State the environmental conditions necessary to maintain a wooden aircraft in good condition ie, hangaring, temperature, operation and handling. Describe the effect of extremes of these conditions on the aircraft structure or finish.
Topic 5 – Inspections II

- Describe the methods employed to determine the strength of a glued joint.
- Describe methods of inspecting the glue line to determine its condition. State factors that might cause an inspection to be misleading.
- State the inspections necessary on a glued joint that has failed due to excessive tension or shear loads. Describe the indications to be observed, their possible interpretation and consequences in regard to other glued joints.

Topic 6 – Spar and Rib Repairs

- Name permissible timbers and describe conditions relating to their selection for the repair or replacement of spars and ribs.
- Describe the types of repairs permitted on wing spars and state limitations that apply in relation to their location, orientation or size.
- Describe the methods of splicing spars. State repair dimensions and any conditions relating to the strength or alignment of the repaired spar.
- Describe the methods, limitations and dimensions for repairs to wing rib caps.
- State the methods employed in bending solid and laminated timbers and describe the manufacture of the joints between vertical members of a wing rib and the rib cap strip.

Topic 7 – General Wood Repairs

- Identify various types of plywood skin repair. Describe the methods of repair including the selection of repair material, grain direction, curvature and dimensions.
- Describe the types of repair applicable to load carrying structural timbers or those subject to landing or shear loads.
- State the precautions to be observed prior to refinishing repaired wooden structures. Describe general finishing procedures for interior and exterior surfaces, end-grain surfaces and fabric or tape repairs.
3. Airframe Specific Group Subjects

3.2. Fabric and Doping (FE)

Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Fabric Identification, Construction and Terminology

- Describe the common types of fabrics currently in use and state their characteristics.
- Describe the common types of tapes, cords and threads currently in use, and state their uses, advantages and disadvantages.
- Define the following textile terms:
  - bias
  - mercerised
  - minimum tensile strength deteriorated (undoped)
  - minimum tensile strength new (undoped)
  - pinked edge
  - seam
  - selvedge
  - strength
  - thread count
  - warp
  - weft (woof or fill)
  - weight.

Topic 2 – Dopes, Thinners, Paints and Cements

- Describe the common types of dopes, thinners, primers, paints, fungicides, rejuvenators, cleaning agents and cements used on fabric-covered aircraft.
- Describe the main physical characteristics of the above-mentioned products, and state their compatibilities with each other and different fabrics.
- State the correct storage requirements for the above-mentioned products.
- Describe the main finishing problems that can occur when using dope, including causes and methods used to correct or overcome them.
Topic 3 – Preparation and Inspection Requirements of the Aircraft Structure Prior to Covering

- State the general inspection requirements for the aircraft structure prior to covering with fabric including:
  - cables
  - electrical wiring
  - fairleads
  - grommets.
- When fitting fabric covers, state the considerations involved in respect of direction of weft and warp, airspeed and slipstream, types of seams, describe methods of stitching including appropriate types of knots.
- State the correct environmental conditions under which fabric covering and doping may be undertaken.

Topic 4 – Inspection and Testing Requirements of Existing Fabric Coverings and New Fabric Prior to Use

- State the tensile strength requirements in relation to airspeed and describe the methods to test for this in new undoped fabrics and existing doped fabric covers.
- Describe the surface conditions that will accelerate the deterioration of the fabric and state the methods used to protect the fabric from deterioration. Describe how a weathered surface may be rejuvenated.

Topic 5 – Fabric Application

- State the inspections required prior to recovering of an aircraft structure.
- List the sequence of events in fabric application, including doping and painting.
- State the various methods of recovering a wing, (envelope, blanket and combination).
- Recognise the common visual cues that indicate defective doping.
- State the different methods of attachment of fabric to metal, wood and plywood. Describe how to remove dope from fabric.
3. Airframe Specific Group Subjects

3.2. Fabric and Doping (FE)

### Topic 6 – Rib Stitching, Surface Tapes Inspection Panels and Zips

- Describe the preparation of fabric prior to rib stitching, and describe methods of single and double rib stitching including the considerations in the choice of either method.
- State the different knots and their uses.
- Describe the considerations behind the use of anti-tear tape, including its use at locations on the upper and lower surfaces of a wing.
- State the different methods of creating inspection panels in fabric covered aircraft, and explain the considerations involved in their:
  - location
  - proximity to structural members
  - shape
  - size.
- Describe the methods used to create drainage holes and identify the location of these drainage holes.

### Topic 7 – Fabric Repairs

- State the general criteria used in a fabric repair scheme with particular reference to type of repair to be carried out ie:
  - repair
  - sewed patch repair
  - sewed-in panel
  - stitched tear, and
  - un-sewed doped-on repair.
- State the correct overlap for these repairs.
- State the criteria for balancing control surfaces following a fabric repair to the surface.
- List the general steps required when preparing a patch, doping on the patch and reapplying the aircraft paint scheme to the patched area.
Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Hydraulic Pumps and Power Transfer Units

● Describe the constructional features and explain the principles of operation of typical hand and power hydraulic pumps.

Topic 2 – Hydraulic Power Supply Basic System

● Describe the relationship between the following components; identify their location and state their function in a basic hydraulic power supply system:
  ● accumulators
  ● bypass or offloading valves
  ● check valves
  ● cutout valves
  ● filters
  ● pumps
  ● reducing valves
  ● regulating valves
  ● relief valves
  ● reservoirs.

Topic 3 – Basic Systems I

● Describe the relationship between components in a basic landing gear system. Indicate component locations and state their function.

Topic 4 – Basic Systems II

● Describe the relationship between components in the following basic systems. Indicate component locations and state their function:
  ● airbrakes
  ● flaps
  ● nose wheel steering
  ● power flight controls
  ● power wheel brakes.
Syllabus of Examination – AME Licences – Mechanical Category

3. Airframe Specific Group Subjects

3.3. Power Fluid Systems (FF)

Approved by Group General Manager, Personnel Licensing, Education and Training Group   Issue 2.1: July 2005

Topic 5 – Specific Aircraft Hydraulic Power Supply

- Identify the location and function of components in typical aircraft hydraulic power supply systems.
- Relate data in the references to these systems and determine the effects of faults in components including the interface with the electrical and emergency systems.

Topic 6 – Powered Aircraft Hydraulic Systems 1

- From given information describe the function of components and principles of operation of the following systems:
  - flight controls including feel systems
  - flaps, spoilers, speed brakes and airbrakes.
- Relate data in the references to these systems and determine the effects of faults in components including the interface with the electrical and emergency systems.

Topic 7 – Powered Aircraft Hydraulic Systems 2

- From given information describe the function of components and principles of operation of the following systems:
  - anti skid braking systems
  - nose wheel steering
  - power wheel brakes.
- Describe a typical brake temperature monitoring system, and be able to use a brake limitation chart.
- Relate data in the references to these systems and determine the effects of faults in components including the interface with the electrical and emergency systems.
Topic 8 – High Pressure Air Systems

- Identify principles and uses of high-pressure air systems and components.
- Identify the location and function of components. Describe the effects of faults in components on system operation.
- Relate components to typical aircraft systems given diagrams, drawings and/or written information.
- State precautions to be observed in the servicing and maintenance of high pressure compressed gas systems.
- Relate data in the references to these systems and determine the effects of faults in components including the interface with the electrical and emergency systems.
3.4 Aeroplane Structures and Systems (FG)

Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Aircraft Structure – General Concepts

- Define the following terms:
  - Beam
  - Bending
  - Compression
  - Fatigue
  - Hoop stress
  - Shear
  - Strain
  - Stress
  - Strut
  - Tension
  - Tie
  - Torsion.
- Apply the above-defined terms to given applications.
- Define aircraft structural classifications, primary, secondary and tertiary.
- Define “fail safe” structure. From given information, identify methods of fail-safe design applicable to aircraft structures.
- Define the concept of “Damage Tolerance”.
- Identify the Airworthiness requirements for structural strength.
- Describe hot and cold bonding methods of bonded joints.

Topic 2 – Fuselage, Doors, Nacelles, Engine Mounts Landing Gear Attachments, Equipment and Furnishings

- Identify the following methods of fuselage construction:
  - monocoque
  - semi monocoque
  - truss (Pratt truss and Warren truss).
- Describe the general constructional features of each of these types of structure and identify load-carrying members.
- Describe general constructional features of aircraft doors, nacelles and firewalls.
- Describe general constructional features of various engine mounting arrangements and structures. Describe engine pylon mounting systems and vibration damping methods.
3. Airframe Specific Group Subjects

3.4. Aeroplane Structures and Systems (FG)

- Describe general constructional features of various landing gear arrangements and structures.
- Describe the drainage and ventilation provisions used to control moisture within a structure.
- Describe the general construction and installation of:
  - seats
  - harnesses
  - emergency equipment
  - galley equipment
  - water waste
  - cargo handling and retention equipment.

Topic 3 – Wings, Primary and Auxiliary Control Surfaces

- Describe various forms of wing and stabiliser construction; typically monospar, multispar and box beam. Identify general constructional features such as ribs, struts, wires and tie rods and describe their application to the structure.
- Describe general constructional features of primary and auxiliary control surfaces.
- Describe the attachment of control surfaces and lift/drag devices.
- Describe the methods used to statically and aerodynamically balance control surfaces.
- Describe the principle of “Load Alleviation”.
- Perform calculations relative to the balance of control surfaces to correct for a control imbalance following repair or repaint.
- Describe the methods used to protect the structure in the advent of a lightening strike.

Topic 4 – Inspection of Structures

- Describe the following terms as applied to the determination of locations on, within or around aircraft:
  - butt lines or buttock lines
  - fuselage stations
  - water lines
  - wing stations.
3. Airframe Specific Group Subjects

3.4. Aeroplane Structures and Systems (FG)

- Describe the ATA-100 zoning system used to identify aircraft component locations and access points.
- Describe the factors to be considered when inspecting structures for wear, damage and deterioration.
- Identify visual cues appropriate to structural damage resulting from flight or ground overloads, structural failure of adjacent members and corrosion.
- Describe the inspection procedure and visual cues when inspecting bonded joints.
- Describe the inspection procedure and identify the visual cues appropriate to damage following lightening strike and High Intensity Radiated Field penetration.
- Describe the classifications of damage and the repair or maintenance implications applicable to them.
- Describe ageing, fatigue and corrosion control programs.

Topic 5 – Airframe Symmetry

- Describe the methods used to make the following alignment and symmetry checks:
  - complete airframe for symmetry
  - fuselage for twist and bending
  - vertical stabiliser for alignment
  - wings and horizontal stabilisers for dihedral and incidence.
- Define the following terms:
  - anhedral
  - cabane struts
  - decalage
  - dihedral
  - incidence angle
  - interplane struts
  - longitudinal dihedral
  - rigging position
  - stagger
  - washin
  - washout.
Topic 6 – Riveting – American Standard

- Be able to identify solid and blind rivets by head marking, physical characteristics or identification number.
- State the requirements of edge distance, pitch and gauge for rivet installation.
- Detail the lay out of a riveted repair.
- Describe the procedures, tools, adaptors and precautions used for the installation of solid and blind rivets by hand or power.
- Identify incorrectly installed rivets or common riveting faults and state the causes of defective riveting and rivet failure.
- In relation to rivet design, installation or layout, define the following terms:
  - clearance
  - countersinking
  - dimpling
  - gauge
  - pitch
  - shaving.

Topic 7 – Sheet Metal Repair I

- Describe the principles applied to the selection of materials and repair schemes for the removal and repair of damaged structure.
- Describe the following processes used in the fabrication of replacement sheet metal parts or patches:
  - bumping
  - coining
  - crimping
  - dimpling
  - folding
  - joggling
  - shrinking
  - stretching.
- Describe the following hand and power tools used for sheet metal forming; state general characteristics, operating principles and precautions for their use:
  - brakes/folding machines
  - presses
  - roll formers
  - shears.
Syllabus of Examination – AME Licences – Mechanical Category
3. Airframe Specific Group Subjects
3.4. Aeroplane Structures and Systems (FG)

Approved by Group General Manager, Personnel Licensing, Education and Training Group   Issue 2.1: July 2005

Topic 8 – Sheet Metal Repair II

- In relation to sheet metal forming, describe the material allowances known as bend allowance and setback. Know the formulae required to calculate these factors and apply the formulae to mark out a flat pattern layout.
- Be able to calculate the area of various geometric shapes, the circumference of circles and the length and angles of the sides of triangles.
- Calculate the weight of a completed repair and determine its effect on surrounding structure.

Topic 9 – Tubular Structure Repair

- Be able to state typical non-welded repair methods for tubular structural members.
- Describe welded repairs to tubular members by patching, inner and outer sleeves and splicing. State design characteristics, angles or dimensions as appropriate.

Topic 10 – Window and Windshield Repairs

- Describe the construction and installation methods of windows and windshields.
- Describe the methods of forming acrylic sheet into final shape by hot and cold means. State temperatures, angles and precautions as appropriate.
- Describe precautions and considerations when cutting and drilling acrylic materials.
- State the methods, materials and general principles involved in cementing and curing acrylics.
- Describe methods of finishing acrylic components by sanding, buffing and polishing; general cleaning techniques and precautions for the protection of installed components.
- Describe the properties of various types of clear plastic material used for windows and windscreens. Describe processes for the care and maintenance of these materials.

Topic 11 – Pressurised Structure Fundamentals

- Describe current practice in aircraft design related to load transfer, load path continuity and reduction of stress raisers in pressurised fuselages.
- Describe methods used to ensure that doors and other large cutouts are restrained from opening under pressurisation loads.
3.4. Aeroplane Structures and Systems (FG)

● Describe methods used to seal the structure and components to the structure of airframe pressure cells.

● Identify the various methods used to ensure structural protection from rapid decompression.

Topic 12 – Pressurised Structure Maintenance

● Describe sealing methods used to seal control and electrical cables at pressure bulkheads. State the maintenance practices necessary to ensure correct sealing of control cables.

● State precautions and describe maintenance actions to be observed when maintaining blowout panels, airflow louvres and decompression doors.

● From given information describe sealing methods used to seal doors and other cutouts in the pressure cell and necessary maintenance practices.

● In relation to pressurised structures describe factors to be considered when conducting an inspection of the structure.

● Describe the need for aerodynamic cleanliness and the methods used to achieve minimum drag structures.

Topic 13 – Surface Preparation for Protective Finish Application

● Describe correct methods to be used for the removal of old corrosion protection systems and corrosion.

● Describe methods of degreasing and cleaning of surfaces prior to surface re-treatment.

● Describe methods of surface pre-treatment applicable to the various aircraft materials in common use.

Topic 14 – Paint Systems and Storage

● Describe various primer systems in use detailing special precautions and handling requirements. State the advantages of particular primers for given applications.

● Describe the various topcoat systems in use detailing special precautions and handling requirements. For given applications state advantages and disadvantages of the various systems.
Topic 15 – Application of Protective Finishes

- Describe the physical conditions necessary for correct application of particular protective finishes.
- Describe the correct use of application processes including equipment clean up.
- From given information describe techniques for spray application of protective coatings.
- Identify and state possible causes of defects in applied coatings.

Topic 16 – Landing Gear Systems

- From given information describe the function of components and principles of operation of the following systems:
  - retractable landing gear
  - emergency landing gear extension systems.
- Relate data in the references to these systems and determine the effects of faults in components including the interface with the electrical and emergency systems.

Topic 17 – Ice and Rain Protection

- Describe the construction, location, operation, inspection, maintenance and typical layout of:
  - anti-ice systems (electric, chemical and thermal)
  - chemical rain-repellent systems
  - de-icing systems (electric, pneumatic and chemical)
  - ice detection systems
  - pneumatic rain removal
  - water and toilet drain heaters
  - windshield wipers (electrical and hydraulic).
- Explain the requirements for ground de-icing of aircraft and the precautions to be observed during use of de-ice chemicals.
Topic 18 – Fuel Systems

- From given information identify the location of fuel system components. Describe the layout and operation of typical piston and gas turbine engined aircraft fuel systems, including the instrument and electrical interface.

Topic 19 – Oxygen

- Describe the human requirements for oxygen with ascending altitudes including the effect of lack of oxygen (hypoxia).

CAO 108.26

- State the means of identifying oxygen cylinders and chemical units for use in aircraft. State the acceptable CIG Gas Code No, and know the requirements of CAO 108.26.

- Describe the general safety precautions to be observed during servicing and maintenance of oxygen systems.

- State the means of identifying oxygen charging rigs.

- State the pressure at which oxygen bottles/systems are considered to be empty. State the reasons for, and methods of purging an oxygen cylinder or system and acceptable gases that can be used.

Topic 20 – Oxygen Systems

- From given information describe the assembly, operation, inspection, servicing and maintenance requirements of both chemical and stored gas oxygen systems for use in flight and passenger compartments.

- State the differences in principles of operation and applications of continuous-flow, demand, diluter-demand and pressure-demand type regulator systems.
Topic 21 – Composite Material Repairs

- State the methods employed to clean the surface of fibre reinforced plastic (FRP) materials prior to repair and describe the ‘water break test’ to determine cleanliness.

- Describe typical repair schemes for damage to FRP/honeycomb sandwich materials by replacement of core material, plugging or patching.

- Describe typical repair schemes to laminated FRP structural members and skin panels by patch or insertion.

- State tools or equipment required to effect repairs and describe the vacuum-bag process of applying pressure.

- State the methods used for the detection of defects in composite materials.
Note: This subject syllabus is to be read in conjunction with the Introduction.

**Topic 1 – Rotary Wing Theory of Flight I**

- Define the terms:
  - air density
  - angle of attack
  - axis of rotation or shaft axis
  - blade loading
  - centrifugal force
  - collective pitch
  - coning angle
  - cyclic pitch
  - disc loading
  - feathering
  - lift thrust vector resultant
  - node
  - pitch angle
  - relative airflow
  - thrust or virtual axis
  - tip path plane.

**Topic 2 – Rotary Wing Theory of Flight II**

- With reference to the terms defined in topic code 1 describe how changes in one affect one or more of the others.

- Describe the relationship between:
  - C of G
  - drag
  - lift
  - thrust
  - weight.

- Describe vortex ring state, power settling, overpitching and their relationship.
Topic 3 – Rotary Wing Theory of Flight III

- Explain torque reaction and describe its effect on directional control of a helicopter.
- Explain gyroscopic precession and describe how its effect is used in the control of the main rotor disc to provide forward, sideways and rearward flight.
- Explain dissymmetry of lift and describe the design feature that is used to control it.
- Define coriolis effect.
- State the design features (lead/lag hinges and underslung rotor) that are used to relieve stresses created by coriolis effect, and describe how these features achieve that result.

Topic 4 – Rotary Wing Theory of Flight IV

- Describe ground effect and translational lift and their relationship.
- Define translating tendency and describe the two methods (mast offset and cyclic rigging) of correcting this tendency.
- State the reason why main rotor blades have built in twist.
- State what blade tip stall is and why it results in a nose pitch up of the helicopter.
- Describe the aerodynamic features of helicopter autorotation. State the areas of the disc that provide rotor drive and overall lift during the autorotation.

Topic 5 – Rotary Wing Stability

- Describe static and dynamic stability and state why most helicopters are considered statically stable and dynamically unstable.
- Describe how the following design methods help overcome the inherent dynamic instability of a helicopter:
  - delta three hinges
  - offset flapping hinges
  - stabiliser bar.
- Describe ground resonance; state its causes and what corrective maintenance action is necessary should it occur.
- Describe the use of fixed and adjustable stabilisers.
3.3. Helicopter Aerodynamics, Structures and Controls (F1)

Topic 6 – Main Rotor Heads

- Describe the physical features of the various main rotor head (MRH) designs and be able to state which features accommodate the flapping, feathering, leading and lagging actions of the main rotor blade.
- Describe the principles of operation of a swash plate and state its effect on tip path plane.
- Describe the construction and operation of MRH dampers.
- Describe the mounting, inspection and maintenance of main rotor heads.

Topic 7 – Tail Rotors and Anti-torque Control

- Describe methods (tail rotor, bleed air, fan and aerodynamic) of achieving directional/anti-torque control.
- From given information describe the assembly, mounting, and operation of typical tail rotor drive systems comprising:
  - bearings
  - couplings
  - gearboxes
  - pitch change mechanism
  - shafts
  - universal joints.
- State the maintenance requirements of a typical tail rotor drive system.

Topic 8 – Clutches, Freewheel Units and Rotor Brakes

- From given information describe the constructional features, location, operation and mounting of:
  - clutches
  - freewheel units
  - rotor brakes
  - couplings
  - drive systems; and
- State their purpose.
Topic 9 – Cyclic Control System

- Describe the layout, operation and maintenance requirements of a typical cyclic control system and its components (cyclic stick to pitch-change rod inclusive).

Topic 10 – Collective Control System

- Describe the layout, operation and maintenance requirements of a typical collective control system and its components (collective lever to pitch-change rod inclusive).
- Describe the methods used to provide pilot assistance in collective movement on helicopters not fitted with power-assisted flying controls.
- Describe methods used for rotor RPM compensation with application of collective control.

Topic 11 – Main Rotor Gearboxes and Main Rotor Masts

- From given information, describe construction, principles, mounting, inspection and maintenance requirements of gearboxes and masts.

Topic 12 – Blade Tracking, Balancing and Helicopter Vibration – Analysis I

- Describe the general precautions to be observed when moving and positioning helicopters.
- Describe the danger areas to be aware of when approaching or leaving a helicopter with rotors turning.
- Describe the various methods of tracking main and tail rotor blades and state when tracking should be carried out.
- Describe the various methods of balancing main rotor systems both statically and dynamically. Describe how and when to carry out hub/main rotor blade alignment checks and/or adjustment on semi-rigid rotor heads.
Topic 13 – Blade Tracking, Balancing and Helicopter Vibration – Analysis II

- State the maintenance requirements of the various types of MRH dampers.
- State the effects of either too high or too low autorotation RPM.
- From given information determine necessary auto rotation RPM corrections.
- Describe the types of vibration experienced in helicopters; state their probable cause and what maintenance action is required to reduce the level of the vibration.

Topic 14 – Main/Tail Rotor Blades

- Describe the construction and material used in typical wooden, metal and composite main and tail rotor blades.
- Describe typical inspections/maintenance of main rotor blades.

Topic 15 – Helicopter Structure – General Concepts

- Define the following terms:
  - Beam
  - Bending
  - Compression
  - Fatigue
  - Shear
  - Strain
  - Stress
  - Strut
  - Tension
  - Tie
  - Torsion.
- Apply the above-defined terms to given applications.
- Define aircraft structural classifications, primary, secondary and tertiary.
- Define “fail safe” structure. From given information identify methods of fail-safe design applicable to helicopter structures.
- Define the concept of “Damage Tolerance”.
- Identify the Airworthiness requirements for structural strength.
Topic 16 – Fuselage, Doors, Engine Mounts, Stabilisers, Landing Gear Attachments, Equipment and Furnishings

- Identify the following methods of fuselage construction:
  - monocoque
  - semi monocoque
  - truss (Pratt truss and Warren truss).

- Describe the general constructional features of each of these types of structure and identify load-carrying members.

- Describe general constructional features of aircraft doors, nacelles and firewalls.

- Describe general constructional features of various engine mounting arrangements and structures. Describe engine pylon mounting systems and vibration damping methods.

- Describe the general constructional features of various landing gear arrangements and structures.

- Describe the general constructional features of fixed and moveable stabilisers.

- Describe the drainage and ventilation provisions used to control moisture within a structure.

- Describe the methods used to protect the structure in the advent of a lightning strike.

- Describe the general construction and installation of:
  - seats
  - harnesses
  - emergency equipment.

Topic 17 – Inspection of Structures

- Describe the following terms as applied to the determination of locations on, within or around helicopters:
  - butt lines or buttock lines
  - fuselage stations
  - water lines.

- Describe the ATA-100 zoning system used to identify helicopter component locations and access points.

- Describe the factors to be considered when inspecting structures for wear, damage and deterioration.
3. Airframe Specific Group Subjects

3.5. Helicopter Aerodynamics, Structures and Controls (Fl)

- Identify visual cues appropriate to structural damage resulting from flight or ground overloads, structural failure of adjacent members and corrosion.

- Describe the inspection procedure and identify the visual cues appropriate to damage following lightning strike and High Intensity Radiated Field penetration.

- Describe the classifications of damage and the repair or maintenance implications applicable to them.

- Describe ageing, fatigue and corrosion control programs.

- Describe the methods used to make the following alignment and symmetry checks:
  - complete airframe for symmetry
  - fuselage for twist and bending
  - vertical stabiliser for alignment
  - horizontal stabilisers for dihedral and incidence.

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Topic 18 – Riveting – American Standard

- Be able to identify solid and blind rivets by head marking, physical characteristics or identification number.

- State the requirements of edge distance, pitch and gauge for rivet installation.

- Detail the lay out of a riveted repair.

- Describe the procedures, tools, adaptors and precautions used for the installation of solid and blind rivets by hand or power.

- Identify incorrectly installed rivets or common riveting faults and state the causes of defective riveting and rivet failure.

- In relation to rivet design, installation or layout, define the following terms:
  - clearance
  - countersinking
  - dimpling
  - gauge
  - pitch
  - shaving.
3. Airframe Specific Group Subjects

3.5. Helicopter Aerodynamics, Structures and Controls (Fl)

Topic 19 – Sheet Metal Repair I

- Describe the principles applied to the selection of materials and repair schemes for the removal and repair of damaged structure.

- Describe the following processes used in the fabrication of replacement sheet metal parts or patches:
  - bumping
  - coining
  - crimping
  - dimpling
  - folding
  - joggling
  - shrinking
  - stretching.

- Describe the following hand and power tools used for sheet metal forming; state general characteristics, operating principles and precautions for their use:
  - brakes/folding machines
  - presses
  - roll formers
  - shears.

Topic 20 – Sheet Metal Repair II and Tubular Structure Repair

- In relation to sheet metal forming, describe the material allowances known as bend allowance and setback. Know the formulae required to calculate these factors and apply the formulae to mark out a flat pattern layout.

- Be able to calculate the area of various geometric shapes, the circumference of circles and the length and angles of the sides of triangles.

- Calculate the weight of a completed repair and determine its effect on surrounding structure.

- Be able to state typical non-welded repair methods for tubular structural members.

- Describe welded repairs to tubular members by patching, inner and outer sleeves and splicing. State design characteristics, angles or dimensions as appropriate.
Topic 21 – Window and Windshield Repairs

- Describe the construction and installation methods of windows and windshields.
- Describe the methods of forming acrylic sheet into final shape by hot and cold means. State temperatures, angles and precautions as appropriate.
- Describe precautions and considerations when cutting and drilling acrylic materials.
- State the methods, materials and general principles involved in cementing and curing acrylics.
- Describe methods of finishing acrylic components by sanding, buffing and polishing; general cleaning techniques and precautions for the protection of installed components.
- Describe the properties of various types of clear plastic material used for windows and windscreens. Describe processes for the care and maintenance of these materials.

Topic 22 – Surface Preparation for Protective Finish Application

- Describe correct methods to be used for the removal of old corrosion protection systems and corrosion.
- Describe methods of degreasing and cleaning of surfaces prior to surface re-treatment.
- Describe methods of surface pre-treatment applicable to the various aircraft materials in common use.

Topic 23 – Paint Systems and Storage

- Describe various primer systems in use detailing special precautions and handling requirements. State the advantages of particular primers for given applications.
- Describe the various topcoat systems in use detailing special precautions and handling requirements. For given applications state advantages and disadvantages of the various systems.
Topic 24 – Application of Protective Finishes

- Describe the physical conditions necessary for correct application of particular protective finishes.
- Describe the correct use of application processes including equipment clean up.
- From given information describe techniques for spray application of protective coatings.
- Identify and state possible causes of defects in applied coatings.

Topic 25 – Composite Material Repairs

- State the methods employed to clean the surface of fibre reinforced plastic (FRP) materials prior to repair and describe the ‘break test’ to determine cleanliness.
- Describe typical repair schemes for damage to FRP/honeycomb sandwich materials by replacement of core material, plugging or patching.
- Describe typical repair schemes to laminated FRP structural members and skin panels by patch or insertion.
- State tools or equipment required to effect repairs and describe the vacuum-bag process of applying pressure.
- State the methods used for the detection of defects in composite materials.
3.6. Airconditioning (FM)

Note: This subject syllabus is to be read in conjunction with the Introduction.

**Topic 1 – Principles and Terminology of Airconditioning**

- Define the terms:
  - adiabatic
  - conduction
  - convection
  - humidity
  - latent heat
  - latent heat of vaporisation
  - radiation
  - relative humidity
  - sensible heat
  - superheat.

- Solve problems using the General (Combined) Gas Law and state how this law relates to transfer of energy in an airconditioning system.

**Topic 2 – Vapour Cycle System Components and Fluids**

- Identify by name the following vapour cycle system components:
  - blowers
  - compressors
  - condensers
  - evaporators
  - expansion valves
  - isolation valves
  - receiver-dryers
  - superheaters/subcoolers.

- And describe the constructional features, principles of operation and location and function within a typical system.

- State the type and characteristics of refrigerants and oils used in the system.
Topic 3 – Vapour Cycle System Maintenance I

- Identify and state the function of the valves, gauges, fittings and hoses of a vapour cycle servicing manifold set.
- Describe the procedures and list the equipment used to carry out purging and charging of the system.
- State precautions necessary for the safe servicing of a vapour cycle system.

Topic 4 – Vapour Cycle System Maintenance II

- Describe the procedures and list the equipment used to carry out leak tests, performance tests, checking compressor oil and evacuating the system.
- Identify and name the procedures to rectify faults in vapour cycle systems.

Topic 5 – Air Cycle System Components

- From given information identify the schematic relationships of the following air cycle system components:
  - air cycle machines
  - flow control valves
  - heat exchangers
  - humidifiers
  - mixing chambers
  - pressure regulation valves
  - recirculation fans
  - recirculation filters
  - silencers
  - spill valves
  - water separators (high and low pressure).
- And describe their operating principles.

Topic 6 – Basic Air Cycle System Layout and Operation

- Identify by name and state the function of components in basic air cycle systems. Trace the airflow through the various schematic layouts provided, from air supply source to distribution outlet.
3. Airframe Specific Group Subjects

3.6. Airconditioning (FM)

Topic 7 – Temperature Control and Air Distribution

- Describe desired airflow paths in occupied cabins.
- Identify provisions for emergency and ground ventilation in given system schematics.
- From given information describe the operation of a trim air system.
- Describe the operating principles of gasper (eyeball) vents and systems.
- Describe the operating principles of cabin temperature control systems and identify appropriate sensor locations which contribute to stable temperature control.

Topic 8 – Typical Aircraft Air Cycle System Layout, Operation and Fault Finding

- From given information describe the operation and trace airflows in given configurations including the electrical and instrument interface.
- From given information be able to fault find the system.
3.7 Structural Composites (FP)

Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Composite Basics 1

- Define the following terms and explain their interaction in typical composite structures:
  - A-stage, B-stage and C-stage
  - Accelerator
  - Advanced Composite
  - Autoclave
  - Balanced Laminate
  - Bi-directional Fabric (BID)
  - Bleeder
  - Blocking
  - Bridging
  - Catalyst
  - Caul Plate
  - Coefficient of Thermal Expansion
  - Core Separation
  - Core splicing
  - Crazing
  - Cure
  - Cure Stress
  - Delamination
  - Exothermic Reaction
  - Fabric – Plain, Satin & Twill Weave
  - Fibre – content
  - Fibre – direction
  - Fill (weft, woof)
  - Filler ply
  - Finish (Size)
  - Gel condition
  - Glass (E and S)
  - Material.
Topic 2 – Composite Basics 2

- Define the following terms and explain their interaction in typical composite structures:
  - Assembly
  - CFRP (carbon FRP)
  - GFRP (glass FRP)
  - Honeycomb Sandwich
  - Inhibitor
  - Kevlar (Aramid)
  - KFRP (Kevlar FRP)
  - Lamination Sequence (Stacking or Nesting)
  - Lay up
  - Matrix
  - Microcracking
  - Mould release agent
  - Peel ply
  - Ply orientation
  - Porosity
  - Post-cure
  - Pot Life
  - Prepreg
  - Reinforced Plastic
  - Resin content
  - Resin richness
  - Resin starvation
  - Tack Free
  - Thermoplastic
  - Thermosetting
  - Thread count
  - Tow
  - Tracer
  - Unidirectional Fabric (UND)
  - Vacuum Bag
  - Void
  - Warp
  - Warp Clock.
Topic 3 – Matrix Materials

- Describe the requirements and precautions related to the storage and use of thermosetting polyester resins, accelerators and catalysts.
- Describe the requirements and precautions related to the storage and use of epoxy resins and hardeners.
- State the reasons for the permitted wide range of polyester resin/catalyst ratios and the tightly controlled resin/hardener ratio for epoxy systems.

Topic 4 – Fibre Cloth, Tapes and Core Materials

- Describe the requirements and precautions for storage and use of fibres, fibre fabrics, sandwich core materials and pre-impregnated fibre fabrics.
- Describe the reasons for and use of protective and surface finishes applied to fibres during production.
- State the methods used to identify glass, boron, aramid and carbon fibre woven products.

Topic 5 – Advanced FRP Component Inspection and Damage Assessment

- Define “negligible damage” relevant to fibre reinforced composites.
- Describe the evaluation criteria for a field bolted or bonded repair in relation to disbonds and through penetration damage.
- Describe methods of non-destructive inspection applicable to FRP composites and know the limitations of each.
- Identify the following and state their causes:
  - resin defects
  - finishing process damage
  - lay up defects.
- and describe methods of ensuring that these defects do not occur in practice.
- Describe the reasons for and use of protective and surface finishes applied to FRP composites.
Topic 6 – Advanced FRP Repair Lay Up

- State the advantages/disadvantages of each of the matrix/fibre combinations in general use.

- Describe the reasons for the use of:
  - different ply orientation in structural laminates
  - GFRP and CFRP hybrid laminated structures
  - Kevlar 49 sheathing
  - unidirectional and bi-directional fibre fabrics.

- Describe acceptable methods of surface cleaning and preparation prior to repair. Know the importance of good surface preparation and its relationship to successful repair.

- Describe methods used to dry out wet laminates prior to repair and state why this step is necessary. Describe precautions to be observed in relation to temperature/overheat and blistering.

- Describe how to perform and apply:
  - a burn test
  - a break wind test
  - a water break test.

- Describe the methods used to repair negligible damage.

Topic 7 – Advanced FRP Repair Methods

- State the general factors which must be considered when applying FRP repair schemes eg, strength, stiffness, ultimate strain, ply overlap related to patch repair, mismatch of metal/composite strengths, cure stress.

- Describe the techniques involved in carrying out a repair lay up using:
  - high temperature cures
  - plain fabrics
  - pre-impregnated fabrics
  - room temperature cures.

- State the advantages and disadvantages of using room temperature cure lay ups.

- Describe the use of Bleeder Plies, Vacuum Bags, Autoclaves and their repair applications.
Describe the following handling requirements and their application to successful repairs:
- prepreg (thaw) temperature and humidity
- prepreg storage temperature
- prior dry-out of honeycomb and facings.
- storage ledger.

Topic 8 – Advanced FRP Structure Environmental Protection
- Describe methods used to minimise galvanic corrosion between CFRP skins and metallic sub-structure.
- Describe methods used to protect FRP structures from erosion.
- Describe methods used to provide lightning protection of FRP structures.
- Describe methods used to protect FRP components from moisture/temperature degradation and breakdown by aircraft fluids.

Topic 9 – Techniques for Cutting, Sanding or Drilling FRP Components
- Describe accepted practices for cutting, sanding or drilling of FRP composite structure. Identify appropriate tool combinations for different FRP materials and state special precautions and handling relating to their use.
3.8. Helicopter Controls and Systems (FR)

Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Main Rotor Heads

- Describe the physical features of the various main rotor head (MRH) designs and state which features accommodate the flapping, feathering, leading and lagging actions of the MR blade.
- Describe the construction, operation and application of elastomeric bearings in main rotor heads.
- Describe the principles of operation of a swash plate and state its effect on tip path plane.
- Describe the construction and operation of MRH dampers.
- Describe the mounting, inspection and maintenance of main rotor heads.

Topic 2 – Tail Rotors and Anti-torque Control

- Describe methods (tail rotor, bleed air, aerodynamic, tandem and contra-rotating) of achieving directional/anti-torque control.
- From given information, describe the assembly, mounting, and operation of typical tail rotor drive systems including hydraulic/electrical actuated controls.
- State the maintenance requirements of a typical tail rotor drive system.

Topic 3 – Cyclic Control System

- From given information, describe the layout, operation and maintenance requirements of a hydraulically boosted cyclic control system and its components (cyclic stick to pitch change rod inclusive).
- Describe methods used for helicopter pitch attitude compensation with cyclic application.
Topic 4 – Collective Control System

- From given information describe the layout, operation and maintenance requirements of a typical collective control system and its components (collective lever to pitch-change rod inclusive).
- Describe methods used for rotor RPM compensation with application of collective control.

Topic 5 – Main Rotor Gearboxes, Masts, Clutches, Freewheel Units and Rotor Brakes

- From given information describe the construction, principles, mounting, inspection and maintenance requirements of gearboxes, masts, clutches, freewheel units and rotor brakes.

Topic 6 – Blade Tracking, Balancing and Helicopter Vibration – Analysis I

- Describe the various methods of balancing main rotor systems both statically and dynamically and be able to describe how and when to carry out hub/main rotor blade alignment checks and/or adjustment on semi-rigid rotor heads.
- Describe ground resonance and state its cause and what corrective maintenance action is necessary should resonance occur.
- Describe the general precautions to be observed when moving and positioning helicopters.

Topic 7 – Blade Tracking, Balancing and Helicopter Vibration – Analysis II

- Describe the damper alignment checks required on multi-bladed rotor systems fitted with elastomeric dampers and state the maintenance requirements of the various types of MRH dampers.
- State the effects of either too high or too low autorotation RPM.
- From given information determine necessary autorotation RPM corrections.
- Describe the types of vibration experienced in helicopters; be able to state their probable cause and what maintenance action is required to reduce the level of the vibration.
- Describe the various methods used to dampen vibration.
Topic 8 – Main/Tail Rotor Blades

- Describe the construction and material used in typical wooden, metal and composite main and tail rotor blades.
- Describe the built-in crack detection methods used on main rotor blades (BIM and BIS).
- Describe typical inspections/maintenance of main rotor blades.

Topic 9 – Miscellaneous Systems

Landing Gear Systems

- From given information, describe the assembly and principles of operation of:
  - retractable landing gear
  - emergency extension systems.
- Relate the data in the references to these systems and determine the effects of faults in components including the interface with the electrical and emergency systems.

Ice and Rain Protection

- From given information, describe the location, operation, inspection, maintenance and typical layout of:
  - anti-ice/de-ice systems
  - rain-repellent/removal systems.

Fuel Systems

- From given information identify the location of fuel system components. Describe the layout and operation of typical piston and gas turbine engined helicopter fuel systems, including the instrument and electrical interface.
Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Terminology

- Define the following terms and describe their application to aircraft pressurisation:
  - cabin altitude
  - controlled leaks
  - differential control mode
  - differential pressure
  - isobaric control mode
  - maximum differential
  - pressure altitude
  - rate control mode
  - uncontrolled leaks.

Topic 2 – Components

- Identify from diagrams or schematic drawings the following pressurisation components and describe their principles of operation:
  - cabin altimeters
  - cabin differential pressure indicator
  - cabin rate of climb indicators
  - jet pumps
  - negative pressure relief valves
  - outflow valves
  - pneumatic relays
  - pressure controllers (automatic and manual)
  - safety (positive pressure relief) valves
  - safety switches.

Topic 3 – System Layout

- Describe typical system layout including the pneumatic or electrical interconnection of components.
Topic 4 – System Operation

- From given information, describe the operation and indicate component function in given system operation modes, including the electrical interface and warning/indication systems.

Topic 5 – Fault Finding/Maintenance

- From given information, diagnose faults in aircraft pressurisation systems including the electrical and instrument interface and indicate how these faults can be rectified.
4. Airframe Specific Type Subjects

4.1. Specific Airframe Type (FS)

References

The questions will be compiled from the relevant manufacturers maintenance, overhaul and operation manuals and may be either pictorial, written or a combination of both.

Examination Outline

The examinations will cover aspects of the aircraft in which an airframe LAME has certification privileges including:

- all maintenance in category airframes
- the interface of airframe systems with the electrical, instrument, engine and radio systems
- electrical and instrument system maintenance as per CAO 100.90, Appendix 1.
- operation of aircraft systems, including A.P.U. and electrical power supply, but excluding propulsion engines, as required to carry out maintenance on airframe systems.

In general, the examinations will be in three parts as indicated below. Candidates may gain a credit for each part passed.

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4. Airframe Specific Type Subjects

4.1. Specific Airframe Type (FS)

Examination Part 2

- Helicopter Vibration Analysis 18
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- Airconditioning Systems 21
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- Pressurisation Systems 21
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- Ice and Rain Protection Systems 30
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- Engine Control Systems (Stranded Control Cables Only) 76

Questions

The number of questions in each Topic area will depend on the complexity of systems in the subject aircraft. They will include questions on:

- adjustment
- construction
- fault-finding
- identification of components
- inspection
- installation
- layout
- location
- operation/function
- operational procedures
- precautions and safety aspects
- repair
- servicing.
Specific Examination Codes

CASA no longer allocates resources to the maintenance, update or delivery of Group 20 Specific Type Examinations. Check AAC 9-4 and 9-5 for approved courses.

Helicopters

A Part 3 examination may not be required for some helicopters. In these instances Part 3 subjects (where applicable) will be incorporated in the Parts 1 and 2 as follows:

- Part 1 add ATA 21, 30, 36, 49 and 76.
- Part 2 add ATA 28.

Airships

- Examinations for airships will consist of a 1 part examination. It will cover all relevant ATA chapter areas and will also cover Theory of Flight and Aerostatics for airships.
Note: This subject syllabus is to be read in conjunction with the Introduction.

**Topic 1 – Principles of Operation and Terminology**

- Explain how heat energy is converted into mechanical energy and the relationship between volume, pressure and temperature during the Otto cycle of operation.
- State the requirements for effective combustion.
- Define:
  - bottom dead centre (BDC)
  - clearance volume
  - stroke
  - swept volume
  - top dead centre (TDC).

**Topic 2 – Engine Operating Cycles and Configurations**

- Describe 4 and 2 stroke operating cycles.
- Describe the inlet and exhaust valve-operating cycle.
- Define valve lead, lag and overlap, and state why they are incorporated in the valve operating cycle.
- Describe the layout and typical firing order of the following engines:
  - inline
  - opposed
  - radial
  - vee.

**Topic 3 – Engine Operating Parameters**

- Define and from given information calculate:
  - mechanical efficiency
  - thermal efficiency
  - volumetric efficiency.
5. Engine Core Subjects

5.1. Piston Engine Theory and Construction (GA)

- State the effect of incorrect valve timing on these parameters.
- Define:
  - compression ratio
  - manifold pressure;
  - piston displacement; and
- State how these values are measured.
- Calculate piston displacement and compression ratio from given information.

**Topic 4 – Engine Construction – Top End**

- Describe the constructional features, function, classification and material composition of engine:
  - connecting rods
  - cylinders
  - inlet and exhaust manifolds
  - piston pins
  - piston rings
  - pistons.

**Topic 5 – Engine Construction – Valves and Valve Operating Mechanisms**

- Describe the constructional features, function and material composition of engine:
  - cam followers
  - inlet and exhaust valves/seats/guides/springs
  - push rods
  - rocker assemblies
  - tappets.
5. Engine Core Subjects

5.1. Piston Engine Theory and Construction (GA)

Approved by Group General Manager, Personnel Licensing, Education and Training Group   Issue 2.1: July 2005

Topic 6 – Engine Construction – Bottom End

- Describe the constructional features, function, classification and material composition of engine:
  - accessory/reduction gearboxes
  - cam rings
  - cam shafts
  - crankshafts
  - engine casings
  - master rod
  - plain and ball bearings
  - typical roller bearings.

Topic 7 – Engine Power Measurement

- Define:
  - brake horsepower (BHP)
  - brake mean effective pressure (BMEP)
  - friction horsepower (FHP)
  - friction mean effective pressure (FMEP)
  - horsepower (HP) and/or kilowatt (KW)
  - indicated horsepower (IHP)
  - indicated mean effective pressure (IMEP).

- Calculate the BHP and IHP of a typical engine, from given information.

- Plot fuel consumption and engine power charts, from given information.

Topic 8 – Factors Affecting Engine Power

- Define brake specific fuel consumption (BSFC) and calculate the BSFC of a typical engine from given information.

- Define:
  - cruise power mixture
  - lean best power mixture
  - rich best power mixture
  - stoichiometric mixture.
5. Engine Core Subjects

5.1. Piston Engine Theory and Construction (GA)

- State the symptoms and causes of the following conditions:
  - after firing
  - back firing
  - detonation
  - pre-ignition.

- Describe how rich and lean mixture burn rates affect engine performance.

Topic 9 – Classification of Engine Lubricants and Fuels

- State the properties and specific uses of the following oils:
  - ashless dispersant
  - detergent
  - hypoid
  - mineral.

- Define the following terms in relation to engine oil ratings:
  - cloud point
  - flash point
  - pour point
  - viscosity and viscosity index.

- State how piston engine fuels (aviation gasoline) are classified.

- Describe the following terms in relation to piston engine fuels:
  - anti knock additive (TEL)
  - octane rating
  - performance number
  - Reid vapour pressure test values
  - specific gravity
  - volatility.
5.  Engine Core Subjects

5.2.  Piston Engine Systems (GB)

Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Magneto Ignition System Principles

- Describe the principles of operation of a magneto ignition system.
- Define:
  - E Gap angle
  - flux reversal
  - lines of flux.
- State the function of the following components within magneto ignition systems:
  - condenser
  - contact breaker
  - distributor.
- Differentiate between primary and secondary systems.

Topic 2 – Magneto Ignition System Configuration and Construction

- Describe the constructional features of the following magneto types:
  - polar inductor
  - rotating magnet.
- Differentiate between high and low tension ignition systems and state the advantages and disadvantages of each system.
- Differentiate between battery and magneto ignition systems.

Topic 3 – Auxiliary Ignition Systems

- Describe the operation and constructional features of the following auxiliary ignition systems:
  - booster coil
  - impulse coupling
  - induction vibrator
  - shower of sparks.
5. Engine Core Subjects

5.2. Piston Engine Systems (GB)

Topic 4 – Magneto Ignition System Operation

- Describe how magneto points gapping affects timing.
- Differentiate between advance/retard ignition timing.
- Describe the operation of magneto switches.
- Describe the construction and function of a compensated cam.

Topic 5 – Spark Plugs and Ignition Leads

- In relation to spark plugs, describe:
  - reach
  - temperature classification
  - typical spark plug constructional features.
- Explain how gapping affects spark plug performance.
- Diagnose engine condition by spark plug appearance.
- Describe the various types of ignition leads/harnesses and their constructional features and screening methods.

Topic 6 – Float Chamber Carburettors

- Describe the principles of operation and constructional features of a typical float chamber carburettor.
- Differentiate between downdraft and updraft configurations.
- Describe the operation of:
  - accelerator pumps
  - discharge nozzles
  - float chambers
  - main/idle jets
  - mixture control systems
  - power enrichment systems
  - throttle valves.
- State the causes of impact, throttle and fuel ice, and state the effects on engine performance. State the conditions for use of carburettor heat.
Topic 7 – Pressure Injection Carburettors

- Describe the principles of operation and constructional features of a typical pressure injection carburettor.

- Describe the function and operation of:
  - acceleration system
  - air/fuel metering forces
  - idle system
  - mixture control system
  - power enrichment system (manual/airflow).

Topic 8 – Bendix RSA Fuel Injection System

- Describe the principles of operation and constructional features of the Bendix RSA fuel injection system.

- Describe the function and operation of:
  - altitude mixture controls
  - flow dividers
  - fuel nozzles
  - fuel/air metering forces
  - impact tubes
  - throttle valves
  - venturis.

Topic 9 – Teledyne Continental Fuel Injection System

- Describe the principles of operation and constructional features of the Teledyne Continental fuel injection system.

- Describe the function and operation of the:
  - altitude mixture control
  - fuel control unit
  - fuel injection pump
  - injector nozzles
  - manifold valve.
Topic 10 – Lubrication Systems

- Describe the operating principles and constructional features of wet and dry sump lubrication systems.
- State the suitability of each system for typical engine configurations.
- Describe the constructional features and operation of the following lubrication system components and state where they are located within the lubrication system:
  - check valves
  - oil cooler regulators
  - oil coolers
  - oil dilution subsystems
  - oil filters
  - oil tanks/hoppers
  - pressure pumps
  - relief valves
  - scavenge pumps.

Topic 11 – Induction, Exhaust and Cooling Systems

- Describe the constructional features and operation of typical engine induction/intake and alternate air systems.
- Describe the construction material composition and operation of typical engine exhaust systems.
- Describe the construction and operation of engine cooling systems comprising any or all of the following:
  - air seals
  - cowl flaps
  - cylinder baffles
  - cylinder cooling fins
  - engine cowls and panels
  - exhaust augmentors
  - liquid jackets.
5.3 Propellers (GC)

Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Propeller Theory

- Describe the blade element theory.
- Define the following and explain their effect on propeller thrust:
  - angle of attack
  - high/low blade angle and reverse angle
  - pitch
  - rotational speed.
- Define propeller slip.

Topic 2 – Propeller Operation

- Explain how the following forces affect the rotating propeller blade:
  - aerodynamic
  - centrifugal
  - thrust
  - torque.
- Describe the effect of changes in the direction of the relative airflow on blade angle of attack.

Topic 3 – Configuration, Type and Operation

- Describe the following propeller types:
  - constant speeding
  - contra-rotating
  - controllable pitch
  - fixed pitch
  - ground adjustable.
- Describe the effect a particular propeller type has on engine operation/performance.
Topic 4 – Construction, Assembly and Installation

- Define:
  - blade back
  - blade face
  - blade shank
  - blade stations
  - hub assembly.

- Describe the construction and specific materials used in composite, metal and wooden propellers.

- Describe typical mounting requirements of tapered and splined propeller installations.

- Describe the general requirements for propeller blade tracking and balancing.

Topic 5 – Pitch Change Mechanisms

- Describe the operation of the following pitch change mechanisms:
  - aerodynamic
  - aerodynamic and hydraulic combination
  - electrical
  - hydraulic
  - mechanical.

Topic 6 – Propeller Auxiliary Systems

- Describe the configuration and operation of the following typical auxiliary systems:
  - auto feather
  - de-couplers
  - feather (non auto)
  - ice protection/elimination
  - negative torque
  - propeller brakes
  - synchronising
  - synchrophasing
  - thrust sensitive
  - unfeathering accumulators.
Topic 7 – Governors – Principles of Operation and Construction

● Describe the operation of a typical governor.

● Describe the effect of variations in spring pressure and engine RPM on governor operation.

● Differentiate between single and double acting governors.

● Describe the operation and function of the:
  ○ fly weights
  ○ pilot valve
  ○ pitch change stops
  ○ speeder spring.

Topic 8 – Governor/Propeller Operating Conditions

● Describe the following operational conditions:
  ○ alpha
  ○ beta
  ○ feathering
  ○ on speed
  ○ overspeed
  ○ reverse pitch
  ○ underspeed
  ○ unfeathering.

Topic 9 – Damage and Repair Criteria

● From given information, assess propeller blade damage and determine the applicable treatment/repair schemes for metal, wooden and composite propeller blades.
5.4 Gas Turbine Engine Theory And Construction (GG)

Note: This subject syllabus is to be read in conjunction with the Introduction. The subject syllabus is applicable to both propulsion engines and auxiliary power units.

Topic 1 – Fundamental Principles

- Describe the relationship between the following and solve problems of their application to gas turbine engine operation:
  - acceleration
  - energy
  - force
  - power
  - velocity
  - work.

- Define each of the following and describe their application to gas turbine engine operation:
  - Bernoulli’s Theorem
  - Brayton Cycle
  - kinetic energy
  - Newton’s Laws of Motion
  - potential energy
  - thermodynamic laws.

- Describe the basic constructional arrangements and the relative merits of the following engine types:
  - turbofan
  - turbojet
  - turboprop
  - turboshaft.

Topic 2 – Principles of Propulsion I

- Define the following conditions and describe the relationship between them and their application to engine operation:
  - choked nozzle thrust
  - equivalent shaft horsepower
  - gross thrust
  - nett thrust
Relative to the thrust conditions stated above, from given information (speed, altitude and temperature), calculate thrust and solve problems of their application to gas turbine engine operation.

**Topic 3 – Principles of Propulsion II**

- Define each of the following engine efficiencies and describe how they are derived:
  - adiabatic
  - propulsive
  - thermal.
- Define by-pass ratio and engine pressure ratio.
- Describe the pressure, temperature and velocity of the gas flow as it passes through each section of the engine.

**Topic 4 – Bearings and Seals**

- Identify the types of bearings used in gas turbine engines and describe their constructional features and principles of operation.
- Describe typical primary loads and causes acting on the engine main bearings.
- Describe the purpose, construction and principles of operation of typical gas turbine engine bearing seals.

**Topic 5 – Inlet Ducts**

- Describe the purpose, construction and principles of operation of the following compressor inlet ducts:
  - bellmouth
  - subsonic
  - supersonic
  - single entry
  - divided entry
  - secondary air inlet doors.
5.4. Gas Turbine Engine Theory And Construction (GG)

- Explain the effects on pressure, velocity and temperature of airflow through convergent, divergent and convergent-divergent ducts.
- Describe the effects of ram recovery and the causes of inlet duct losses.

**Topic 6 – Centrifugal Compressors**

- Describe the purpose, constructional features, materials and operating principles of single stage and two stage centrifugal compressors:
- Describe the purpose and function of:
  - diffusers
  - impellers
  - inlet guide vanes.

**Topic 7 – Axial Compressors.**

- Describe the purpose, constructional features, materials and operating principles of the following axial flow compressors:
  - dual/twin spool
  - single spool
  - triple spool.
- Describe the purpose and function of:
  - fixed inlet guide vanes
  - rotor blades
  - stator blades
  - variable inlet guide vanes.

**Topic 8 – Compressor Operation.**

- Describe the purpose, constructional features, materials and operating principles of a combined axial and centrifugal compressor assembly (centri-axial compressor).
- State the relative advantages and disadvantages of the centrifugal, axial and centri-axial compressors.
- Define the terms compressor stall and surge and describe the causes of each condition.
5. Engine Core Subjects

5.4. Gas Turbine Engine Theory And Construction (GG)

- Describe the following principle methods of air flow control:
  - bleed valves
  - variable inlet guide vanes
  - variable stator vanes.

- Define the term compressor ratio and describe how the ratio is derived.

**Topic 9 – Combustion Section**

- Describe the purpose, constructional features, materials and principles of operation of the following combustion chambers and their respective advantages and disadvantages:
  - annular type
  - can type
  - can-annular type
  - reverse-flow annular type.

- Describe each of the following:
  - combustion fuel/air ratio
  - flame stabilisation
  - flame temperatures
  - overall fuel/air ratio
  - primary zone/airflow
  - secondary zone/airflow (dilution and cooling).

- Describe the purpose, construction and principles of operation of:
  - duplex (dual orifice), atomising fuel nozzles
  - simplex (single orifice) atomising fuel nozzles
  - spill type atomising fuel nozzles
  - vaporising type nozzles.

- Describe the purpose, construction and operation of swirl chambers, air shrouds and discharge orifices.
Topic 10 – Turbine Section

- Describe the principles of operation and characteristics of the following turbine blading:
  - impulse
  - impulse-reaction
  - reaction.
- Explain the purpose and function of nozzle guide vanes and how the driving force for impulse and impulse-reaction turbines are obtained.
- Describe the difference between the turbine power extraction requirements for turbo-jet, turbo-fan and turbo-prop engines.
- Describe the various methods of turbine blade to disc attachment.
- Describe the causes and effects of turbine blade stresses.
- State the constructional properties of the typical materials used in the fabrication of turbine components.
- State the factors that determine blade creep.

Topic 11 – Exhaust Section

- Describe the purpose, constructional features, materials and operating principles of the exhaust system:
  - cone
  - cooling shroud
  - gas flow straighteners
  - propelling nozzle
  - tail pipe.
- State the purpose of convergent, convergent-divergent and variable area nozzles.
- Describe the pressure, velocity and temperature changes that occur in the various types of exhaust systems.
- Describe the purpose, constructional features, materials and principle of operation of engine thrust reversers.
- Describe the effect of thrust reverser operation on:
  - engine efficiency
  - magnitude of reverse thrust produced
  - re-ingestion of exhaust gases.
● Describe the purpose, constructional features, materials and principle of operation of engine noise suppressors.

● Explain the relationship of noise levels to the turbulence and energy in the exhaust gas stream, including typical noise patterns and methods of reducing the noise level.

Topic 12 – Classification and Properties of Lubricants and Fuels

● State the basic requirements of a gas turbine lubricant and define the following lubricant characteristics:
  ◦ viscosity
  ◦ viscosity index.

● Describe the following desirable characteristics of synthetic based lubricants:
  ◦ anti-foaming quality
  ◦ high flash point
  ◦ low lacquers and coke deposit
  ◦ low pour point
  ◦ low volatility.

● Describe the following properties in relation to gas turbine engine fuels:
  ◦ calorific value
  ◦ corrosion characteristics
  ◦ energy per lb (or kg)
  ◦ fire hazard
  ◦ flash point
  ◦ fuel icing
  ◦ specific gravity
  ◦ vapour pressure.

● State the ground handling requirements and the safety precautions to be observed with the use of gas turbine engine fuels.

● Describe the various forms of fuel system contamination, including:
  ◦ foreign particles
  ◦ microbial growth
  ◦ other grades/types of fuels
  ◦ sediment
  ◦ water.

● Describe methods of fuel system contamination detection and control.

● State the common fuel additives and their uses.
Note: This subject syllabus is to be read in conjunction with the Introduction. The subject syllabus is applicable to both propulsion engines and auxiliary power units.

Topic 1 – Lubrication Systems

- Describe the basic requirements, arrangements and principles of operation of typical gas turbine engine lubrication systems.
- Describe the relationship, location and function of the following gas turbine engine lubrication system components:
  - oil cooler
  - oil filters/screens
  - oil jets
  - oil pumps (pressure/scavenge)
  - oil tank
  - scavenge subsystem
  - valves (by-pass/check/relief)
  - vent subsystem (air/oil separators).
- From given information, identify the effects of faults in components on a lubrication system.

Topic 2 – Fuel Control and Metering Systems I

- State the basic requirements, arrangements and principles of operation of gas turbine engine fuel control/metering systems, including:
  - acceleration scheduling
  - air density/altitude/OAT/airspeed compensation
  - overspeed governing
  - power limiting
  - shutdown control
  - starting control
  - temperature limiting.
Topic 3 – Fuel Control and Metering Systems II

- Describe the relationship, location and function of the following gas turbine engine fuel control system components:
  - engine sensing variables
  - fuel control unit (hydropneumatic, hydromechanical & electro-hydromechanical)
  - fuel filters (HP and LP)
  - fuel heater
  - governors and limiter devices
  - main fuel pumps (HP and LP)
  - valves (throttle/dump/shutoff).

- Describe the relationship, location and function of a Full Authority Digital Electronic Control (FADEC) system.

- From given information, identify the effects of faults in components on a fuel control system and determine fault location and rectification requirements of system faults.

Topic 4 – Engine Air Systems

- Describe the basic requirements, arrangements and principles of operation of gas turbine engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.

- Describe the relationship, location and operation of:
  - air distribution/external services components
  - air starting system components
  - anti-icing system components
  - engine internal cooling/sealing system components.

- From given information, identify the effects of faults in components on internal cooling/sealing, anti-icing, anti-surge bleed and air distribution systems.

Topic 5 – Starting and Ignition Systems

- State the basic requirements, arrangements and principles of operation of the following typical engine starter systems and components:
  - air turbine starters
  - electric starters
  - pressure regulating and shut-off valves
  - starter-generators.
5. Engine Core Subjects

5.5. Gas Turbine Engine Systems (GH)

- State the basic requirements, arrangements and principles of operation of the following engine ignition systems and components:
  - harnesses
  - high voltage AC input
  - igniter plug types
  - low voltage DC input.

- State the safety requirements during servicing and maintenance of engine ignition systems.

- From given information, identify the effects of faults in components on engine starting and ignition systems.

Topic 6 – Engine Indicating/Instrument Systems

- Describe the basic requirements, method of operation, relationship, and function of the following typical engine instrument systems:
  - flow measuring instruments (pressure/volume, fuel and mass air flow sensing types)
  - mechanical measurement (engine rpm and torque)
  - pressure measuring instruments (EPR, oil and fuel)
  - temperature measuring instruments
  - vibration measuring instruments.

- From given information, identify the effects of faults in components on the engine instrument system.

Topic 7 – Electrical Power Supply/Distribution Systems

- From given information, be able to identify the location and determine the function of typical engine electrical power supply and distribution system components.

- State the basic requirements, arrangements and principles of operation of constant speed drives (CSD) and integrated drive generators (IDG).

- From given information, identify the effects of faults in components on power supply/distribution systems.
Topic 8 – Power Augmentation Systems

- Describe the basic requirements, arrangements and principles of operation of the following gas turbine power augmentation systems and components:
  - water injection
  - water/methanol injection
  - afterburners.
- Describe the relationship, location and function of the engine power augmentation system components, and the inter-relationship between the augmentation system and the fuel control system.
- From given information, identify the effects of faults in components on the power augmentation systems.

Topic 9 – Engine Controls

- Describe the basic requirements, arrangements and principles of operation of the following engine controls:
  - linkages and controls to and from the propeller co-ordinator/interconnector and fuel control unit
  - linkages and controls to and from the collective throttle and fuel control unit
  - mechanical control inputs and outputs for electronic fuel control systems
  - throttle/power/condition levers, cables and linkages
  - units and components interconnected for emergency shut-down.
- Describe the relationship, location and function of engine mechanical control system units and components.
- Describe the relationship, location and function of engine electrical/electronic control systems, units and components.
- From given information, determine location and rectification requirements of engine mechanical control system faults.

Topic 10 – Engine Installation, Storage and Preservation

- Describe the function, construction and configuration of typical gas turbine engine firewalls, cowlings and acoustic panels.
- Describe the general procedures for the installation and inspection, of engine mountings, accessories and associated equipment.
- State the general requirements for the preservation and de-preservation of gas turbine engines and accessories/systems both installed (on wing) and in storage.
Topic 11 – Engine Operation and Ground Running

- Describe the general precautions and pre-start checks prior to ground running a gas turbine engine.
- Describe general procedures for starting, ground run-up and stopping a gas turbine engine.
- Determine engine and system malfunctions, using given typical manufacturers procedures and data.
- Interpret engine power output and limitation charts and determine adjustment or rectification requirements.

Topic 12 – Inspection and Maintenance

- Using given data, determine permissible limits of damage and repair criteria on inlet guide vanes, compressor casings, stator blades, rotor blades and fan blades.
- Using given data, determine limits of damage such as cracking, warpage, burning, erosion and hot spots in an engine combustion section.
- Using given data, determine damage and repair limits of typical turbine blades/wheels, turbine case, turbine vanes and exhaust section.
- Describe the use of specialised equipment designed for internal inspection of engines.
- Describe the principles pertaining to engine condition and trend monitoring and determine engine condition from given data.
- Describe the procedure for compressor washing.
- Describe the procedure for field balancing of compressor fans.
- Describe the constructional features and the maintenance requirements of:
  - reduction gearboxes
  - accessory gearboxes
  - combining gearboxes.
Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Installation, Storage and Preservation

- Describe the procedures and general safety precautions for the removal and replacement of an engine.
- Describe the procedures for the inspection and servicing of engine mountings and associated installation equipment and hardware.
- Describe the procedures for the preparation of an engine for storage and preservation.
- Describe the procedures for the preparation of an engine and accessories for installation following storage, preservation or overhaul.

Topic 2 – Ignition and Starting Systems

- From given information interpret ignition and starting system circuit diagrams and determine system operation and system faults.
- Describe the procedures for magneto internal timing and magneto to engine timing.
- Identify the effects of faults in components on an engine ignition system and determine rectification requirements of system faults.
- Identify the effects of faults in components on an engine starting system and determine rectification requirements of system faults.
- With respect to spark plugs and spark plug leads, describe recommended inspection, servicing, cleaning, assembly and testing procedures.

Topic 3 – Fuel Metering/Control – Carburettor Systems

- Describe the procedures for the installation, removal, inspection and servicing of carburettor systems and system components.
- From given information, describe the procedures for the inspection, adjustment and the functional checks required of the carburettor systems following maintenance.
- Identify the effects of faults in components on the carburettor system and determine rectification requirements of system faults.
Topic 4 – Fuel Metering/Control – Injection Systems

- Describe the procedure for the installation, removal, inspection and servicing of fuel injection systems and system components.
- From given information, describe the procedures for the inspection, adjustment and the functional checks required of the fuel injection system and components following maintenance.
- Identify the effects of faults in components on the fuel injection system and determine the rectification requirements of system faults.

Topic 5 – Lubrication and Oil Supply Systems

- Describe the procedures for the inspection and servicing of engine oil systems and typical nacelle systems.
- Describe the procedures for the inspection and servicing of the lubrication oil cooling, temperature control and temperature/pressure measurement systems.
- Describe the procedures for the inspection and servicing of engine lubrication system filters and screens.
- Identify the effects of faults in components on the engine lubrication system and determine rectification requirements of system faults.

Topic 6 – Propeller and Governor Control

- Describe the procedures for the installation, removal and inspection of propellers.
- From given manufacturer’s data, determine the limits and permissible damage repair criteria of propellers and blades.
- Describe propeller blade angle checking methods and procedures and typical propeller tracking procedures.
- Describe the procedures for the installation and adjustment of the governor and governor control system.
- From given information diagnose operational faults in the governor and controls and determine the rectification requirements for these faults.
6. Engine Specific Group Subjects

6.1. Aeroplane Piston Engine Installation, Operation and Maintenance (GD)

Approved by Group General Manager, Personnel Licensing, Education and Training Group   Issue 2.1: July 2005

Topic 7 – Power Plant (cowlings/drains/exhaust/induction), Accessories and Fuel Supply Systems

- Describe the procedures for the inspection and servicing of engine cowlings, drains and exhaust/induction systems.
- Describe the procedures for the servicing, installation and removal of engine accessories such as:
  - generators
  - pumps (fuel/hydraulic/vacuum)
  - starters
  - thermocouples.
- Describe the procedures for the inspection and servicing of aircraft fuel systems and components.
- Describe the various means of testing fuels for contamination and suitability.
- From given information, describe the effect of faults in fuel supply system components on engine operation and determine rectification requirements of system faults.

Topic 8 – Engine Controls, Starting and Ground Running

- From given information describe the procedures for the adjustment and rigging of each of the controls that govern engine operation.
- Identify the effects of faults, control maladjustment and rigging problems on the engine controls and determine the rectification requirements of these problems or faults.
- Describe the requirements and procedures for a cold cylinder check.
- Describe the manufacturer's recommended procedures for starting, ground run-up and stopping engines.
- From given information, diagnose faults encountered during engine starting and ground running and determine the rectification actions required.
Topic 9 – Engine Operation

- Determine typical engine power output parameters and limitations by interpretation of given power charts or graphs.
- From given information, diagnose faults and defects encountered during flight operations and determine the necessary rectification actions required.
- From given information, describe adjustment procedures, checking and interpretation of fuel pressure, oil pressure and other instrumentation associated with engine operation.

Topic 10 – Maintenance I

- Describe the procedures recommended for the preparation, disassembly and cleaning of an engine for maintenance/top overhaul.
- Describe the procedures for the removal and replacement of a cylinder and associated components.
- Describe the procedures and requirements for the inspection of the valve operating assemblies, cylinders, pistons, bearings and associated components after removal, strip down and disassembly.

Topic 11 – Maintenance II

- Describe the procedures for the replacement of broken studs, the insertion of heli-coils and the fitting of oversize studs.
- Describe the procedures for the refacing of valves and valve seats.
- Describe the procedures for the fitting of piston rings, the determination of side clearance and gap and other associated precautions and tolerances.

Topic 12 – Maintenance III

- Determine from given information the dimensional limits, fits, alignment and clearances of the engine and sub-components.
- Describe the various techniques and types of equipment used to determine the dimensional parameters required during engine repair/top overhaul/maintenance.
- Describe the test requirements, procedures and the use of equipment and tooling for the top overhaul/repair/maintenance of an engine.
Topic 13 – Maintenance – Radial Engines

- From given information, describe the procedures for checking valve adjustment and the timing of typical valve operating mechanisms.
- Describe the procedures for removing and refitting piston and cylinder assemblies.
Note: This subject syllabus is to be read in conjunction with the Introduction.

**Topic 1 – Installation, Storage and Preservation**

- Describe the procedures and general safety precautions for the removal and replacement of an engine.
- Describe the procedures for the inspection and servicing of engine mountings and associated equipment and hardware.
- Describe the procedures for the preparation of an engine and accessories for installation following storage, preservation or overhaul.
- Describe the procedures for the preparation of an engine for storage and preservation.

**Topic 2 – Ignition and Starting Systems**

- From given information, interpret ignition and starting system circuit diagrams and determine system operation and faults.
- Describe the procedures for magneto internal timing and magneto to engine timing.
- Identify the effects of faults in components on an engine ignition system and determine rectification requirements of system faults.
- Identify the effects of faults in components on an engine starting system and determine rectification requirements of system faults.
- With respect to spark plugs and spark plug leads, describe recommended inspection, servicing, cleaning, assembly and testing procedures.

**Topic 3 – Fuel Metering/Control – Carburettor Systems**

- Describe the procedures for the installation, removal, inspection and servicing of carburettor systems and system components.
- From given information, describe the procedures for the inspection, adjustment and functional checking of carburettor systems, following maintenance.
- Identify the effects of faults in components on a carburettor system and determine the rectification requirements of system faults.
Topic 4 – Fuel Metering/Control – Injection Systems

- Describe the procedures for the installation, removal, inspection and servicing of fuel injection systems and system components.
- From given information describe the procedures for the inspection, adjustment and functional checking of injection systems and components following maintenance.
- Identify the effects of faults in components on an injection system and determine the rectification requirements of system faults.

Topic 5 – Lubricating and Oil Supply Systems

- Describe the procedures for the inspection and servicing of typical engine oil filters and screens.
- Describe the procedures for the inspection and servicing of engine oil temperature control, cooling and pressure temperature measurement systems.
- Describe the procedures for the inspection, servicing and operational checks of engine oil pressure and scavenge systems and components.
- Describe the inspection and servicing procedures of nacelle engine oil supply, cooling and temperature control systems and components.
- Identify the effects of faults in components on a typical engine lubricating system and determine the rectification requirements of faults in the system.

Topic 6 – Engine Accessories and Engine to Transmission Drive System

- Describe the procedures for the servicing, installation and removal of engine driven accessories, and determine rectification requirements of any faults.
- Describe the procedures for the installation, removal, adjustment, inspection and servicing of the engine cooling system, fans, pulleys, drive mechanisms and couplings.
- Describe the procedures for the inspection and maintenance (removal/installation) of engine output drive systems.
Topic 7 – Power Plant (cowlings/drain/exhaust/induction) and Fuel Supply Systems

- Describe the procedures for the inspection and servicing of engine cowlings, drains, exhaust and induction systems and determine rectification of defects/faults.
- Describe the various methods and procedures for testing fuels for contamination and suitability.
- Describe the procedures for the inspection and servicing of the aircraft fuel supply systems and components.
- From given information, describe the effect of faults in fuel supply system components on engine operation and determine rectification requirements of system faults.

Topic 8 – Engine Controls, Starting and Ground Running

- From given information describe the procedures for the rigging and adjustment of each of the controls which govern engine operation.
- From given information describe the procedures for the rigging and adjustment of emergency (shut-down) controls.
- Describe the procedures for the rigging, inspection and adjustment of engine/collective control system.
- Identify the effects of faults, control maladjustment and rigging problems on the engine controls and determine the rectification requirements of these faults or problems.
- Describe the requirements and procedures for a cold cylinder check.
- Describe the manufacturers recommended procedures for starting, ground run-up and stopping engines.
- From given information, diagnose faults encountered during engine starting and ground running and determine the rectification actions required.

Topic 9 – Engine Operation

- Determine typical engine power output parameters and limitations by interpretation of given power charts or graphs.
- From given information, diagnose faults and defects encountered during flight operations and determine the necessary rectification actions required.
- From given information, describe adjustment procedures, checking and interpretation of fuel pressure, oil pressure and other instrumentation associated with engine operation.
6. Engine Specific Group Subjects

6.2. Helicopter Piston Engine Installation, Operation and Maintenance (GE)

Approved by Group General Manager, Personnel Licensing, Education and Training Group   Issue 2.1: July 2005

Topic 10 – Maintenance I

● Describe the procedures for the preparation, disassembly and cleaning of an engine for maintenance/top overhaul.

● Describe the procedures for the removal and replacement of a cylinder and associated components.

● Describe the procedures and requirements for the inspection of the valve operating assemblies, cylinders, pistons, bearings and associated components after removal, strip down and disassembly.

Topic 11 – Maintenance II

● Describe the procedures for the replacement of broken studs, the insertion of heli-coils and the fitting of oversise studs.

● Describe the procedures for the refacing of valves and valve seats.

● Describe the procedures for the fitting of piston rings, the determination of side clearance and gap and other associated precautions and tolerances.

Topic 12 – Maintenance III

● Determine from given information the dimensional limits, fits, alignment and clearances of the engine and sub-components.

● Describe the various techniques and types of equipment used to determine the dimensional parameters required during engine repair/top overhaul/maintenance.

● Describe the test requirements, procedures and the use of equipment and tooling for the top overhaul/repair/maintenance of an engine.

Topic 13 – Maintenance – Radial Engines

● From given information, describe the procedures for checking valve adjustment and the timing of typical valve operating mechanisms.

● Describe the procedures for removing and refitting piston and cylinder assemblies.
6.3 Supercharging Systems (GF)

Note: This subject syllabus is to be read in conjunction with the Introduction.

Topic 1 – Principles of Supercharging

- Describe the purpose and principles of supercharging and the effects on:
  - brake horsepower (BHP)
  - charge density and temperature
  - detonation
  - fuel consumption
  - manifold absolute pressure (MAP)
  - revolutions per minute (RPM)
  - volumetric efficiency.

Topic 2 – Construction and Operation

- Describe the construction and operating principles of a typical geared supercharger and turbo supercharger system.
- Describe the construction and function of the:
  - diffuser
  - engine gear drive
  - impeller
  - intercooler
  - turbine.

Topic 3 – System Terminology

- Define the following:
  - boot strapping
  - critical altitude
  - deck/upper deck pressure
  - density altitude
  - overboost
  - overshoot
  - rated power.
6. Engine Specific Group Subjects

6.3. Supercharging Systems (GF)

Topic 4 – System Configurations

- Differentiate between the following systems:
  - external (turbo supercharger)
  - internal (supercharger)
  - multi speed
  - multi stage.
- Differentiate between ground boosted and altitude engines.

Topic 5 – System Control I

- Describe the operation and layout of a system consisting of:
  - absolute pressure controller
  - manifold pressure relief valve
  - ratio controller
  - waste gate assembly.
- Describe the operation and construction of all system components and installation requirements.

Topic 6 – System Control II

- Describe the operation and layout of a system consisting of:
  - density controller
  - differential pressure controller
  - waste gate assembly.
- Describe the operation and construction of all system components and installation requirements.

Topic 7 – System Control III

- Describe the operation and layout of a system consisting of:
  - variable absolute pressure controller
  - waste gate assembly.
- Describe the operation and construction of all system components and installation requirements.
Topic 8 – System Control IV

- Describe the operation and layout of a system consisting of:
  - ground adjustable waste gate valve
  - manifold pressure relief valve.
- Describe the operation and construction of all system components and installation requirements.

Topic 9 – Maintenance I

- Identify the effects of faults in components on a supercharging system and determine the rectification requirements of system faults involving:
  - high deck pressure
  - low critical altitude
  - low deck pressure
  - low oil pressure
  - low power
  - surging.

Topic 10 – Maintenance II

- Describe the requirements and procedures for the inspection, servicing, removal and installation of supercharging systems and system components.
- Describe lubrication system protective systems and procedures.
- Describe control system adjustment requirements and procedures.
References

- The examination questions will be compiled from the relevant manufacturers servicing, maintenance, overhaul and operation manuals.

Examination Outline

- The specific engine type examination will cover the aspects of the engine, engine systems and the associated engine/airframe systems which an engine LAME has certification privileges, including:
  - all maintenance in category engines
  - the interface of the engine with the electrical, instrument, airframe and radio systems
  - electrical and instrument system maintenance as specified in CAO 100.90, Appendix 1
  - operation of the engine, APU and the associated airframe systems as required to carry out maintenance on the engine and the associated systems.

- The examination will only relate to a specific engine series and the airframe installations in general and not to a particular engine model or aircraft.

- The candidate will be expected to demonstrate a reasonable knowledge of the differences between models within a series, and for this reason, answers such as “not fitted this model” or “manufacturer’s optional equipment” and similar comments/answers are not acceptable and will be marked accordingly.

- However, when a question refers to a system that is different for a particular engine model or airframe installation the candidate is advised to nominate the engine model and aircraft selected for his/her answer.

- The specific type engine examination is set in two (2) parts. Each part will be marked separately and a pass must be obtained in each part to qualify for a rating. A credit for an individual part passed will be given.
Syllabus of Examination – AME Licences – Mechanical Category

7. Engine Specific Type Subjects

7.1. Specific Engine Type (GS)

Approved by Group General Manager, Personnel Licensing, Education and Training Group  Issue 2.1: July 2005

Examination Part 1: Engine and Systems

- Constructional features
- Lubrication system (internal and nacelle)
- Fuel Control and Metering system
- Carburation/Injection system (as applicable)
- Accessories
- Ignition and Starting systems
- Air Systems and control (internal and external services)
- Power augmentation (as applicable)
- Supercharging systems (as applicable)

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Examination Part 2: Airframe Interface and Systems

- Fuel supply system
- Engine control systems (levers, linkages, cables etc.)
- Fire protection systems
- Engine installation/cowlings/drains
- Electrical power supply system
- Engine indicating system
- Manufacturers maintenance practices—eg, borescope, SOAP, preservation etc
- Thrust reverser/exhaust (as applicable)
- Auxiliary power unit (as applicable)
- Generator constant speed drive (as applicable)
- Transmission driveshafts (helicopters, as applicable)
- Top overhaul procedures (as applicable)

ATA Chapter

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Questions

- The number and type of questions in each area will depend on the complexity of the engine and the associated systems. The questions may be either pictorial, written or a combination of both and will include such topics as:
  - adjustment
  - construction
  - fault-finding
  - identification of components
  - inspection
7. Engine Specific Type Subjects

7.1. Specific Engine Type (GS)

- installation
- layout
- location
- maintenance procedures
- operation/function
- operational procedures
- precautions
- repair
- servicing.

Specific Examination Codes

CASA no longer allocates resources to the maintenance, update or delivery of Group 20 Specific Type Examinations. Check AAC 9-4 and 9-5 for approved courses.

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<tr>
<td>“Aerodynamics for Naval Aviators”, Hurt, US Navy NAVWEPS, 00-80T-80, Revised 1965</td>
<td>BB</td>
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<tr>
<td>Airworthiness Advisory Circulars (AACs) – CASA</td>
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<tr>
<td>Aviation Technician Integrated Training Program Series Published by International Aviation Publishers Inc</td>
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### 8. List of Reference Textbooks

#### 8.1. Airframe Category

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<tr>
<td>“Aircraft Hydraulic Systems”, EA-AH-1</td>
<td>FF</td>
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<tr>
<td>CAIP Leaflets (Civil Aviation Inspection Procedures)</td>
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<tr>
<td>CAA (UK) reference: CAP459. Copies of individual leaflets are available upon request from:</td>
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<td>Civil Aviation Safety Authority</td>
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<td>P O Box 2005</td>
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<tr>
<td>Canberra ACT 2601</td>
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<td>Australia</td>
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<td>Phone: (61) 2 6217 1660</td>
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<td>Civil Aviation Regulation 42G</td>
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<td>“Practical Helicopter Aerodynamics”, R W Prouty, 1985, PJS Publications INC</td>
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<tr>
<td>Relevant Engine and Equipment Manufacturers Servicing, Maintenance and Operation Manuals – (Avco-Lycoming, Airesearch, Garrett, Cessna, Teledyne Continental)</td>
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<tr>
<td>The Jet Engine, Rolls-Royce Limited 3rd and 4th Ed, Publication Ref TSD 1302</td>
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**Note:** The Revision History shows the most recent amendment first. Scroll down the table to view details of previous amendment information.

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<td>Sec 8.1</td>
<td>On page 108, contact address to obtain CAIP leaflets changed from Airservices to CASA.</td>
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<td>January 2004</td>
<td>Complete syllabus</td>
<td>Syllabus reformatted. Additional study material incorporated within Topics: BA1, BA8, BA10, BA11, BA12, BA19, BB1, BB3, BB4, BB7, BB8, BB12, BB13, BB14, BC13, FA7, FA8, FG1, FG2, FG4, FG10, FG21, FI5, FI7, FI8, FI15, FI16, FI17, FI20, FI21, FI25, FM6, GG12, GH2, GH3, GH6, GH8, GH9, GH12.</td>
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