

**APPENDIX R62.14
RECREATIONAL PILOT LICENCE –
MICROLIGHT AND LIGHT SPORT AEROPLANES
PART 96 AUTHORIZATION
THEORETICAL KNOWLEDGE COURSE**

1. Aim of training course

The aim of the Part 96 authorisation training course is to train the holder of a recreational, or private pilot licence to the level necessary for the issue of a Part 96 authorisation, required to operate any of the following aircraft in commercial air transportation, namely –

- **Conventional microlight aeroplanes**
- **Weight-shift controlled microlight aeroplanes**
- **Light sport aeroplanes**

2. Theoretical knowledge training course

The theoretical knowledge course must cover the following subjects:

- **Principles of flight**
- **Aviation meteorology**
- **Air law**
- **Aircraft Airframes, Engines and Instruments**
- **Navigation**
- **Human performance limitations**
- **Flight planning and flight operations**

3. Theoretical knowledge training course syllabus

- (1) The theoretical knowledge training course syllabus in the case of a Part 96 authorisation in the category microlight aeroplanes consists of the following subjects:

3.1.3 Principles of Flight - General

- (1) **PHYSICS AND MECHANICS**
- (a) Speed, velocity, force
 - (b) Speed squared law
 - (b) Pressure – Bernoulli's Principle
 - (c) Motion of body along a curved path
- (2) **AEROFOILS, LIFT AND DRAG**
- (a) Air resistance and air density
 - (b) Aerofoil shapes

- (c) Lift and drag – Angle of attack and airspeed
- (e) Drag – Induced, parasite – Form, skin, interference
- (f) Lift/drag ratio and aspect ratio
- (g) Wake turbulence

(3) EQUILIBRIUM

- (a) The four forces: Lift, weight, thrust and drag
- (b) Centre of gravity (C of G) position
- (c) The balance of the four forces: Straight and level
 Climbing
 Descending

(4) STABILITY

- (a) Positive, neutral, negative
- (b) Lateral and directional stability
- (c) Longitudinal stability
- (d) Wash-out

(5) FORMATION FLYING

- (a) Law Governing
- (b) Procedures and hazards

(6) TURNING FLIGHT

- (a) The forces in the turn
- (b) Compensation for loss of lift

(7) THE STALL

- (a) Airflow separation
- (b) Stalling angle – Relationship to airspeed
- (c) Wing loading
- (d) Wing loading increase with bank angle increase
- (e) High-speed stall

(8) AIRCRAFT PERFORMANCE

- (a) Power curves
 - Effect of temperature, altitude, density, moisture etc.
 - Range and endurance
- (b) Climbing performance
 - Rate of climb
 - Angle of climb
- (c) Take-off and landing performance

- Take-off run available
- Take-off distance available
- Landing distance available

(d) Take-off and initial climb - performance

Effect of –

- wind, wind gradient and wind shear
- weight
- pressure, altitude, temperature and density
- ground surface and gradient

(e) Approach and landing – performance

Effect of –

- wind, wind gradient and wind shear
- weight
- turbulence and gusts
- ground effect

3.2 Aviation meteorology

(1) THE ATMOSPHERE

- (a) Composition and structure
- (b) Vertical divisions

(2) DENSITY AND TEMPERATURE

- (a) Barometric pressure, isobars
- (b) Changes of pressure, density and temperature with altitude
- (c) Solar and terrestrial energy radiation, temperature
- (d) Lapse rate
- (e) Stability and instability
- (f) Effects of radiation, advection subsidence and convergence

(3) HUMIDITY AND PRECIPITATION

- (a) Water vapour in the atmosphere
- (b) Dew point and relative humidity

(4) PRESSURE AND WIND

- (a) High and low pressure areas
- (b) Gradient wind
- (c) Vertical and horizontal motion
- (d) Effect of wind gradient and windshear on take-off and landing
- (e) Relationship between isobars and wind, Buys Ballot's law
- (f) Turbulence and gustiness
- (g) Local winds, land and sea breezes, berg winds, valley winds

(5) CLOUD FORMATION

- (a) Cloud types
- (b) Convection clouds
- (c) Orographic clouds
- (d) Stratiform and cumulus clouds

(6) VISIBILITY

- (a) Fog, mist and haze
- (b) Radiation, advection, frontal
- (c) Formation and dispersal
- (d) Reduction of visibility due to mist, snow, smoke, dust and sand
- (e) Hazards of flight due to low visibility, horizontal and vertical

(7) AIRMASSES

- (a) Weather associated with pressure systems

(8) FRONTS

- (a) Formation of cold and warm fronts
- (b) Associated clouds and weather, cold front

(9) ICE ACCRETION

- (a) Conditions conducive to ice formation
- (b) Effects of hoar frost, rime ice, clear ice
- (c) Effects of icing on microlight performance
- (d) Precautions and avoidance of icing conditions
- (e) Powerplant icing

(10) THUNDERSTORMS

- (a) Formation – airmasses, frontal, orographic
- (b) Conditions required
- (c) Development process
- (d) Recognition of favourable conditions for formation
- (e) Hazards
- (f) Effects of lightning and severe turbulence
- (g) Avoidance of flight in the vicinity of thunderstorms

(11) FLIGHT OVER MOUNTAINOUS AREAS

- (a) Hazards
- (b) Influence of terrain on atmospheric processes
- (c) Mountain waves, windshear, turbulence, vertical movement, rotor effects

(12) CLIMATOLOGY

- (a) General world circulation
- (b) South African summer patterns
- (c) South African winter patterns
- (d) The South Westerly Buster
- (e) The Cape Doctor
- (f) The Black South Easter

(13) ALTIMETRY

- (a) Operational aspects of pressure settings
- (b) Pressure altitude, density altitude
- (c) Height, altitude, flight level

(14) THE METEOROLOGICAL ORGANISATION

- (a) Forecasting service

(15) WEATHER ANALYSIS AND FORECASTING

- (a) Weather charts, symbols, signs
- (b) Significant weather charts
- (c) Prognostic charts for general aviation

(16) WEATHER INFORMATION FOR FLIGHT PLANNING

- (a) Reports and forecasts for departure, *en route*, destination and alternate(s)
- (b) Interpretation of coded information METAR, TAF
- (c) Availability of ground reports for surface wind, windshear, visibility

(17) METEOROLOGICAL BROADCASTS FOR AVIATION

- (a) ATIS, SIGMET

(18) MICRO-METEOROLOGY

- (a) Rotors
- (b) Venturies
- (c) Katabatic and Anabatic winds
- (d) Thermal activity
- (e) Dust devils
- (f) The immediate environment.
 - Wind indicators
 - Cloud forms
 - Topography

3.3 Air law

Aviation legislation in South Africa is a vast subject.

Emphasis should therefore be put on

- Laws most often encountered and most relevant to Microlight flying,
- an overview off all the applicable acts
- how to use the applicable documents to find detailed information.

The candidate is not expected to know all the applicable acts and details off by heart, and it is recommended that the theoretical examination is a limited time, open book exam, so that the ability to use and reference the following documents be tested: CAR's, CAT's, ANR's, AIP's, AIP supplement, AIC's and NOTAMS

The theoretical knowledge training course for microlight aeroplane pilots should include the following air law subjects:

1. AIR LAW - FUNCTION AND STRUCTURE

- (a) CAR's
- (b) CAT's
- (c) AIP's
- (d) AIP supplements
- (e) AIC's
- (f) NOTAMS
- (g) Currency
- (h) Filing of updates

2. CONTROLLING BODIES, THEIR FUNCTIONS AND LIMITATIONS

- (a) SACAA
 - SACAA constitution
 - Departments and functions
 - Requirements of inspectors
 - Privileges and limitations of inspectors and SACAA office bearers
 - CAHRS system
- (b) CARCOM
- (c) Aero Club of South Africa
- (d) MISASA

3. AMENDMENT AND IMPLEMENTATION OF THE LAW.

- (a) Publication of proposals in the Government gazette
- (b) The rights of relevant role players
- (c) Public / interested parties rights

3. GENERAL KNOWLEDGE

The candidate is expected to have a good general knowledge of Civil Aviation Regulations 1997, covering the following sections as applicable to Microlighting, as well as all references found of the Civil Aviation Technical Standards which may accompany them.

- (a) Reg. 1.00.1 – Definitions
- (b) Part 12. Accidents and Incidents
 - Subpart 12.2: Accident and Incident Notification Procedures.
 - Subpart 12.3: Investigation of Accidents and Incidents.
 - Subpart 12.4 Scene of an Accident.
- (c) Part 13 Enforcement Procedures.
- (d) Part 24 Airworthiness Standards: Non-type certificated aircraft.
- (e) Part 43 General Maintenance Rules

(f) Part 47 Registration and Marking.

(g) Part 62 Recreational Pilot Licensing.

(h) Part 67 Medical Certificates

- Reg. 67.00.2: Classes of Medical Certificates
- Reg. 67.00.5 Class 4 Medical Certificates.
- Reg. 67.00.6 Period of validity.
- Reg. 67.00.9 Duties of holder of medical certificate.
- Reg. 67.00.10 Foreign medical assessment.

(i) Part 91 General Operating and Flight Rules

- Subpart 91.1: General Provisions
- Subpart 91.2 Flight crew.
- Reg. 91.03.1 Documents to be carried on board.
- Reg. 91.03.2 Aircraft flight manual.
- Reg. 91.03.5 Flight folio.
- Reg. 91.03.7 Certificate of Release to Service.
- Subpart 91.4 Instruments and Equipment.
- Reg. 91.05.1 Communication Equipment.
- Subpart 91.6 Rules of the Air:
 - Division One: Flight Rules
 - Division Two: Visual Flight Rules
 - Division Five: Air Traffic Rules.
- Reg. 91.06.32 Minimum heights.
- Reg. 91.06.33 Semi-circular rule.
- Reg. 91.07.1 Routes and areas of operation.
- Reg. 91.07.3 Use of aerodromes.
- Reg. 91.07.10 VFR operating minima.
- Reg. 91.07.11 Mass and balance.
- Reg. 91.07.12 Fuel and oil supply.
- Reg. 91.07.14 Smoking in aircraft.
- Reg. 91.07.16 Noise abatement procedures.
- Reg. 91.07.17 Submission of flight plan.
- Reg. 91.07.18 Seats, safety belts and harness.
- Reg. 91.07.20 Passenger briefing.
- Reg. 91.07.21 Emergency equipment.
- Reg. 91.07.26 In-flight simulation of emergency situations.

- Reg. 91.07.28 Starting of engines.
- Reg. 91.09.1 General provisions: Performance operating limitations.
- Reg. 91.09.4 Aeroplane performance classification.
- Subpart 91.10 Maintenance.

(j) Part 92 Conveyance of Dangerous Goods Regulations.

- Reg 92.00.1 Applicability
- Reg. 92.00.2 Conveyance of dangerous goods forbidden.
- Reg. 92.00.27 Dangerous goods carried by passengers or flight crew members.
- Reg. 92.00.28 Information to passengers.

(k) Part 94 Operation of non-type certificated aircraft:

- Subpart 1 – General provisions
- Subpart 2 – Flight crew
- Subpart 3 – Documentation and records
- Subpart 4 – Communication and navigation equipment
- Subpart 5 – Rules of the air
- Reg. 94.06.7 – Operation of amateur-built or production-built aircraft, including microlight aeroplanes
- Subpart 7 – Maintenance.
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(l) Part 96 Commercial operation of Non-type certified aircraft

- Subpart 1: General
- Subpart 2: Flight Crew
- Subpart 3: Documentation and Records
- Subpart 4: Operating Certificate
- Subpart 5: Maintenance

(m) Part 149 Aviation Recreation Organisations:

- Subpart 1 – General
- Subpart 2 – Approval.

(n) Part 183 Administration.

(o) Part 185 Offences.

(p) Part 187 Fees.

3.4 Engines, Airframes and Instruments.

(1) ENGINES

(a) The four-stroke Engine

- The principal of operation of the four-stroke engine.
- Operation of the inlet and exhaust valves.
- The crankshaft and connecting rod.
- Piston and piston rings.
- Cylinders.
- Arrangement of cylinders.
- Cylinder head.
- The 4-stroke cycle.

(b) The 2-stroke Engine

- The construction of the 2-stroke engine.
- The operation of the 2-stroke engine and the 2-stroke cycle.
- The operation of the rotary valve. (Rotax 582, 618).

(c) The fuel system.

- The operation of the carburettor.
- The float and float chamber.
- The main jet.
- The idle jet.
- The power jet.
- The choke system.
- The throttle control.
- The fuel filter.
- The water trap.
- The air filter.
- Maintenance of the carburettor.
- The operation of the constant-vacuum carburettor.

(As per Rotax 912)

- The operation of the piston-type carburettor.
(As per Rotax 503, 582, 618)

(d) The cooling system

- The operating principle of the cooling system.
- Coolants (glycol based), anti freeze.
- The water pump, operating principle and the tell-tail hole.
- The pressure cap, operating principle.
- The thermostat, operating principle.
- Operating temperature, problems associated with engine operating temperature too hot and too cold.

- The radiator, operating principle.
- The radiator overflow-header tank, operating principle.
- The air-cooled engine operating principle.
- The fan and fan belt.
- Service intervals and preventative maintenance.

(e) The exhaust system

- The function and operation of the exhaust, muffler, after-muffler.
- Back pressure and its importance to the 2-stroke engine.
- De-coking and carbon build-up, when to de-coke, 2-stroke engines.
- Exhaust springs, locking wire, copper slip.
- Checking for cracks and security of system.
- Exhaust temperature min/max, operational.
- The principle of carburettor heat and the exhaust.

(f) The vibration mounting, engine and exhaust

- Causes of vibration and types of vibration.
- The purpose of the vibration mounting.

(2) THE FUEL SYSTEM

(a) Fuel storage

- Water contamination.
- Dirt contamination.
- Aircraft fuel tanks

(b) Types of fuel

- Octane number.
- Avgas.

(c) Two-stroke oil

- Outboard oil
- Mixing ratios.

(d) Fuel hose and fittings

- The fuel hose.
- Braided fuel hose.
- Hose clamps.
- Rooting of fuel hose.

(e) Aircraft fuel tanks

- Water trap position and operation.
- Fuel tank caps and breathers.
- Fuel cocks, and reserve fuel tanks.

(f) Fuel pumps, their construction and operation

- Fuel pressure.
- The electrical fuel pump.
- The vacuum pump.
- The hand-primer fuel pump.

- the combination of vacuum and electric fuel pumps.
- (g) Layout of the complete fuel system
 - Carburettor.
 - Fuel filters.
 - Fuel water trap.
 - Fuel hosing.
 - Fuel taps/reserve.
 - Fuel tanks and breather systems.
- (h) Carburettor icing
 - Theory of carburettor icing.
 - Weather conditions conducive to carburettor icing.
 - Preventing carburettor icing.
 - Warning signs of carburettor icing.
- (i) Service schedules and intervals
 - Air filter.
 - Fuel filter.
 - Cables and connecting linkages.
 - Carburettor flange/to inlet manifold.
- (j) The oil lubrication system
 - The qualities of oil, engine oil, gear oil, 2-stroke oil.
 - Types: mineral and synthetic oils.
 - Oil grades and viscosity's.
 - The four functions of oil.
 - The operation of the lubrication system of the 2-stroke engine.
 - The operation of the lubrication system of the 4-stroke engine.
 - The operation of oil pressure relief valve, oil pressure min/max 4-stroke engine.
 - The oil pressure pump operation, 4-stroke engine.
 - The oil filter operation, 4-stroke engine.
 - The oil filter checking for contamination, 4-stroke engine.
 - The automatic oil lubrication system, 2-stroke engine.
 - Mixing of 2-stroke oil.
 - Differences between wet and dry oil sump, 4-stroke engine.
 - Oil and oil filter change schedules, 4-stroke engine.
 - Oil temperature, min/max, warm up, operating temperature.
 - Testing of water contamination, 2- and 4-stroke engines.

(3) THE ELECTRICAL SYSTEM

- (a) The battery - basic principle of operation.
- (b) Battery maintenance.
- (c) The operating principle of the starter motor.
- (d) The rectifier regulator, operating principle.
- (e) The charging circuit.
- (f) The spark plug, types of spark plug hot/cold, long/short reach, electrode/gap setting, colour of electrodes, engine operating conditions (rich/lean, amount of oil), problems associated with spark plugs, plug caps, high tension cables.
- (g) The ignition circuit dual and single CDI (capacitor discharge ignition).
- (h) Points, condenser.
- (i) Fuses (correct fuses), values.
- (j) The earth straps and connections.
- (k) Preventative maintenance.
- (l) Service intervals.

(4) THE PROPELLER

- (a) The operational principle of the propeller.
- (b) Types of propeller: pusher, tractor.
- (c) Fixed pitch, ground adjustable, in-flight adjustable.
- (d) The effects of incorrect pitch setting, out of balance, engine rpm.
- (e) Tracking and its effects if adjustment is incorrect.

(5) THE GEAR BOX AND REDUCTION GEAR

- (a) Types of gear box and construction.
- (b) The operating principle of the gear box.
- (c) Engine-to-gear box coupling.
- (d) The slipper clutch, 4-stroke engine (Rotax 912/914).

(6) LOCKING WIRE

- (a) The correct locking-wire procedures.
- (b) Parts on the engine to be secured with locking wire.

(7) TROUBLE-SHOOTING AND PROBLEM-SOLVING

- (a) Basic trouble-shooting 2- and 4-stroke engines; student to be able to find fault.
- (b) Basic trouble-shooting air- and water-cooled

(8) AIRFRAME

- (a) Materials
 - composite
 - aluminium
 - stainless steel
 - mild steel
 - Fiber glass

- Dacron
- Mylar
- Rip-stop
- Cables
- Bolts, nuts and washers
 - AN
 - 8.8
 - 12.9

(b) Characteristics, Advantages and disadvantages of materials

- composite
- aluminium
- stainless steel
- mild steel
- anodizing
- corrosion

(c) Causes of wear and damage

- vibration
- corrosion
- UV
- Flight in turbulent conditions
- Hard landings
- Hangar rash
- Trailing

(d) Design considerations

- welding
- bending
- casting
- machining
- drilling
- cable crimps
- shackles
- brackets
- material grades

(e) Suspension

- spring steel
- shock absorbers
- bungee suspension.

(f) Wheels and tires

(9) BASIC INSTRUMENTS

- (a) The Altimeter
- (b) Airspeed Indicator
- (c) Engine management instruments.
- (d) Vertical Speed Indicator
- (e) Magnetic Compass
- (f) G.P.S.

(10) RECORD KEEPING, SERVICING, CHECKS

- (a) Engine and airframe/propeller log books,
- (b) 50-hour checks.

(c) Annual inspection.

3.5 Navigation

(1) FORM OF THE EARTH

- a. Axis, poles
- b. Meridians of longitude
- c. Parallels of latitude

(2) DIRECTION

- a. True north
- b. Earth's magnetic field,
variation – annual change
- c. Magnetic north
- d. Magnetic influences
within the microlight
- e. Compass deviation
- f. Turning, acceleration
errors
- g. Avoiding magnetic
interference with the compass

(3) DISTANCE

- 1. Nautical mile, statute mile, kilometre

(4) AERONAUTICAL MAPS AND CHARTS (TOPOGRAPHICAL)

- a. Projections and their properties
- b. Scale
- c. ICAO 1:250 000 and 1: 500 000 charts
- d. main properties
- e. Scale
- f. depiction of height
- g. Topography
- h. Relief
- i. Cultural features
- j. Aeronautical symbols
- k. Aeronautical information

(5) CHARTS IN PRACTICAL NAVIGATION

- a. Plotting positions
- b. Latitude and longitude
- c. Bearing and distance
- d. Use of navigation protractor
- e. Measurement of tracks and distances
- f. Conversion of units

- (6) PRINCIPLES OF NAVIGATION
 - a. IAS, RAS (CAS) and TAS
 - b. Track, true and magnetic
 - c. Wind velocity, heading and ground speed
 - d. Triangle of velocities
 - e. Calculation of heading and ground speed
 - f. Drift, wind correction angle
 - g. EET and ETA
 - h. Dead reckoning, position, fix

- (7) FLIGHT PLANNING
 - a. Selection of charts
 - b. Route and aerodrome weather forecasts and reports
 - c. Assessing the weather situation
 - d. Plotting the route
 - e. Considerations of controlled airspace, airspace restrictions, danger areas, etc.
 - f. Use of AIP and NOTAMS
 - g. ATC liaison procedures in controlled airspace
 - h. Fuel considerations
 - i. *En-route* safety altitude(s)
 - j. Alternate aerodromes
 - k. Communications and radio/navaid frequencies
 - l. Compilation of flight log
 - m. Compilation of ATC flight plan
 - n. Selection of check points, time and distance marks

- (8) PRACTICAL NAVIGATION
 - a. Compass headings, use of deviation card
 - b. Organisation of in-flight workload
 - c. Departure procedure
 - d. Maintenance of heading and altitude
 - e. Use of visual observations
 - f. Establishing position, checkpoints
 - g. Lost Procedure
 - h. Revisions to heading and ETA
 - i. Arrival procedures, ATC liaison
 - j. Use of minute marker graph.

- (9) GLOBAL POSITIONING SYSTEM (GPS)
 - a. Limitations
 - b. Application
 - c. Principles
 - d. Presentation and interpretation
 - e. Coverage
 - f. Errors and accuracy
 - g. Factors affecting reliability and accuracy
 - h. Legalities

3. 6. Human Performance Limitations

(1) BASIC PHYSIOLOGY

- a. Concepts
- b. Composition of the atmosphere
- c. The gas laws
- d. Respiration and blood circulation

(2) EFFECTS OF PARTIAL PRESSURE

- a. Effect of increasing altitude
- b. Gas transfer
- c. Hypoxia
 - Symptoms
 - Prevention
- d. Cabin pressurisation
 - Effects of rapid decompression
 - Time of useful consciousness
 - The use of oxygen masks and rapid descent
- e. Hyperventilation
 - Symptoms
 - Avoidance
- f. Effects of accelerations
- g. Recognizing potential problem reactions in your passenger

(3) VISION

- a. Physiology of vision
- b. Limitations of the visual system
- c. Vision defects
- d. Optical illusions
- e. Spatial disorientation
- f. Avoidance of disorientation
- g. Recognising potential problems in your passenger

(4) HEARING AND BALANCE

- a. Air sickness

(5) SOCIAL PSYCHOLOGY AND EMOTIONAL FACTORS

- a. The ego factor
- b. Stress and stress management.
- c. Showing off / crowd pleasing
- d. Anger, Irritability, Sadness
- e. Family/ work related problems
- f. Recognizing potential problems in your passenger.

(6) GENERAL

- a. Blackouts
- b. Blackouts
- c. Epilepsy

- d. Low Blood Pressure
- e. High Blood Pressure
- f. Toxic hazards

3.7 Flight planning and flight operations

(1) MASS AND BALANCE

(a) Terminology:

- Arm, moment, reference datum, station, centre of gravity,
- Forward and aft limitations of centre of gravity, normal and utility operation
- Maximum ramp and taxi mass
- Maximum take-off mass
- Maximum zero fuel mass
- Empty operating mass
- Maximum floor load
- Limitations on maximum mass

(b) Load sheet

- Calculation of CG
- Movement of CG in flight
- Maximum load at station

(2) PERFORMANCE

(a) Take-off:

- Take-off run and distance available
- Take-off and initial climb
- Effects of mass, wind and density altitude
- Effects of ground surface and gradient
- Use of flaps

(b) Landing:

- Effects of mass, wind, density altitude and approach speed on landing distance
- Displaced threshold
- Use of flaps
- Ground surface and gradient

(c) In flight:

- Maximum rate and maximum angle of climb
- Range and endurance
- Effects of configuration, mass, temperature and altitude
- Gliding and descending

(d) Fuel performance

- Specific weight
- Specific gravity
- Fuel consumption
- Calculation of fuel requirements

(3) FLIGHT OPERATIONS

(a) Controlled airspace

(b) Time

- (c) Establishing contact
- (d) Practical radio operation
- (e) Mandatory radio communication
- (f) Position reports
- (g) Use of radio at unmanned aerodromes
- (h) Flight plans
- (i) Altimeter-setting procedures
- (j) Transition altitude and level
- (k) Q codes

(6) NAVIGATION

- (a) Compass Readings
- (b) Variation, deviation
- (c) Track and heading
- (d) Timing
- (e) Effect of Wind
- (f) Triangle of Velocities
- (g) Map Reading
- (h) Lost Procedure