

30.20

AVIATION TECHNOLOGY (450)



MANYAM FRANCHISE
Discover! Learn! Apply!

30.20.1 Aviation Technology Paper 1 (450/1)

1. (a) SAFETY PRECAUTIONS

Use soft cleaning cloth or chamois leather
Avoid excessive pressure
Avoid contact with oil or grease
Avoid excessive heat
Use the recommended cleaning agent.

Any 2 x ½

(b) FUNCTION OF INSTRUMENTS

Enable pilot to:

- maintain straight and level path;
- fly on determined course;
- maintain safe height above the ground;
- maintain coordinated turns;
- navigate on aerial highway system.

Any 4 x ½

2. (a) SOURCES OF INFORMATION

Aircraft plans
Assembly manuals
Parts catalogue.

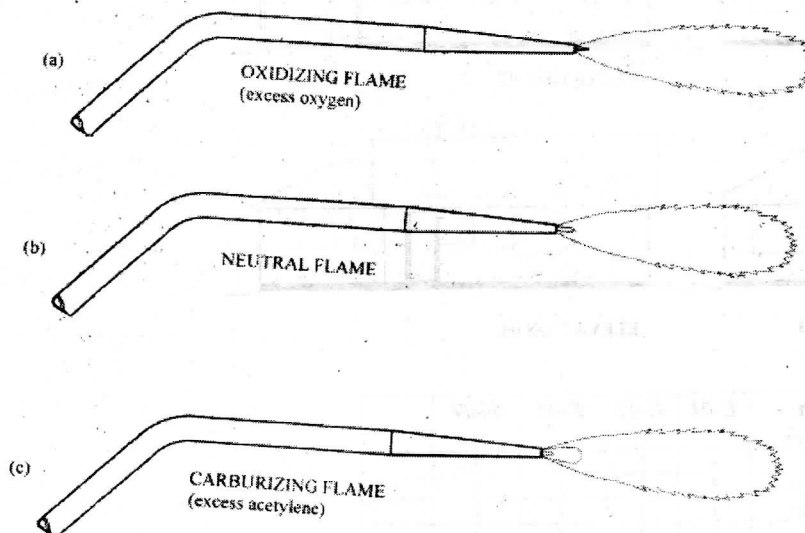
Any 2 x ½

(b) FUNCTION OF WASHERS

Provides shim when needed
Spreads load equally
Provides locking mechanisms
Prevents damage to a surface
Adjusts castle nut in relation to drilled hole.

Any 4 x ½

3. WELDING FLAMES



4. TITANIUM FOR A/C CONSTRUCTION

Weight to strength ratio
Resistance to high temperature
Corrosion resistance
Malleability

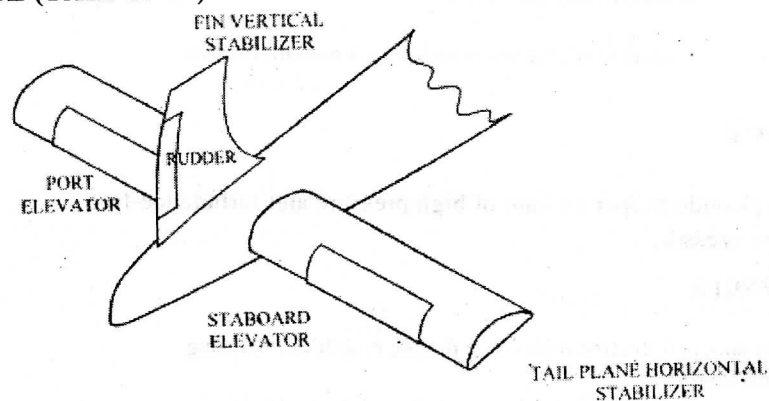
Any 3 x 1

5. CHARACTERISTICS OF TROPOSPHERE

Is the lowest atmospheric layer varying from 0 - 36000 ft
Clouds occur in this layer
All weather conditions (pressure, density, temperature) decrease rapidly with height
Terrain is within troposphere hence its effect.

Any 3 x 1

6. EMPENNAGE (TAIL UNIT)



Horizontal stablizer is used to prevent airplane from pitching up or down.

Vertical stablizer is used to prevent airplane from yawing back and forth.

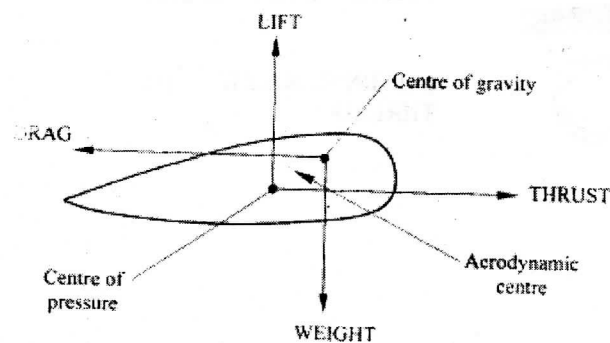
Rudder is the rear part of vertical structure. Its a movable airfoil and is used to turn the aircraft.

Staboard and port elevator hinged to horizontal stablizer and are airfoil that controls up and down motion of aircraft nose.

Sketch and labelling
Explanation

(2 marks)
(4 x 1)

(a) CP and CG



(5 x 1/2)

- (b) (i) CP changes position with change in angle of attack and CG with reduction in fuel (2 x 1)

- (ii) Corrected by - fuel transfer
- using moveable tail plane
- trimming the aircraft (3 x ½)

8. (a) **FUNCTIONS OF OIL**

Cooling	Corrosion prevention
Cleaning	Friction reduction
Cushioning	Reduction of wear
Sealing	

(b) **SUB-SYSTEMS**

- (i) Scavenge: removes oil from the main bearing compartments and accessory gear drives.
- (ii) Breather: provides balance between the tank and atmosphere (2 x 1)

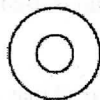
9. (a) **INLET DUCT**

designed to provide proper amount of high pressure and turbulence-free air to the compressor.

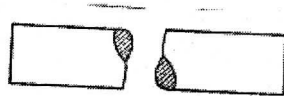
(b) **DIFFERENCES**

- Has simple, effective inlet while double is split thus causing some distortion.
- Has very smooth airflow characteristics while double has increased skin friction due to length.
- Has engine mounted midship while double is either higher or lower thus requiring support. (3 x 1)

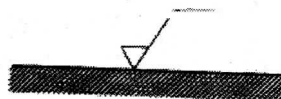
10.



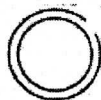
FIRST ANGLE PROJECTION (1)



SOLID CYLINDER (1)

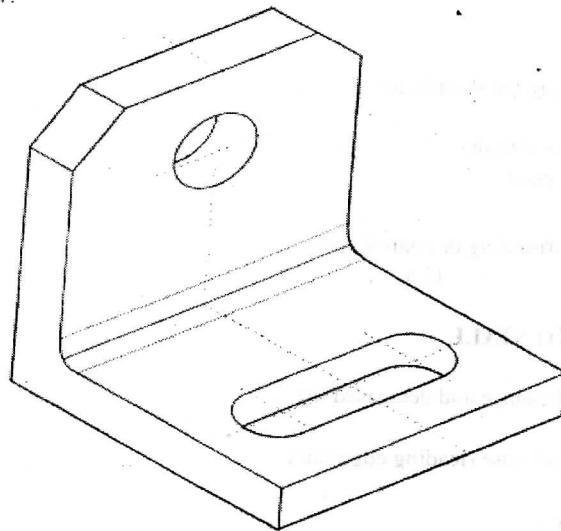


MACHINED SURFACE (1)



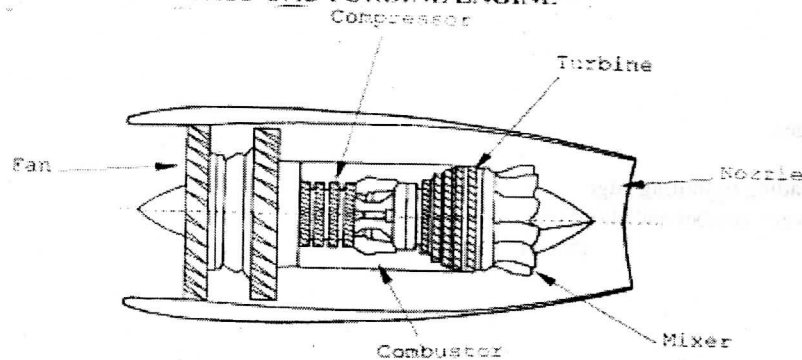
INTERNAL SCREW THREAD (1)

11.



Faces (5 x 1)	= 5
Hole: location & details	= 1½
Slot: location & details	= 2 ½
Isometric angle	= 2
X as lowest point	= 1
Correct radii (2 x 1)	= 2
Neatness	= 1
TOTAL	15

12. AERO BYPASS GAS TURBINE ENGINE



Sketch 4
Labelling 2

- (i) **Fan** - the fan which pulls air into the engine and sucks in large quantities of air. It then, speeds the air up and splits it into two parts. One part continues through the "core" or centre of the engine, where it is acted upon by the other engine components. The second part "bypasses" the core of the engine, instead travelling through a duct that surrounds the core of the back of the engine where it produces much of the force that propels the airplane forward.
- (ii) **Compressor** - The compressor squeezes the air that enters it into smaller areas, resulting in an increase in the air pressure. This results in an increase in the energy potential of the air. The squashed air is forced into the combustion chamber.
- (iii) **Combustor** - air is mixed with fuel and then ignited. This process results in high temperature, high energy airflow. The fuel burns with the oxygen in the compressed air producing hot expanding gases.
- (iv) **Turbine** - The task of a turbine is to convert gas energy into mechanical work to drive the compressor and the accessory gear box.
- (v) **Nozzle** - The nozzle is the exhaust duct of the engine. The energy depleted airflow that passed the turbine, in addition to the colder air that bypassed the engine core, produces a force when exiting the nozzle that acts to propel the engine, and therefore the airplane forward.
- (vi) **Mixer** - Combines the high temperature air coming from the engine core with the lower temperature air that was bypassed in the fan. These results in a quieter engine than if the mixer was not present.

13. (a) **RATE OF CLIMB INITIATED BY:**

- (i) Providing more power by advancing the throttle to:
 - overcome the drag as in level flight
 - lift the weight at vertical speed
 - accelerate a/c slowly.
- (ii) Increasing the angle of attack by trimming or control stick.
(2 x 1)

(b) **FACTORS THAT CAN CAUSE A/C TO STALL**

If aircraft wings produce increased air resistance and decreased lift.

If airflow no longer goes around the airfoil nose (leading edge) and separates from upper wing surface.

If plane is under too great angle of attack.

For light aircraft without high-lift devices, the critical angle is usually = 16°
(4 x 2)

(c) **DESIGN FEATURES**

- (i) Camber line
- (ii) Leading and trailing edges
- (iii) Chord line of the airfoil
- (iv) Precise distance from leading to trailing edge
- (v) Maximum distance between camber and chord line.
(5 x 1)

14. (a) **MAINTENANCE TASKS**

- (i) Keep battery fully charged all the time.
- (ii) Never hit posts with a hammer when disconnecting the terminals.
- (iii) Keep the electrolyte level topped all the time.
- (iv) Store in cool dry place and recharge as recommended.
- (v) Check and clean regularly the terminals to avoid any corrosion.
Any 4 x 1

(b) **AC vs DC**

- (i) DC units are heavy compared to their power output capabilities
- (ii) DC units are often not reliable and they increase maintenance
- (iii) DC units also use an inverter for conversion to alternating current of AC powered equipment
- (iv) AC power requires less current because of higher voltage and a ground neutral system
- (v) AC components are lightweight, simple, and reliable.
(5 x 1)

- (c) (i) Inverter is an electromagnet device that converts direct current to alternating current while rectifier is a device that converts alternating current to direct current.

(ii) A fuse is an electric device that disconnect a circuit by blowing when a fault occurs while a circuit breaker disconnects a circuit by triggering off when there is a fault but can be reset after the fault is rectified.

(iii) An alternator is an electric device consisting of rotating coil in a strong magnetic field to generate alternating current while a generator produces direct current by rotating a magnet.

(3 x 2)

15. (a) **SELECTOR VALVE**

(i) Directional control device to ensure the movement of the hydraulic fluid flow is in proper direction.

(ii) Stop locks to lock the selector switch in a certain position.

(2 x 1)

(b) **CAUSE OF FLUID FLOW**

Roughness of the inner surface of the pipe

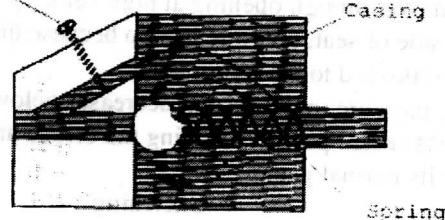
Abrupt changes in pipe direction e.g 90° bend

Pipe size changes e.g. velocity increases in fluid due to decrease in cross-sectional area of the pipe.

(3 x 1)

(c) (i) **ONE WAY ADJUSTOR**

Adjustment screw



ONE WAY ADJUSTMENT

Sketching = 2

Labelling (2 x ½) = 1

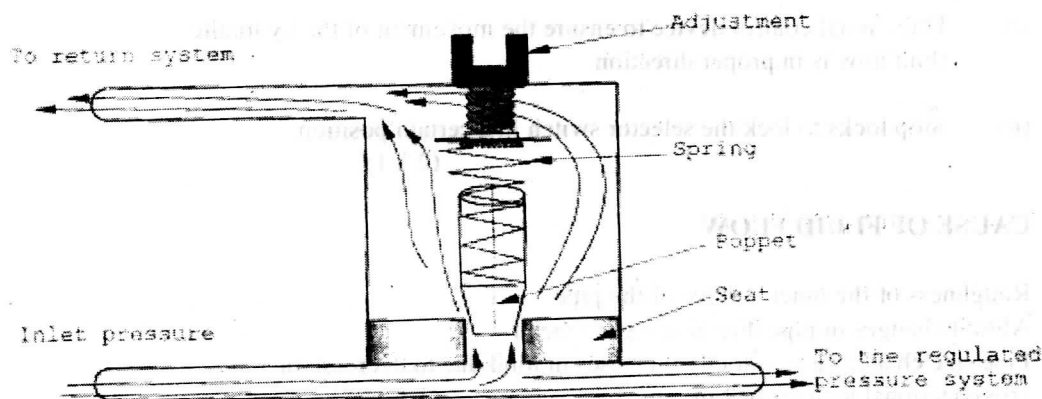
- When the flow pressure seats the check valve ball (i.e. flow moving from right to left), some of the fluid can still reach the other side through the drilled hole in the seat. The amount of fluid passed through the drilled opening in the seat is regulated by means of an adjustment screw.

Explanation (1)

(ii) BASIC PRESSURE CONTROL VALVE

- Function - To limit the pressure of some section of hydraulic system when the pressure has reached a predetermined level.

Principle of Operation



- In general, even with a pressure of P_1 , the poppet would lift up, except that the spring is strong and has downward pressure forcing the poppet closed. Poppet will not move until a pressure greater than that required is felt by the system (i.e., $P_1 > P_2$)
- When the pressure increases, the poppet will move up, forcing the excess liquid to move through opening at high velocity.
- On other side of seat, pressure is zero because the back side of the relief valve is connected to the return line.
- When the pressure in the system decreases below maximum, poppet will return to its seated position, sealing the orifice and allowing the fluid to follow its normal path.

Sketching	= 2
Labelling (4 x ½)	= 2
Explanation	= 2