## 5.8 AVIATION TECHNOLOGY (450)

### 5.8.1 Aviation Technology Paper 1 (450/1)

1. (a) Fineness Ratio is defined as the Ratio of the chordline to the thickness of the aerofoil.
   (1 mark)

   (b) Aerofoil is a device designed to produce a light reaction force when moving through a passage of air with minimum drag.
   (2 marks)

   (c) (i) Longitudinal stability is about the lateral axis and is provided by the horizontal stabilizer.
   This refers to pitch motions where the aircraft has a tendency to keep a constant angle of attack with reference to the relative wind.

   while

   (ii) Directional stability is about the vertical axis provided by the vertical stabilizer.
   This refers to yawing motions where the aircraft attains a straight flight attitude.
   (4 marks)

2. Cross-section of an aircraft propeller blade in flight.



Cross-section of an aircraft propeller blade in flight
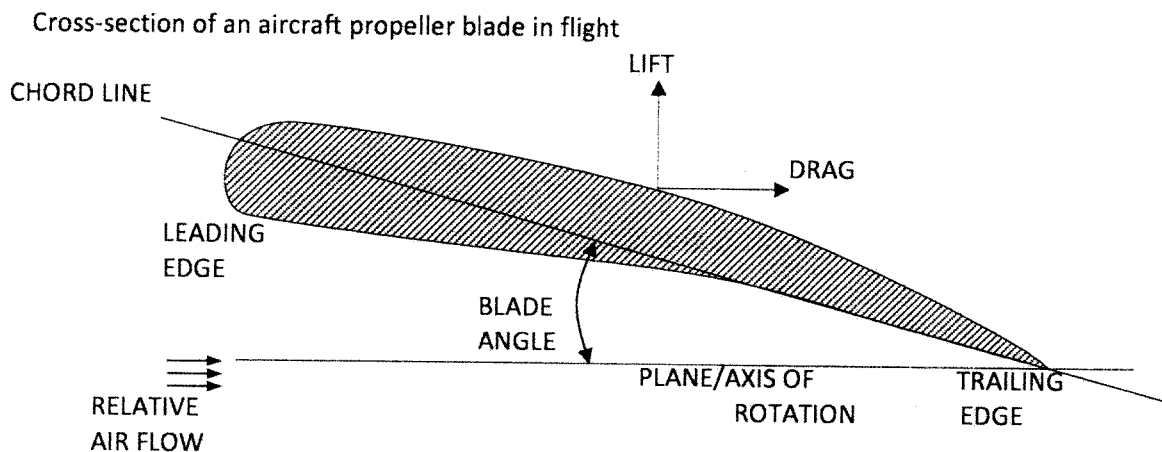
Sketch 2 marks
Labelling $\underline{\text{any} \frac{8}{2} = 4}$
6 marks

3. (a) Function of aircraft wing ribs.

   (i) Give cross-section strength
   (ii) Provide shape of the wing
   (iii) Transfer the wing load from the covering skin to the spar.
   (iv) Prevention of fuel surge to intergral fuel tanks.

   Any 2 x 1 = (2 marks)

   (b) Visual and coin tapping method. This is used as an elementary to locate delamination by tapping with a coin the part being inspected and listening for debonding sound.
   (2 marks)

4. (a) Rescue equipment

   (i) Axe
   (ii) Fire extinguishers
   (iii) First Aid Kit
   (iv) Radio beacon
   (v) Flare
   (vi) Dinghy

   Any 5 x $\frac{1}{2}$ = (2$\frac{1}{2}$ marks)

   (b) Foreign object damage safety aspects.

   (i) Ensure the engine guards are fitted.
   (ii) Ensure no loose articles around.
   (iii) Ensure cleanness of the running pad.
   (iv) Ensure danger zones are clear.

   Any 2 x 1 = (2 marks)

5. (a) Four ramp maintenance tasks:

   (i) Servicing
   (ii) Engine starting
   (iii) Refuelling or defuelling
   (iv) Marshalling
   (v) Releasing the aircraft.

   Any 4 x $\frac{1}{2}$ = (2 marks)

   (b) Characteristics of cirrus clouds:

   (i) wispy appearance
   (ii) very high altitude
   (iii) ice crystals
   (iv) less bumpy.

   Any 3 x $\frac{1}{2}$ = (1$\frac{1}{2}$ marks)

6. Working environmental requirements:

   (i) Lighting should be adequate
   (ii) Noise should be below destruction level
   (iii) Temperature must be adequate to work without discomfort.

   3 x 1 = (3 marks)

7. Materials and hardware:

   (a)   Titanium and titanium alloys

         (i)    High melting point
         (ii)   Good corrosion resistance
         (iii)  Strength to weight ratio
         (iv)   Machinability

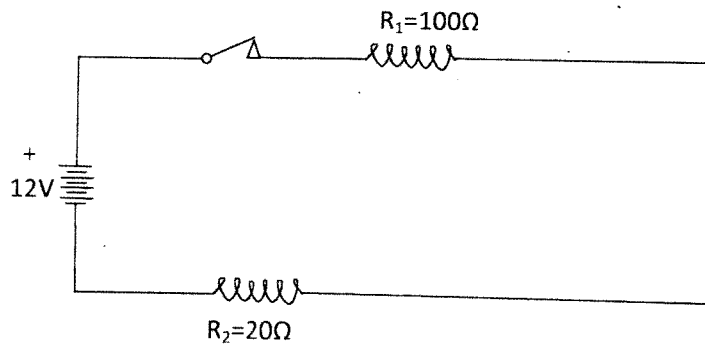   Any 3 x $\frac{1}{2}$ = ($1\frac{1}{2}$ marks)

   (b)   Round head rivets
         Round head rivets are used on internal structures where strength is a major factor and streamlining is not important.

   ($1\frac{1}{2}$ marks)

8. (a)   Double pole, single throw switch.
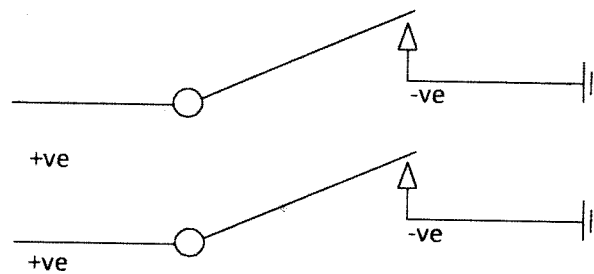


   (1 mark)

   (b)



   $E = I(R)$

   $I = \dfrac{E}{R}$

   $E = 12$

   TOTAL R = (100+20)Ω

   = 120Ω

   $\therefore I = \dfrac{12}{120} = 0.1 Amp$

   SKETCH       - 1 mark
   LABELLING    - 1½ mark
   CALCULATION- 1½ mark
   (4 marks)

9. Title block on a drawing:

   (a)   Drawing number to identify the print.
   (b)   The name of the part or assembly (nomenclature) for filing purposes.
   (c)   The scale to which it is drawn.
   (d)   The date. When the date was done.
   (e)   The name of the firm.
   (f)   The name of the draftman and signature.
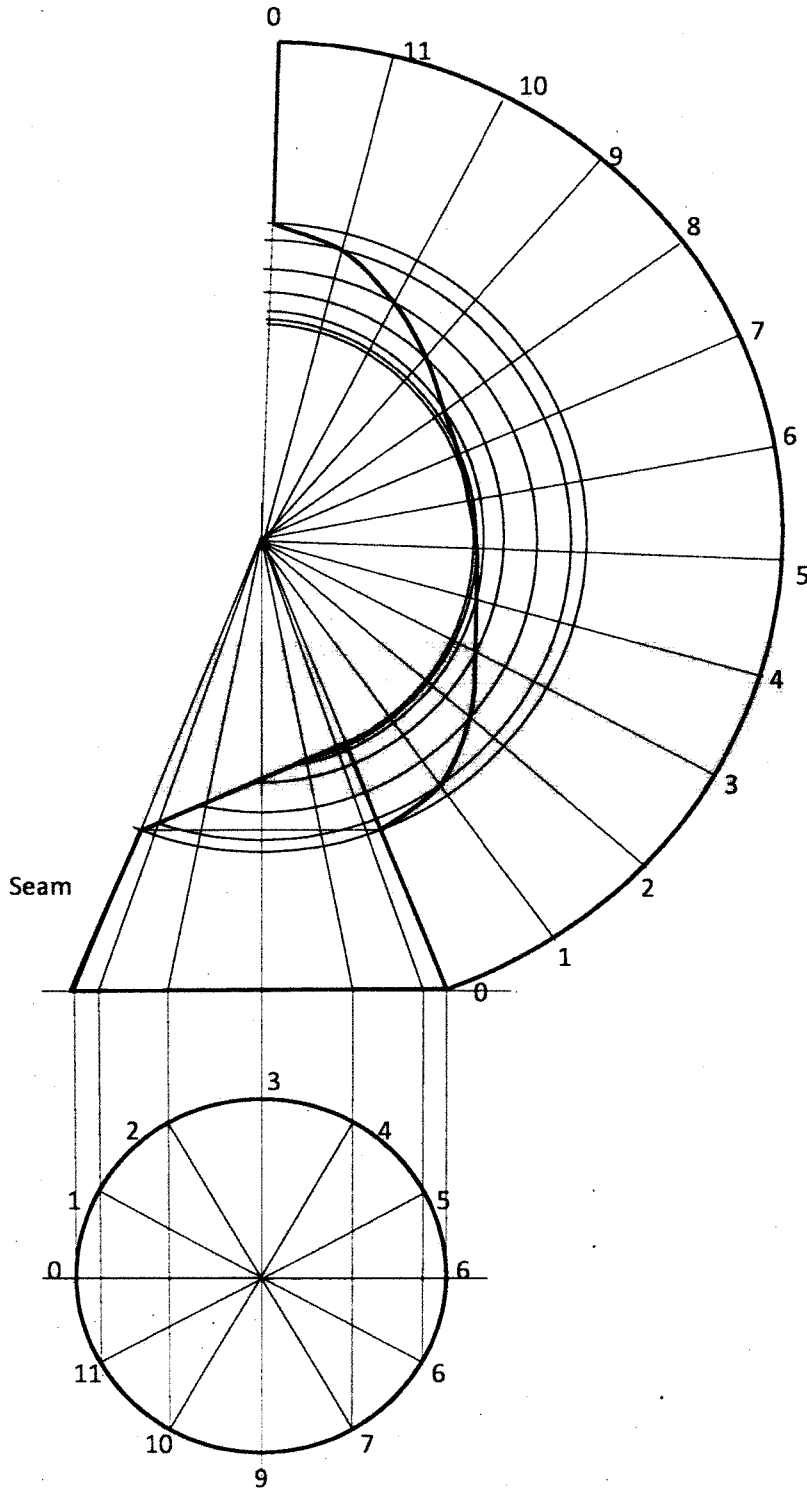
   Any 4 x 1 = 4 marks

193

10. Heat treatment processes.

    (a)    Annealing - To produce maximum softness.
    (b)    Case hardening - To produce wear resistance surface.
    (c)    Normalizing - Produce tensile strength or remove internal stresses.
    (d)    Tempering - To reduce brittleness.

4 x 1 = 4 marks

11.



| FULL SCALE | = 2 marks |
|---|---|
| LAYOUT | = 3marks |
| BASE | = 1mark |
| FRONT ELEV. | = 1mark |
| CONSTRUCTION | = 3marks |
| NUMBERING | = 1mark |
| DEVELOPMENT | = 2marks |
| NEATNESS | = 1mark |
| | 14marks |

12. (a) Engineers steel rule requirements:

  (i) Made from hardened and tempered corrosion resistant spring steel.
  (ii) Machine graduated so that the graduations should be precision engraved.
  (iii) Ground on the edges so that it can be used to guide in scribing lines.
  (iv) Ground on one edge so that it can be used as a zero datum.
  (v) Chrome finished so as to remove glare.
  (vi) Parallelism on the sides to give correct measurements.
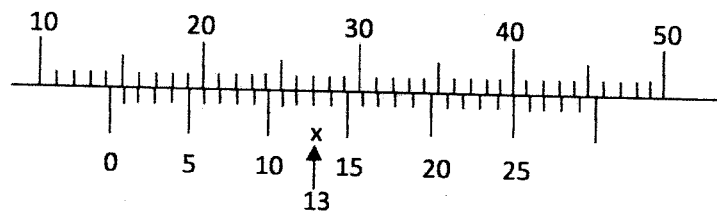
  Any 4 x 1 = (4 marks)

 (b) (i) Micrometer reading 13.14 mm.
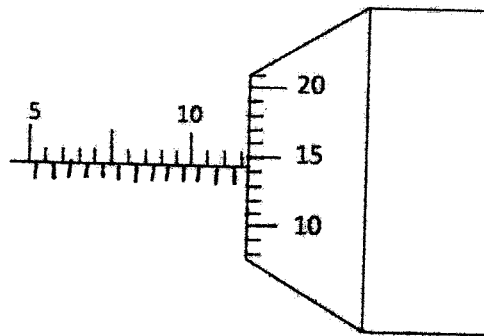


BARREL 13.00
0.00
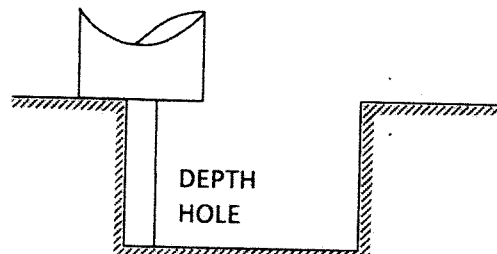THIMBLE 0.14
13.14

SKETCH =1 mark
READING =1 mark
2 marks

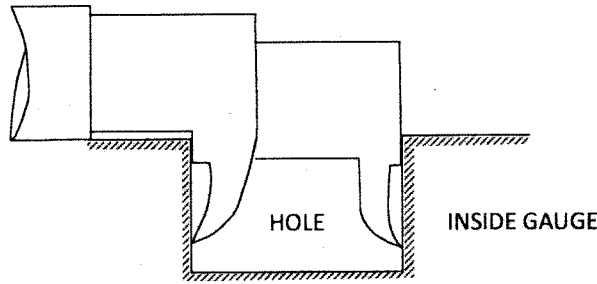  (ii) Vernier calliper (0.02) reading 13.26 mm.



13.00
13×0.02 = 0.26
13.26

SKETCH = 1 mark
READING = 1 mark
2 marks

 (c) (i) Depth measurement of a vernier calliper



DEPTH
HOLE

Sketch -1 mark
Labelling -1mark

(ii)    Internal measurement of a vernier calliper.



Sketch  -1 mark
Labelling -1mark

HOLE       INSIDE GAUGE

(d)    Advantages of a micrometer over a vernier calliper.

    (i)      Micrometer is more accurate than a vernier calliper.
    (ii)     Micrometer is easier to read than a vernier calliper.
    (iii)    Micrometer free from parallax error.
    (iv)    Micrometer has better feel than a vernier calliper.

                                         Any 2 x 1 = (2 marks)

13.    (a)    Functions of hot gases from an aircraft gas turbine engine.

    (i)      To provide thrust and propel the aircraft forward.
    (ii)     Blown through ducts for the purpose of activating.
    (iii)    Blown through nozzle guide vanes for the purpose of cooling.
    (iv)    For the purpose of air conditioning and pressurization.
    (v)     For engine starting from a running engine.

                                         Any 4 x 1 = (4 marks)

(b)    (i)    Types of combustion clambers for gas turbine engines.

        (I)     Multiple combustion chambers/cans.
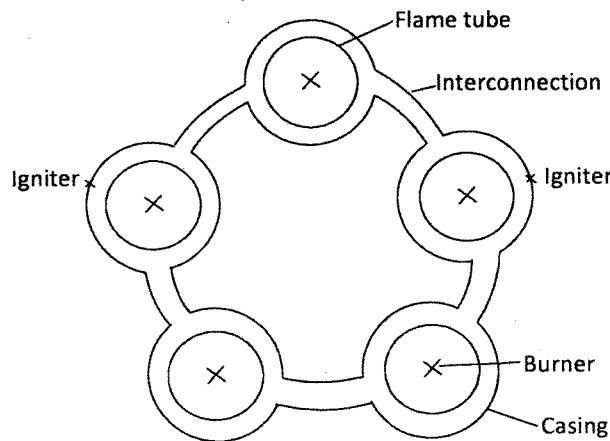


Sketch   =1 mark
Labelling =2marks
            3marks

This consists of chambers disposed around the engine.
Each chamber has an inner flame tube around which there is an air casing.
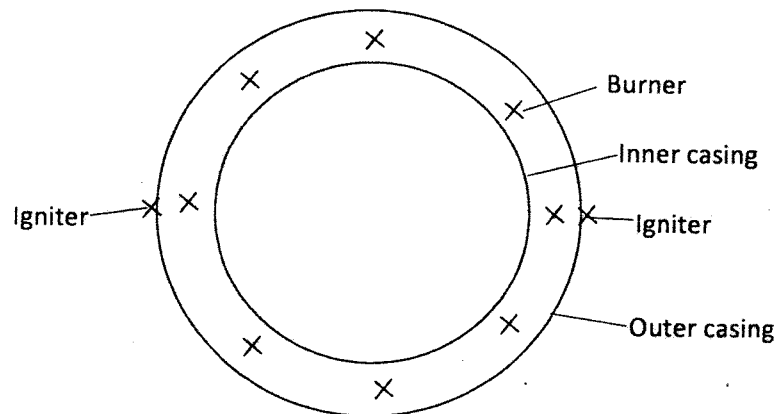Each chamber has a burner.
There are two igniter plugs one on each side of the engine.
The chambers are connected with interconnectors to equalise pressures and propagate
the flame during starting.                        (5 marks)

                  SKETCH         1 mark
                  ARRANGEMENT  1 mark
                  LABELLING    2 marks
                  DESCRIPTION   1 mark             (5 marks)

196

(ii) Annular combustion chamber.



This type of combustion chamber consists of a single flame tube completely annular in form, which is contained in an inner and outer casing. The burners are suspended in the annular for supplying the fuel from the fuel manifold. There are two igniter plugs, one on each side of the engine.

| | |
|---|---|
| SKETCH | 1 mark |
| ARRANGEMENT | 1 mark |
| LABELLING | 2 marks |
| DESCRIPTION | 1 mark |
| | 5 marks |

(10 marks)

(14 marks)

14. (a) The function of ILS main elements:

(i) Localizer - The localizer provides tracking guidelines along the extend centreline of the runway. (guideline in azimuth left or right of the extended centreline).

(ii) The glide scope - The glidescope provides vertical guidance towards the runway touch down point, usually a slope of approximately 3° to the horizontal.

(iii) The marker - The marker beacons provides accurate range fixes along the approach (usually inner, middle and outer markers).

(3 marks)

(b) The sources of information presented on the R.M indicator dial.

(i) Magnetic Heading - Heading from a remote indicating compass to a particular station.

(ii) V.O.R - The bearing from a Very High Frequency Omnidirection Range (VOR) ground station.

(iii) A.D.F - The bearing from an Automatic Direction Funding (ADF) station.
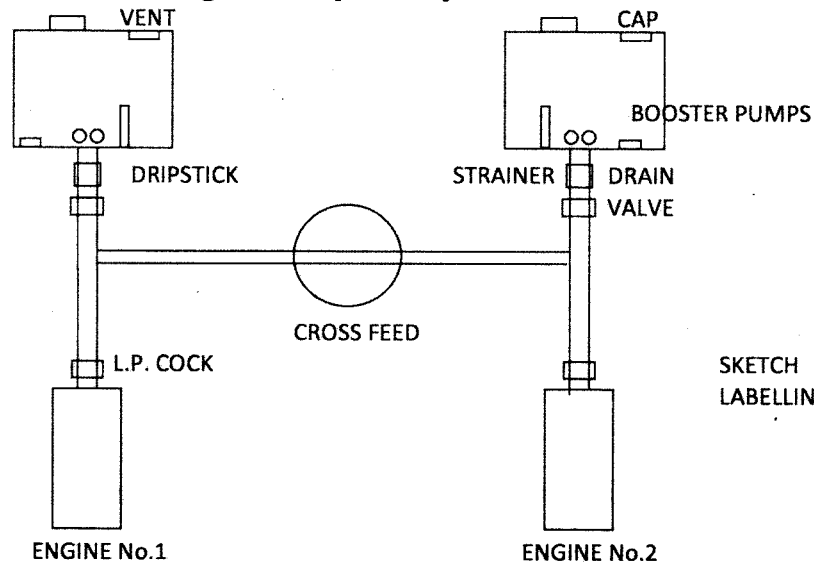
(3 marks)

(c) (i) Fuel cross-feeding

- Incase of engine failure.
- Incase of one or more tanks failure.
- Distribution of fuel for weight and balance purposes.

Any 2 x 1 = (2 marks)

197

(ii)    Twin engine fuel system layout.



VENT
CAP
BOOSTER PUMPS
DRIPSTICK
STRAINER    DRAIN
VALVE
CROSS FEED
L.P. COCK
ENGINE No.1
ENGINE No.2

SKETCH        = 2 marks
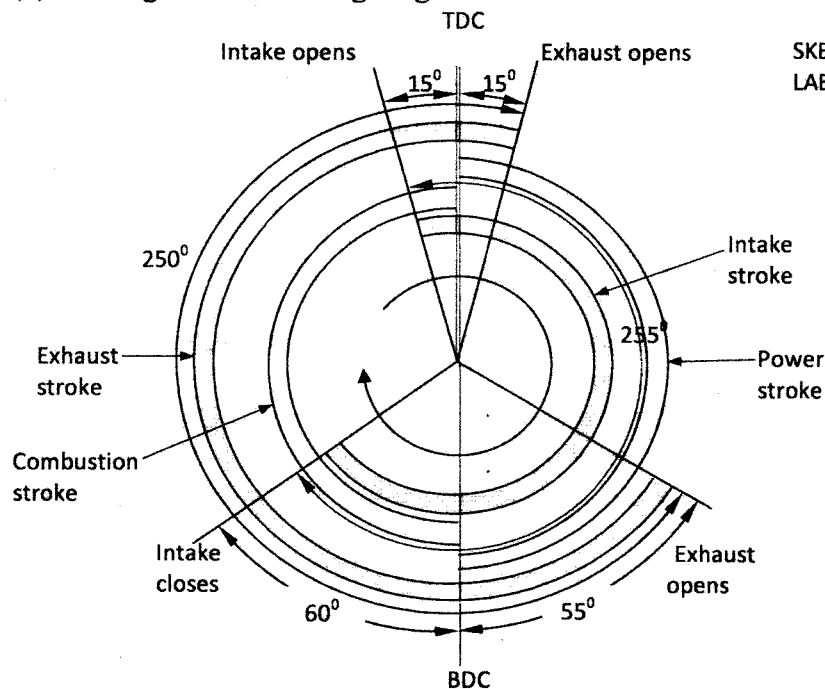LABELLING 8×½ = 4 marks
              6 marks

(Total = 14 marks)

15.    (a)    Reasons for value timing on Aeropiston engines.

(i)     Improve volumetric efficiency of the engine.
(ii)    Obtain maximum engine power.
(iii)   Ensure ignition occurs at the right time.
(iv)    To prevent backfiring and detonation.
(v)     To improve the cooling of the engine.
(vi)    Ensure all the burnt out gases are expelled.

Any 4 x 1  =  (4 marks)

(b)    Engine value timing diagram.



TDC
Intake opens          Exhaust opens
$15^0$    $15^0$
250$^0$
Intake stroke
255$^0$
Exhaust stroke
Power stroke
Combustion stroke
Intake closes
Exhaust opens
60$^0$        55$^0$
BDC

SKETCH        = 4 marks
LABELLING 12×½ = 6 marks
               10 marks

(Total  =  14 marks)

198