L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2019 FIRST SESSION

SUBJECT:	**Engineering Drawing/Graphical Communication**
PAPER NUMBER:	I
DATE:	30th May 2019
TIME:	9:00 a.m. to 12:05 p.m.

Directions to Candidates

Write your index number where indicated at the top of all drawing sheets.

Attempt any **FIVE** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

a. drawings should conform to B.S. or equivalent (ISO) standards;
b. all dimensions are in millimetres;
c. all answers are to be accurately drawn with instruments;
d. unless otherwise stated, all construction lines must be left in each solution;
e. drawing aids may be used.

Dimensions not given should be estimated.

Careful layout and presentation are important.

Marks will be awarded for accuracy, clarity and appropriateness of constructions.

1. A right cylinder with a hexagonal hole is placed resting on its circular base on a horizontal plane. The traces VTH of an oblique plane are shown passing through the cylinder cutting off the upper portion as illustrated in Figure 1a.
   Draw, full size:
   a) the traces VTH and the complete plan of the solid as shown in Figure 1b; (2)
   b) an auxiliary elevation showing the oblique plane as an inclined section plane passing through the solid; (4)
   c) project a front elevation of the sectioned solid; (4)
   d) from the first auxiliary view drawn in part (b), construct a second auxiliary view showing the true shape of the sectioned face; (6)
   e) project an end elevation of the sectioned solid as seen from the right-hand side. (4)

   (Total: 20 marks)

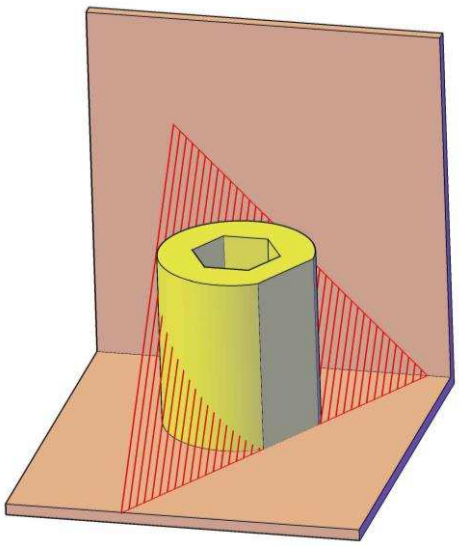


Figure 1a

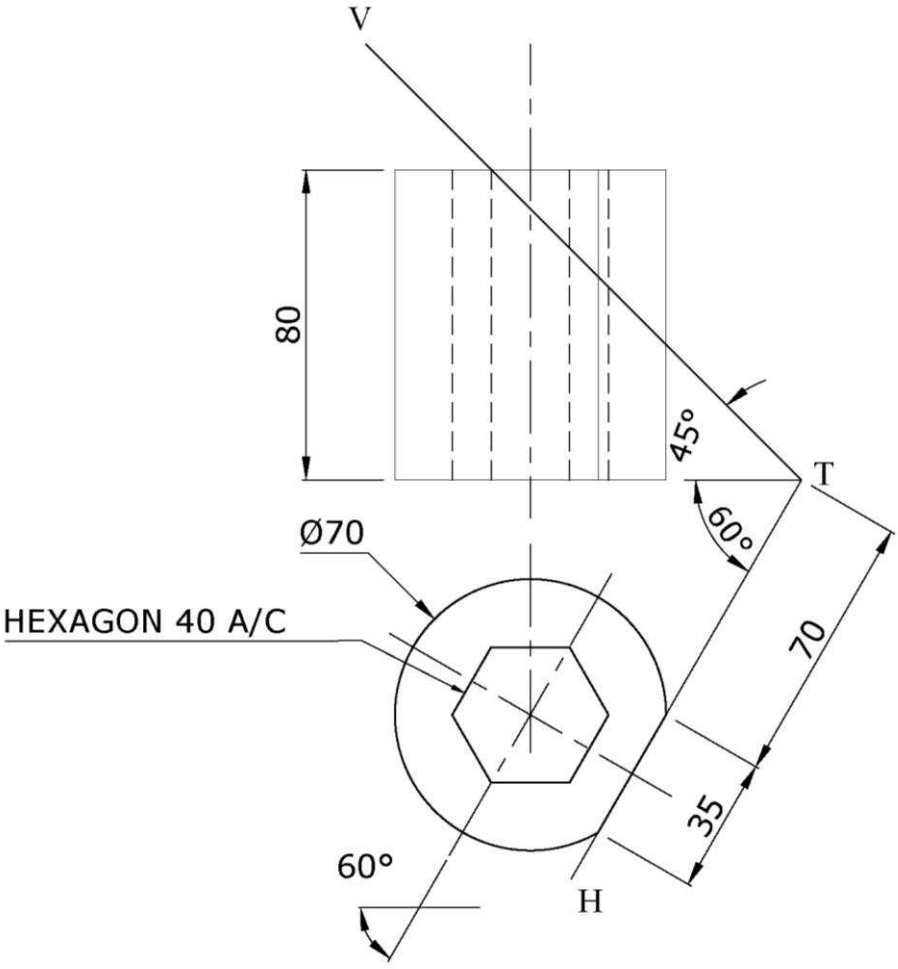
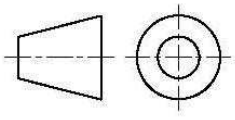


Figure 1b



2. A flanged wheel having an inner and outer circumference, is constrained to roll without slipping on its inner circumference, for two complete revolutions. Figure 2a shows an arrangement of the flanged wheel and the track on which the wheel is to roll. From the initial position shown in Figure 2b, and to a scale of 1:1, construct:

   a) the locus generated by the point P as the wheel rolls for one complete revolution on its inner circumference round the fixed directing curve. State the name of the locus generated. (9)

   b) the locus generated by the point P as the wheel rolls a further revolution on its inner circumference along the inclined track. State the name of the locus generated. (6)

   c) the instantaneous radius of curvature of the locus drawn in part (a) when the wheel has rotated 240° from the initial position. State the value of this radius of curvature. (3)

   d) a normal and a tangent to the locus drawn in part (b) when the wheel has rotated 240° on the inclined track. (2)

(Total: 20 marks)

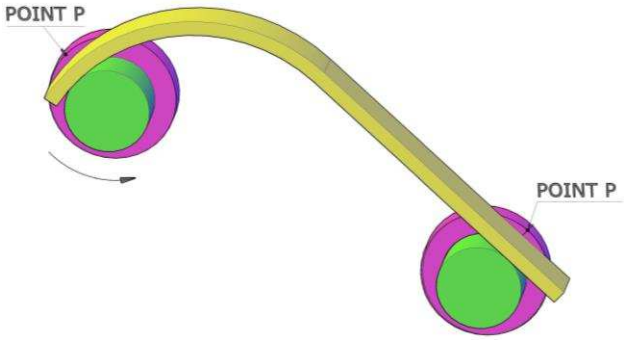


Figure 2a

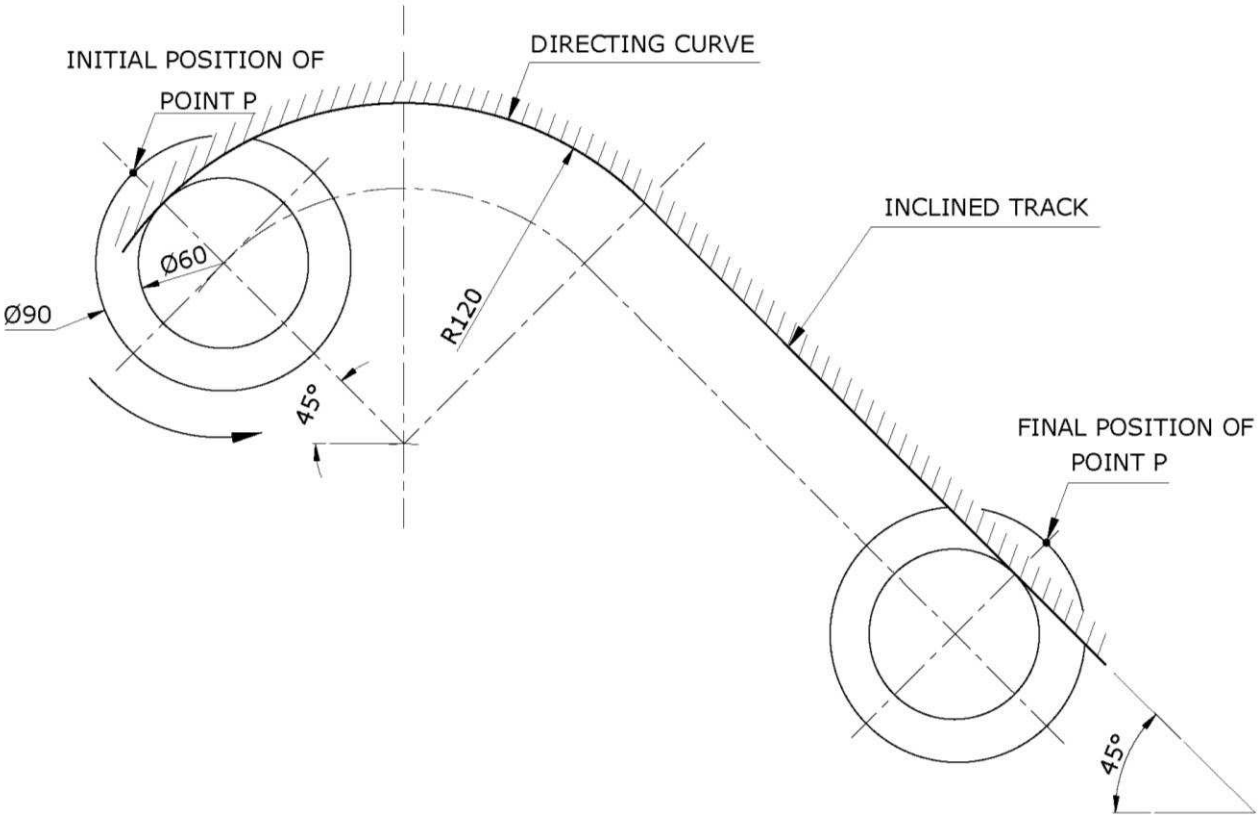


Figure 2b

3. The illustration, Figure 3a, shows a cone, a sphere and a cylinder joined together. Figure 3b shows a front elevation and an end elevation of the arrangement. The axis of the cone, the centre of the sphere and the axis of the cylinder are aligned on the same vertical plane.
   a) Copy, full size, the **TWO** elevations shown in Figure 3b and draw a plan. (3)
   b) Determine the curve of intersection between the cone, the sphere and the cylinder in the:
      i) front elevation; (9)
      ii) end elevation; (4)
      iii) plan. (4)

   Note: Show hidden detail.

(Total: 20 marks)

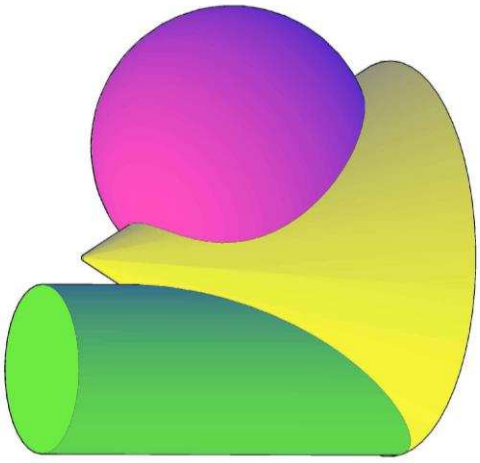


Figure 3a

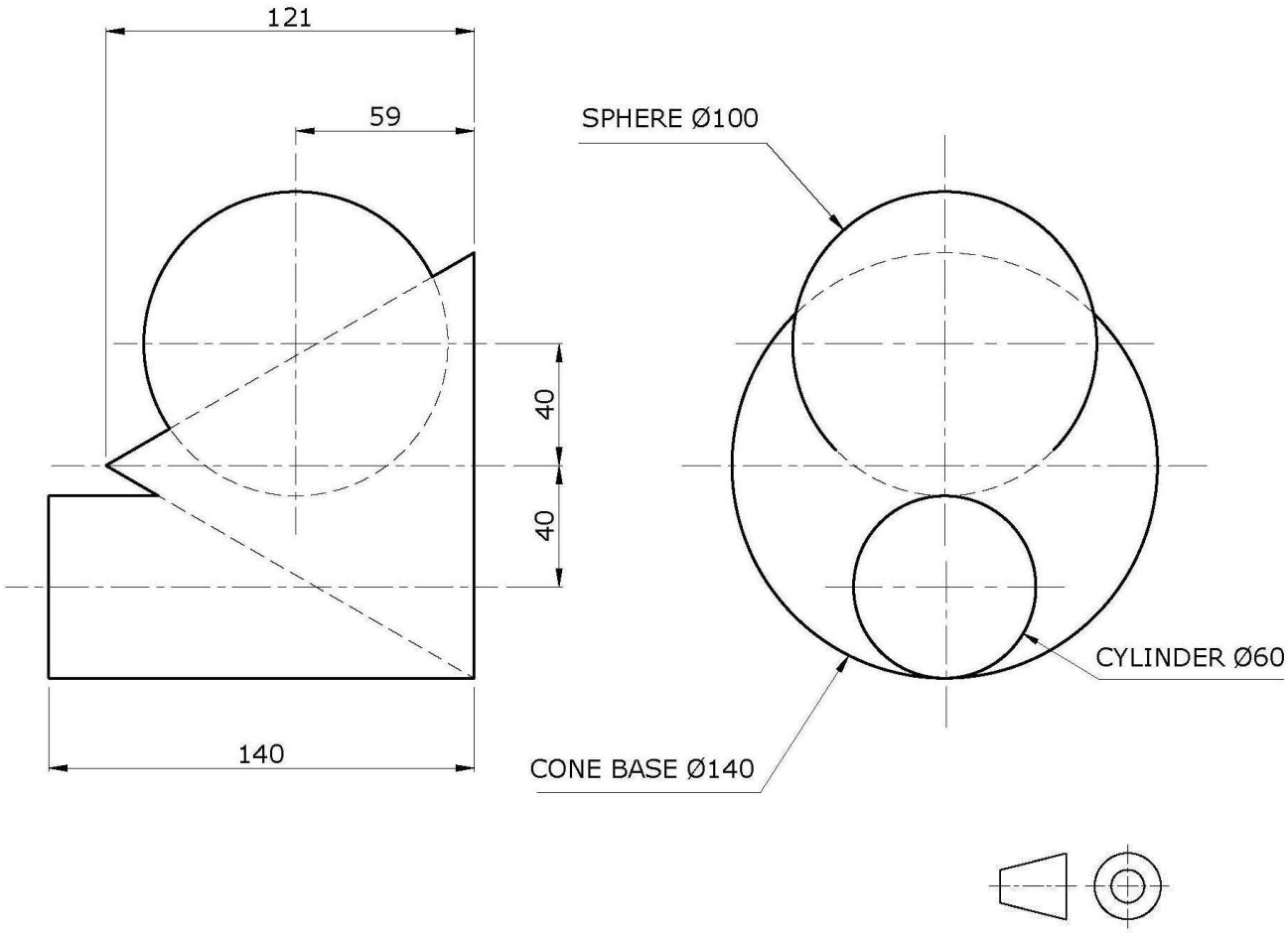


Figure 3b

4. An offset roller-ended follower operating on a plate cam is shown in Figure 4a. The line of action of the roller-ended follower is 25 mm to the right of the vertical centre-line of the cam and the roller follower is 20 mm diameter. The cam is to rotate in an anti-clockwise direction.
   a) Copy, full size, the profile of the plate cam shown in Figure 4b. (5)
   b) Plot round the cam profile the locus of the roller centre. (2)
   c) Draw the cam graph displacement curve for the cam which rotates at 30 rpm. Use a scale of 180 mm to represent one revolution of the cam for the cam graph. (13)

(Total: 20 marks)

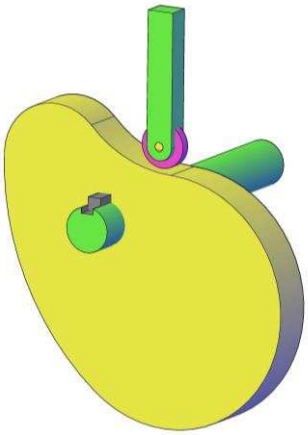


Figure 4a

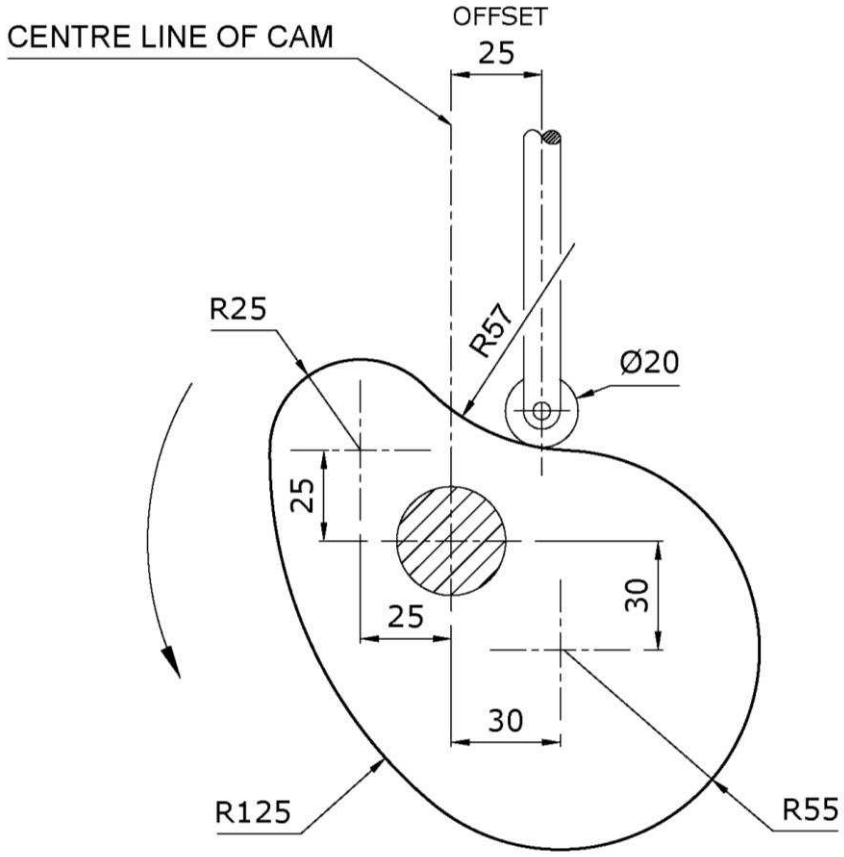


Figure 4b

5. Figure 5 shows a framework consisting of nine jointed light rods hinged to a fixed point at the top left-hand corner of the frame. The framework is kept in position by a horizontal reaction at the left-hand bottom corner. The framework is loaded with 100 kg each at the point indicated in Figure 5.
   a) Copy the space diagram and use the scale indicated. (4)
   b) Determine graphically:
      i) the stresses in the rods, stating whether they are in tension or in compression; (8)
      ii) the magnitude, direction and angle with the H.P. of the reaction at the hinge; (4)
      iii) the magnitude of the reaction at the left-hand bottom corner. (4)

(Total: 20 marks)

SPACE DIAGRAM SCALE: 50 mm REP 1 m

FORCE DIAGRAM SCALE: 50 mm REP 100 kg

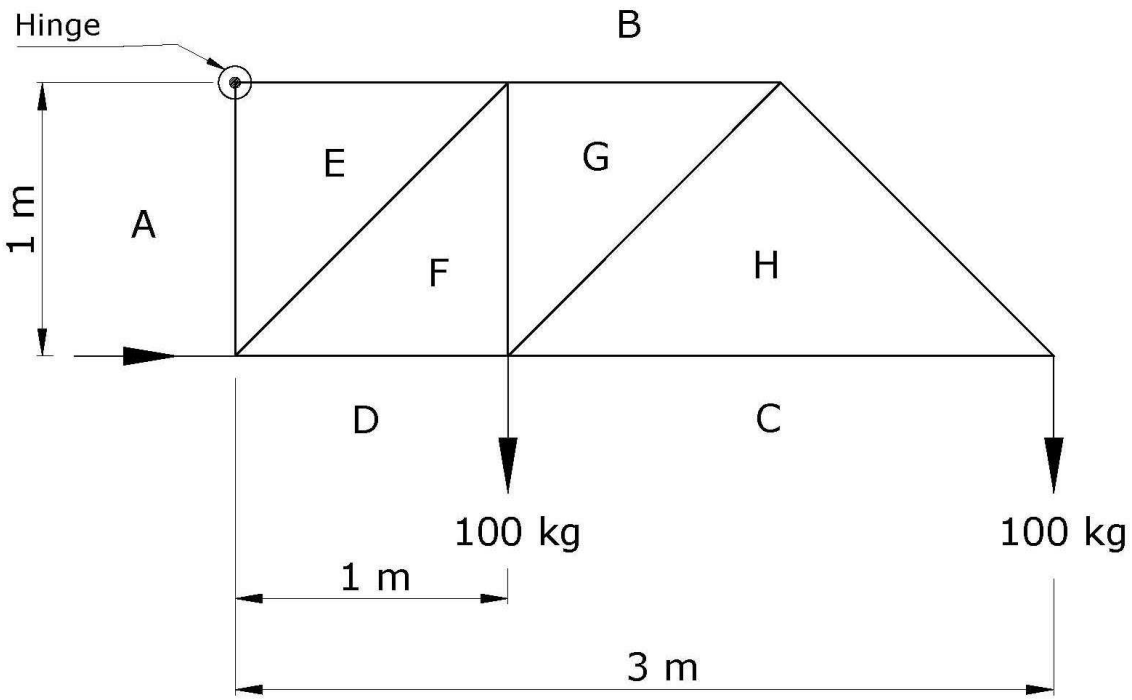


Figure 5

6. A cylindrical solid was machined and its shape partly changed from a cylinder to a cone with a spherical nose end as illustrated in Figure 6a. Two vertical parallel sections were cut off leaving two flat surfaces. Finally, a square hole was machined through the upper conical solid.

   a) Draw, full size, the front elevation and the incomplete plan shown in Figure 6b. (4)

   b) Project a view looking on the flat surface from the direction of the arrow X showing:

      i) the resulting curves of intersection between the solid and the vertical section; (3)

      ii) the outline of the cone as affected by the square through hole. (4)

   c) Complete the plan by showing the curve of intersection between the cone and the through square hole. (9)

   Note: Show hidden details.

(Total: 20 marks)

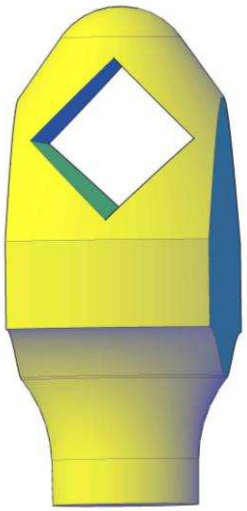


Figure 6a

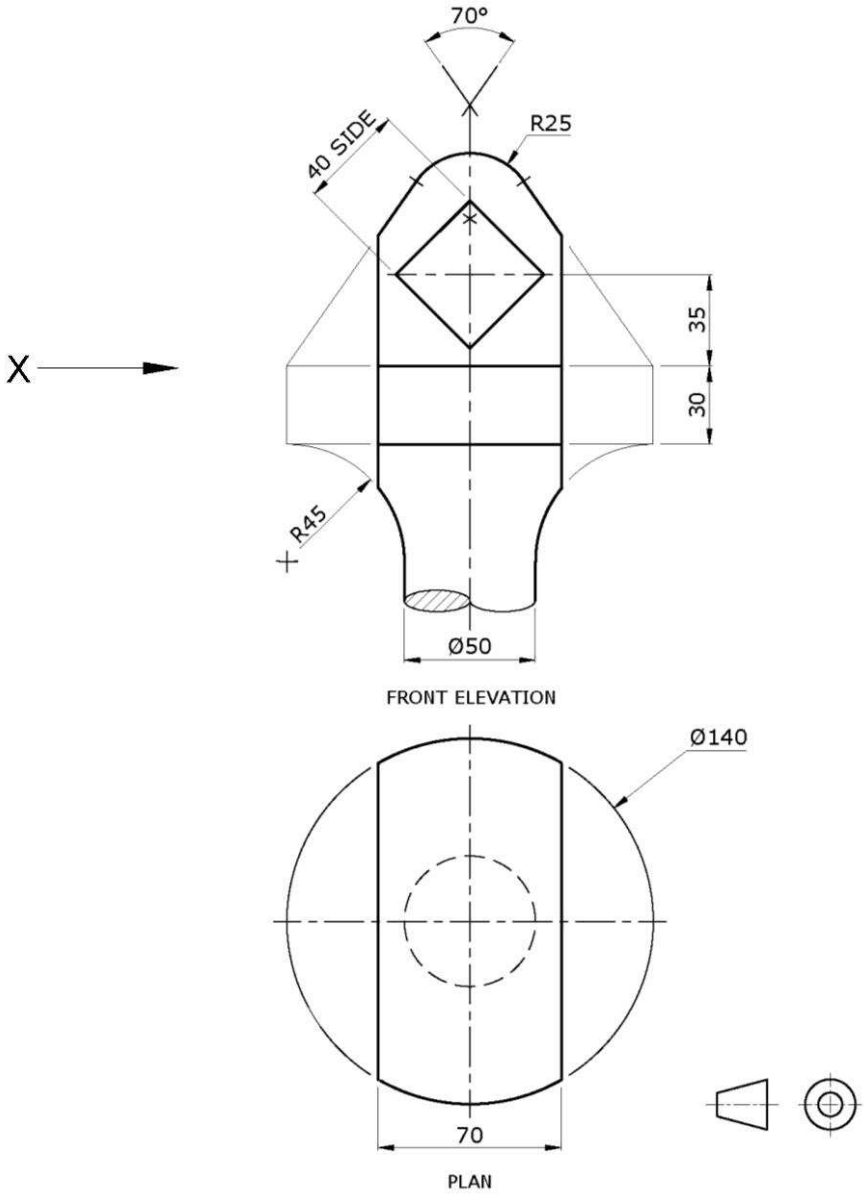


Figure 6b

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2019 FIRST SESSION

SUBJECT:	**Engineering Drawing**
PAPER NUMBER:	II
DATE:	30th May 2019
TIME:	4:00 p.m. to 7:05 p.m.

Directions to Candidates

Write your index number where indicated at the top of all drawing sheets.

Attempt **Question 1** and any other **TWO** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

a. drawings should conform to B.S. or equivalent (ISO) standards;
b. all dimensions are in millimetres;
c. all answers are to be accurately drawn with instruments;
d. all construction lines must be left on each solution;
e. drawing aids may be used.

Dimensions not given should be estimated using engineering judgement.

Careful layout and presentation are important.

Marks will be awarded for accuracy, clarity and appropriateness of constructions.

Mark allocations are shown in brackets.

Question 1 carries 60 marks. Questions 2, 3 and 4 carry 20 marks each.

1. A pictorial view of a valve is shown in Figure 1c. Detailed drawings of the components of the valve are shown in Figure 1d on the attached A3 paper. The components of the valve may be assembled as follows.
   - The valve seat (item 1) is positioned and pressed into the 48 mm diameter recess in the lower half of the body (item 2).
   - The valve (item 3) is inserted into the 40 mm diameter bore of the valve seat with the 45° face of the valve resting on the 45° face of the valve seat.
   - The square end of the spindle (item 4) is passed up through the M60 portion of the cap (item 5) and the 20 mm square thread engages with the 20 mm square thread in the cap and rotated through its full length.
   - The cap and spindle assembly are screwed into M60 threaded hole in the top of the body and tightened.
   - Three gland packing rings (item 6) are placed over the spindle and pressed into the annular space between the spindle and the 24 mm diameter counter bore in the cap.
   - The gland (item 7) is placed over the spindle and positioned on the packing.
   - The gland nut (item 8) is located over the spindle and M36 thread screwed on the M36 thread of the cap (item 5). The gland nut compresses the packing when tightened.

   With the non-return valve fully assembled and showing the valve in the closed position, draw the following views, full size, omitting hidden detail.
   (i) Full sectional view of the arrangement taken on the cutting plane X-X. (45)
   (ii)A complete view looking in the direction of the arrow A. (15)

   Notes:

   In the sectional view draw and represent:
   a) the lower part of the cap (item 5) as an outside view;
   b) the upper part of the cap (item 5), the packing rings (item 6), the gland (item 7) and the gland nut (item 8) as a sectioned view (see Figures 1a and 1b).

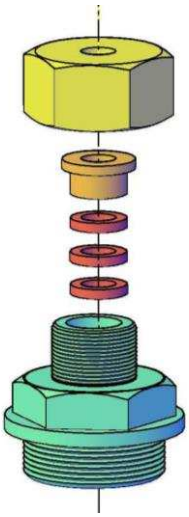


Figure 1a

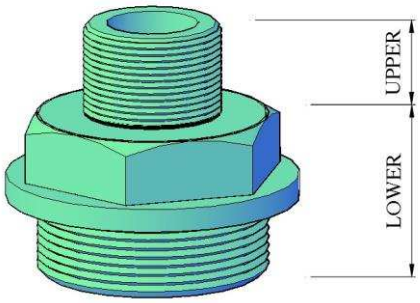


Figure 1b

(Total: 60 marks)

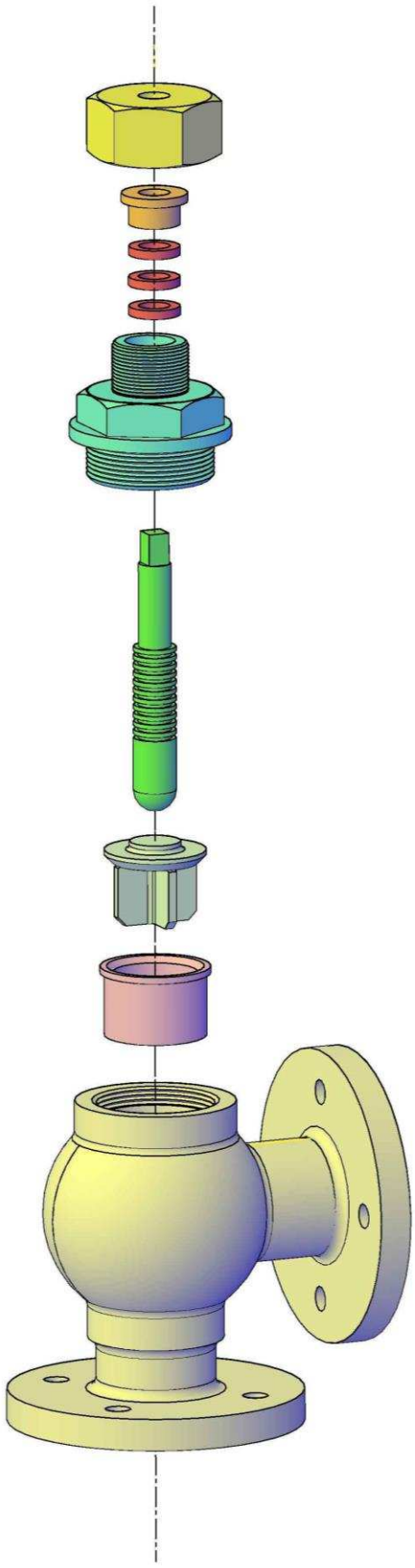


Figure 1c

2. A key is a piece of mild steel lying partly in a groove in the shaft (i) and extending into another groove in the hub (ii).
   a) State the technical terms for the groove referred as (i) and (ii) in the above statement. (1)
   b) State:
      i) the use of a key; (1)
      ii) why the key may act in a safety capacity. (1)
   c) Draw a sectional view of a sunk key and the upper half of a shaft with the suitable proportions used for assembly drawings. (1)
   d) Produce a neat, well-proportioned 2-D sectional view (see Figure 2) showing the profile of a:
      i) gib head key on a 50 mm diameter shaft; (3)
      ii) feather key on a 50 mm diameter shaft. (3)
      State the advantage of a gib head over the feather key. (1)
   e) Draw a 2-D sectional view showing the profile of a woodruff key:
      i) on a 50 mm diameter shaft; (3)
      ii) on a tapered shaft. (4)
      Write a short note on each. (2)

(Total: 20 marks)

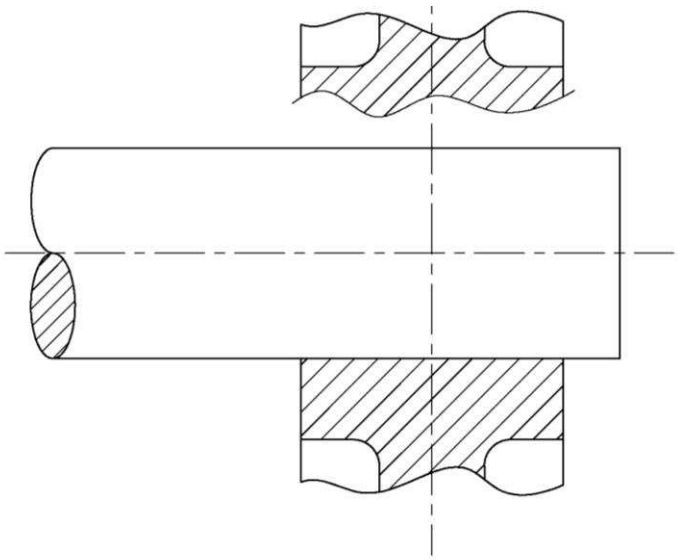


Figure 2

3. Welding is a method of joining adjacent parts. The weld is a permanent fastening application. The location of the weld is where the materials actually combine the grain structure from one piece to the other. The parts that are welded become one and the properly welded joint is as strong or stronger than the original material.
Welding drawings are made up of several parts to be welded together, usually called weldments or welding assemblies.
Welding symbols identify the type of weld, the location of the weld, the welding process, the size and the length of the weld and other welding information.

a) The incomplete table below shows the type of weld associated with the weld shape and/or the type of groove to which the weld is applied. Draw the weld shape symbol that is to be included to the table. (3)

FILLET	SQUARE	V	BEVEL	U	J	FIELD WELD	WELD ALL ROUND	FLUSH CONTOUR

b) Draw isometric views of **FOUR** weld joints used in most weldments. Name the basic welding joints. (7)

c) Four mild steel plates are to be joined together and arranged to form a column. The weld joint is to be ground flush with the surface and is later welded to a square base. Figure 3a shows a pictorial view of the column base detail. Copy the plan shown in the orthographic views shown in Figure 3b and attach on the plan the proper welding symbol for the joint:
i) between the upright plates leaving a flush face; (1.5)
ii) between two sides of the vertical column and the base. (1.5)

d) Orthographic views of a wheel steel shaft support are shown in Figure 3c. The support is to be fabricated from the items shown in Figure 3d. Copy the left-hand half of the front view and include on this view suitable proper welding symbols. (7)

(Total: 20 marks)

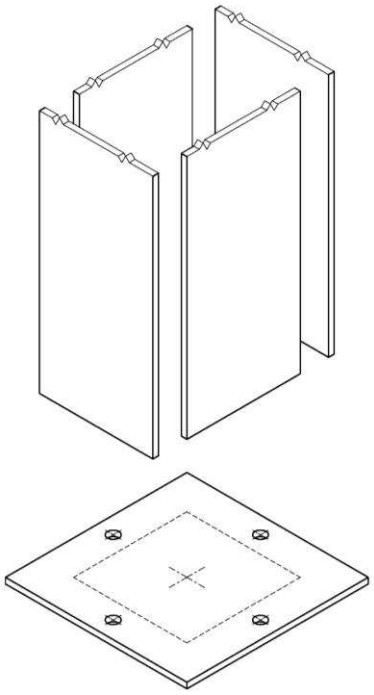


Figure 3a

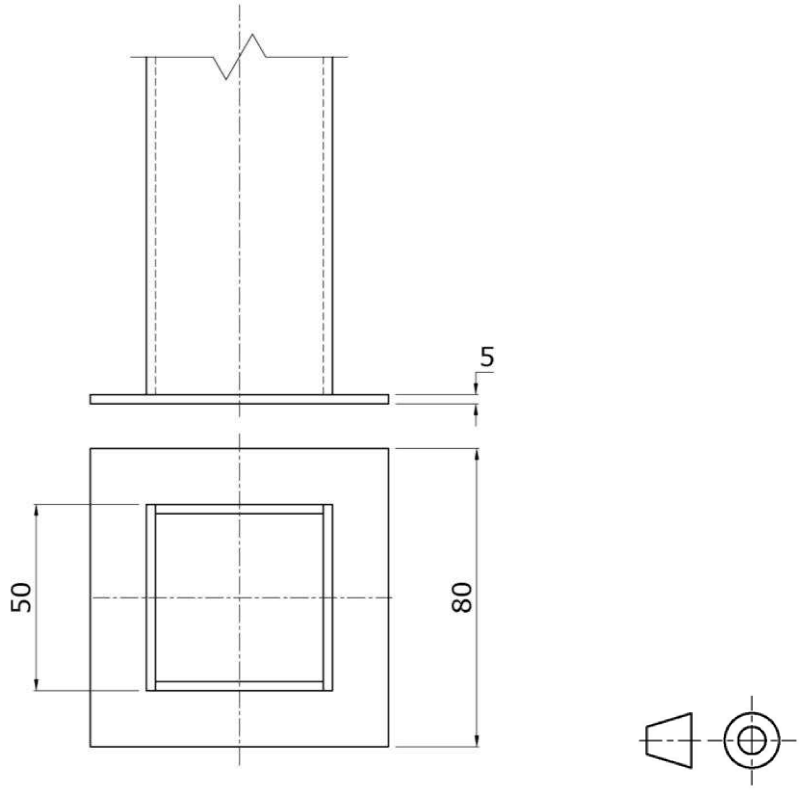


Figure 3b

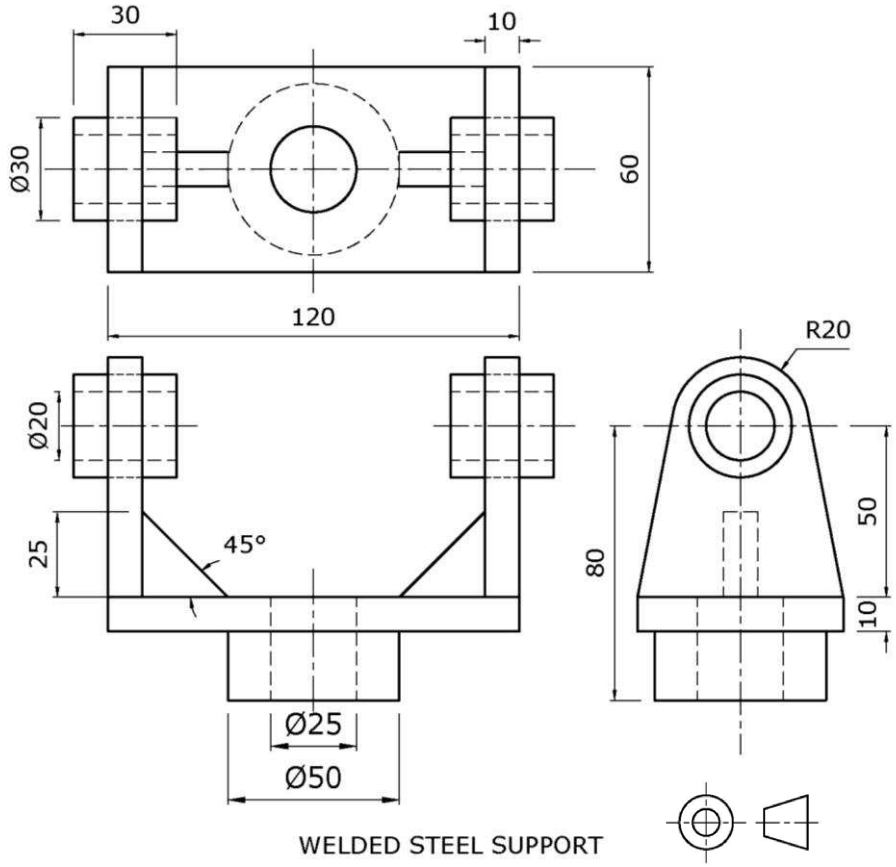


Figure 3c

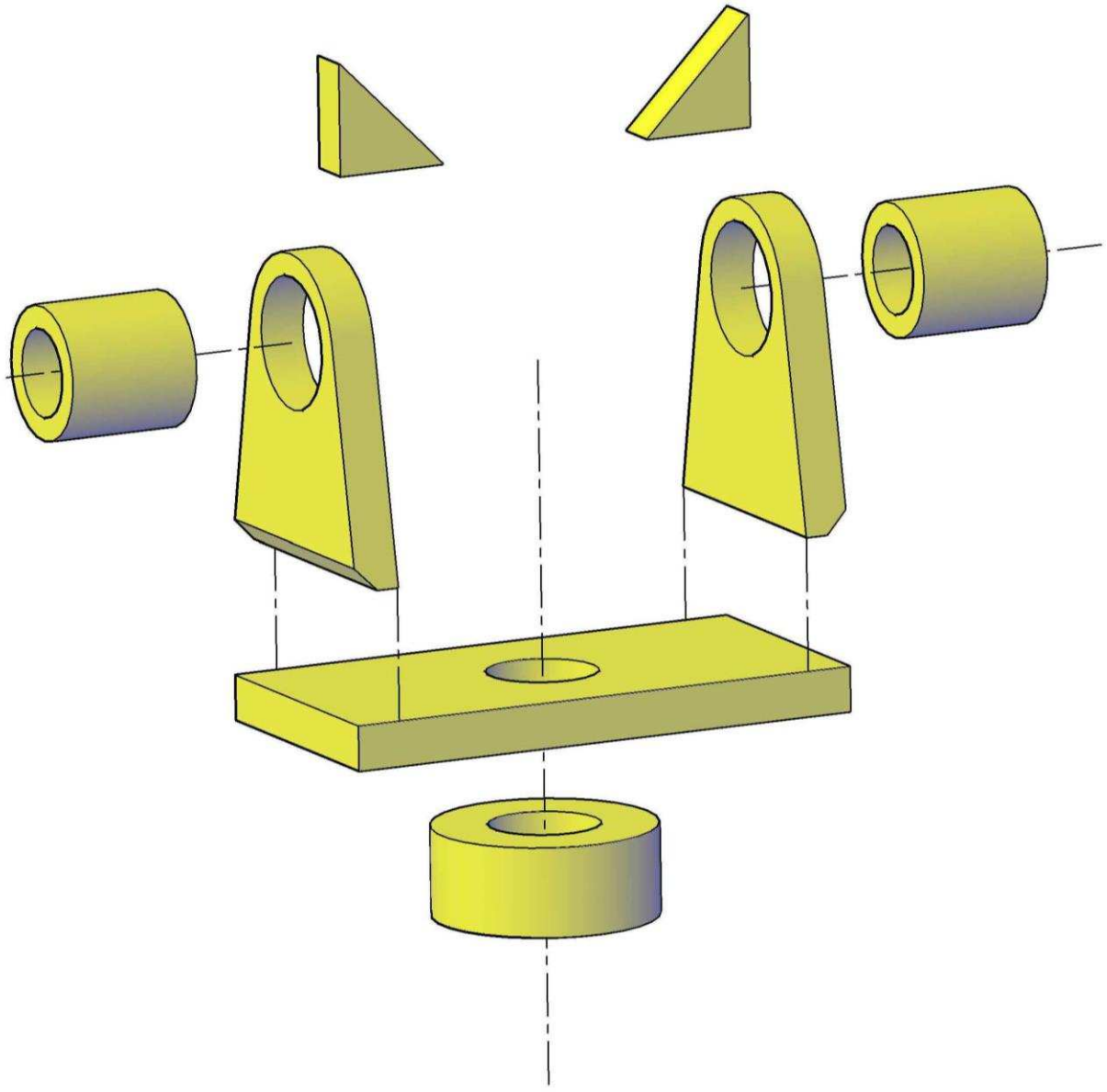


Figure 3d

Questions continue on next page

4. Geometrical Tolerance is the dimensioning and tolerancing of individual features of a part where the permissible variation relates to characteristics of form, profile, or the relationship between features.
Symbols on drawings represent specific information that would otherwise be difficult and time consuming to duplicate in note form. Symbols must be clearly drawn to required size and shape so that they communicate the desired meaning uniformly.
   a) Copy and complete the indication of geometrical tolerances shown in Figure 4a by including a note for each symbol contained in the rectangular compartment frames. (2)
   b) Draw the symbol applicable for each of the following tolerance characteristic:
   (i) straightness, (ii) flatness, (iii) roundness, (iv) cylindricity, (v) profile of a line and (vi) profile of a surface, (vii) parallelism, (viii) squareness, and (ix) angularity. Place the symbols in the table shown in Figure 4b and label accordingly. (2)
   c) Two examples of tolerance of flatness are shown in Figure 4c, show the interpretation of these examples by two oblique projection. (4)
   d) Copy the four drawings shown in Figure 4d and complete by indicating the correct geometrical tolerance to satisfy the following conditions in each case:
      i) the axis of the whole component is required to be contained in a cylindrical zone 0.03 mm diameter;
      ii) the top surface of the component is required to lie between two parallel planes 0.03 mm apart;
      iii) the periphery at any cross-section perpendicular to the axis is required to lie between two concentric circles 0.03 mm radially apart;
      iv) the right-hand face of the component is required to lie between two parallel planes 0.03 mm apart and perpendicular to the top surface. (12)

   Note: Your solution may be presented as shown in Figure 4.

(Total: 20 marks)

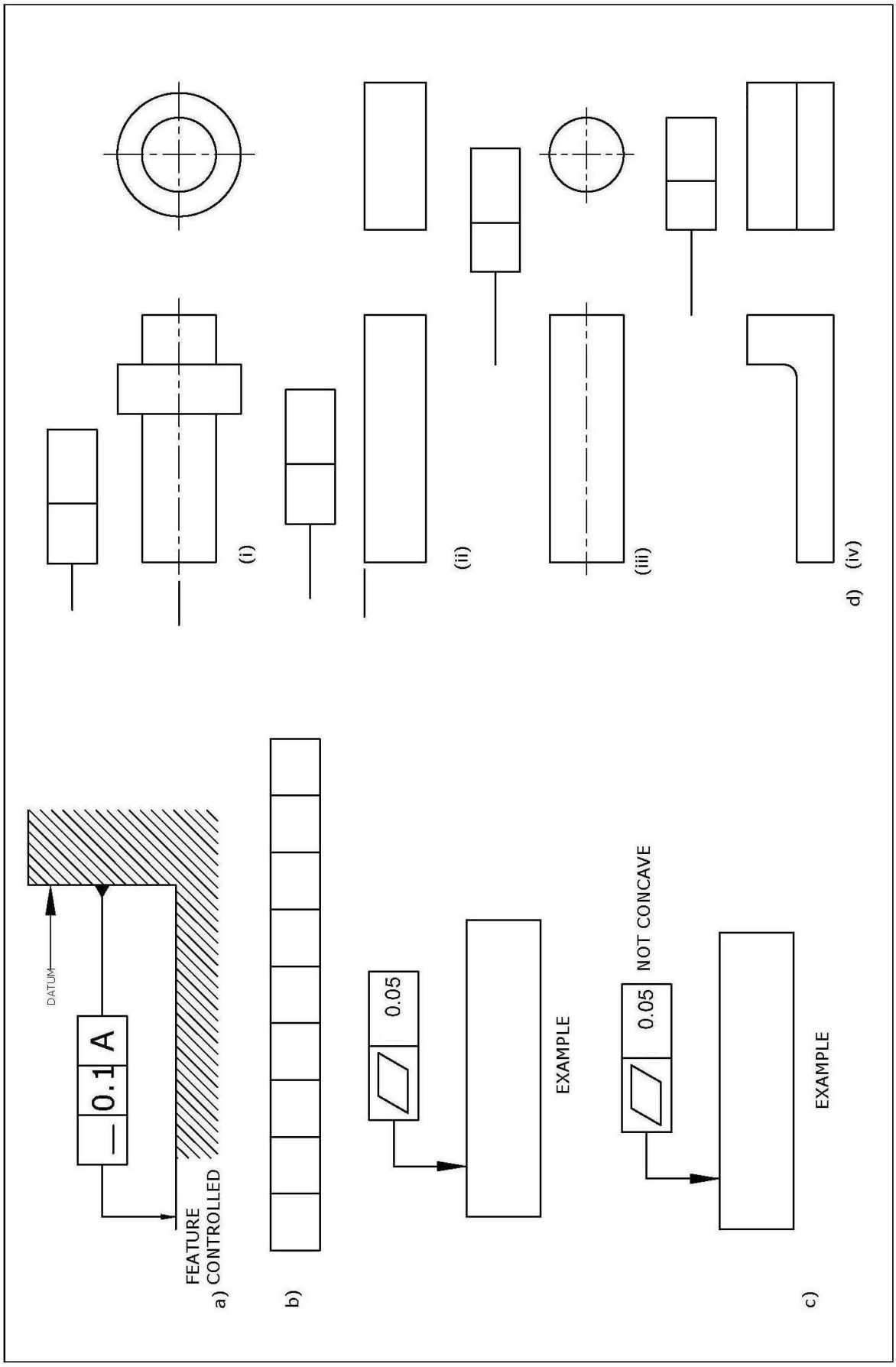
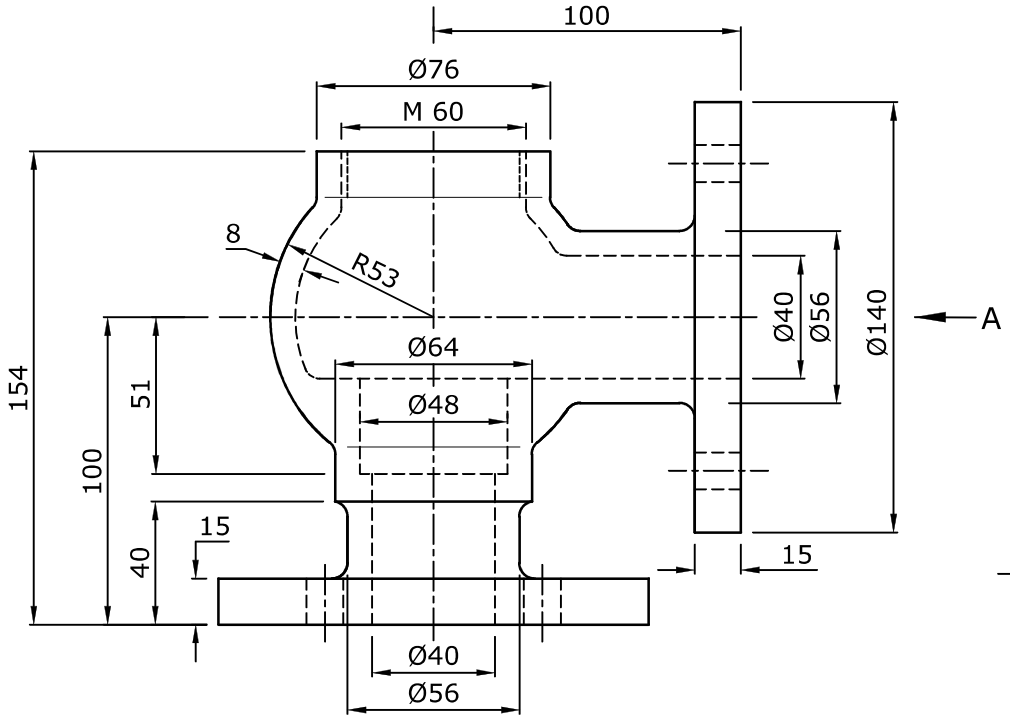
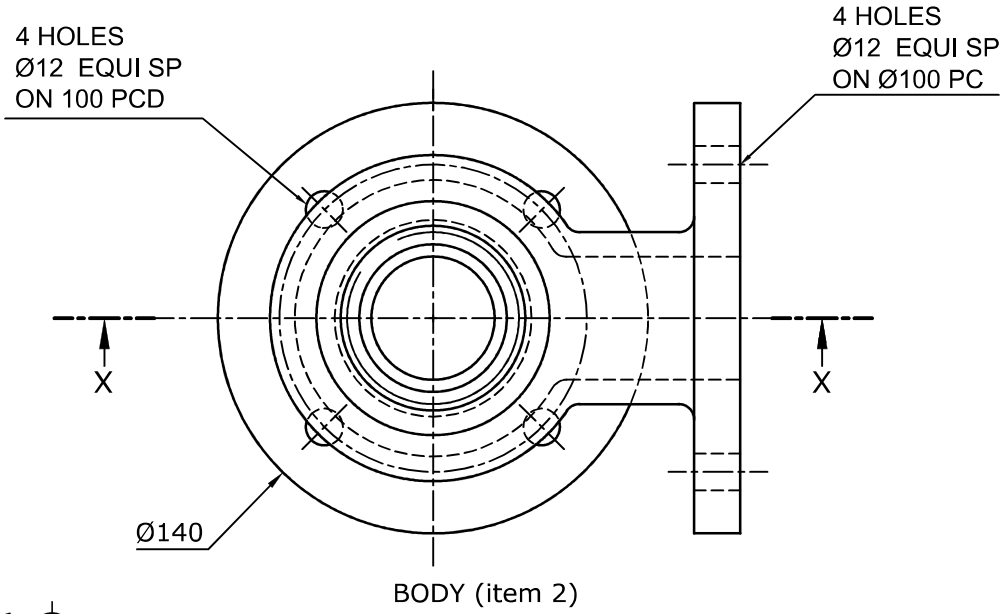
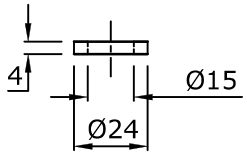

a) CONTROLLED FEATURE
DATUM
0.1 A
b)
0.05
EXAMPLE
c)
NOT CONCAVE
0.05
EXAMPLE
d)
(i)
(ii)
(iii)
(iv)

Figure 4

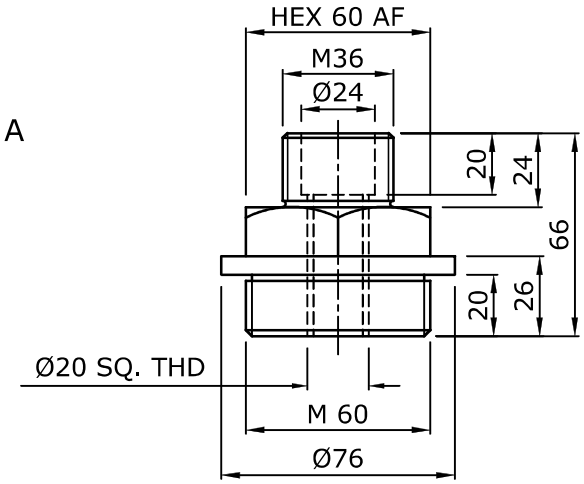




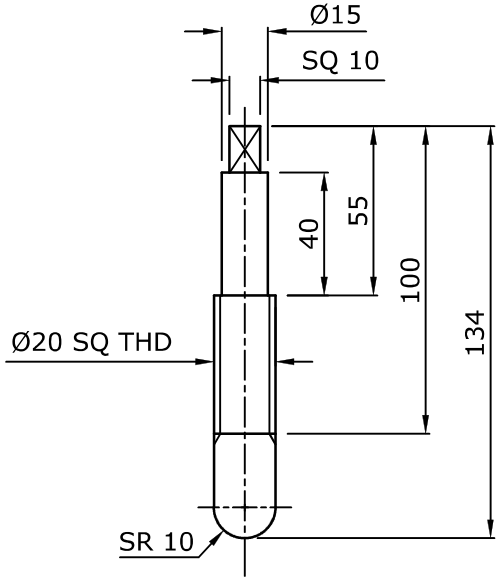
BODY (item 2)



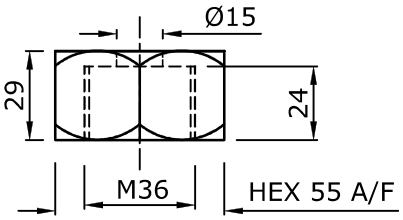
PACKING RINGS-3 off (item 6)



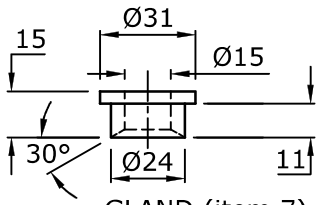
CAP (item 5)



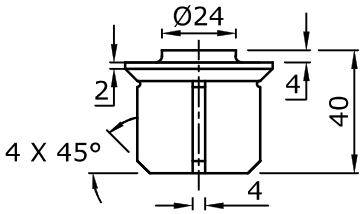
SPINDLE (item 4)

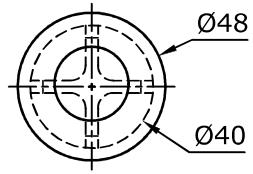


GLAND NUT (item 8)

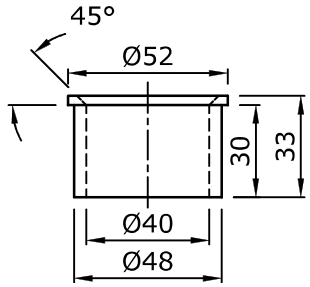


GLAND (item 7)





VALVE (item 3)



VALVE SEAT (item 1)

UNIVERSITY OF MALTA	MATRICULATION CERTIFICATE EXAMINATION	AM 09 19m ENGINEERING DRAWING PAPER II QUESTION 1	FIGURE 1d