L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2018 FIRST SESSION

SUBJECT:	**Engineering Drawing/Graphical Communication**
PAPER NUMBER:	I
DATE:	2nd May 2018
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 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 loaded truss is shown in Figure 1.
   a) Using a scale of 10 mm representing 1 m, copy the space diagram and label the frame using Bow's notation. (3)
   b) Calculate the left and right support reactions for the unsymmetrical loaded truss. (5)
   c) Construct the stress diagram for the truss and determine the force in the vertical member HJ. (8)
   d) State whether the member HJ is in compression or in tension. (4)

(Total: 20 marks)

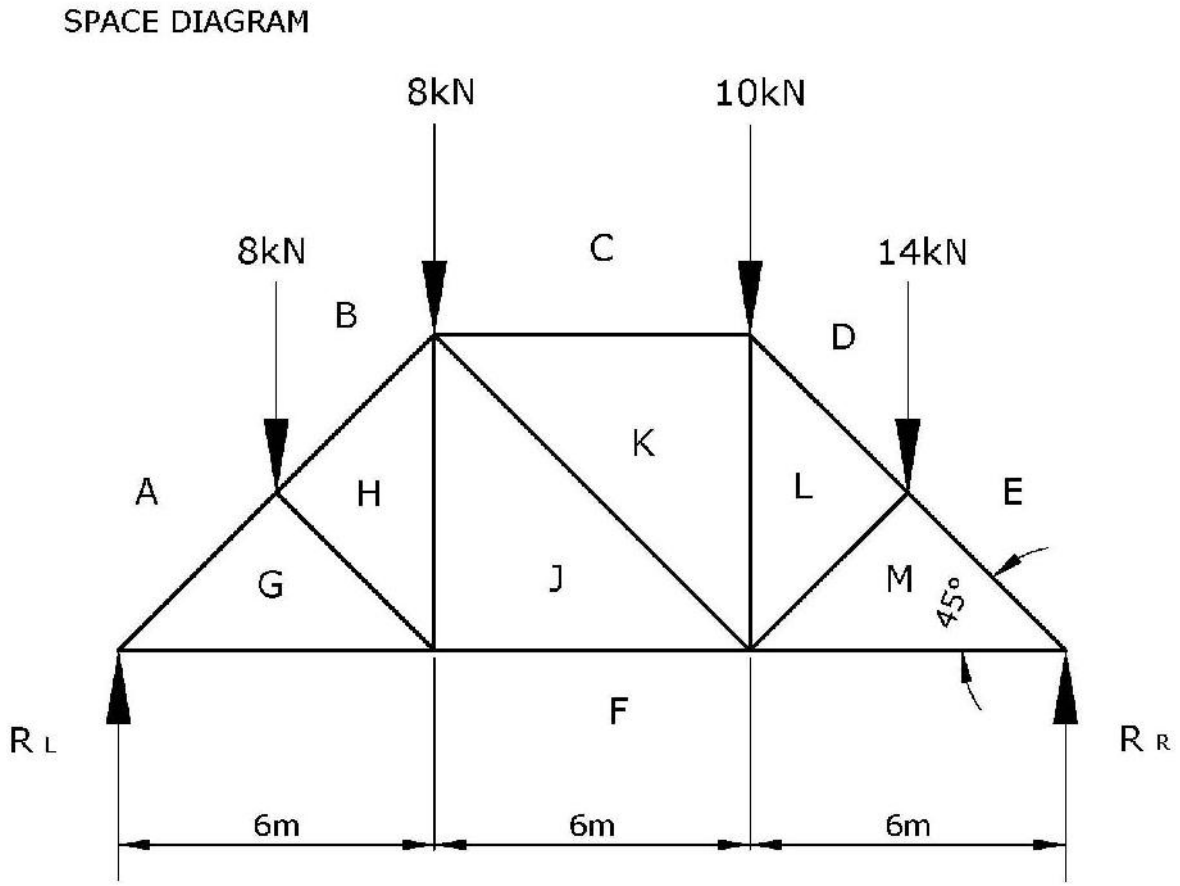

Figure 1

2. A line in space is heading in the direction of a triangular plate as shown in the sketch of Figure 2a.

   a) Copy, full size, the plan and front views of the triangular plate ABC and the line EF shown in Figure 2b. (5)

   b) Draw an auxiliary view to show the triangular plate ABC as an edge. Include the line EF in this view. Locate the point of intersection P of the line EF with the triangular plate. Project the point of intersection P on the front and plan view. (4)

   c) Project another auxiliary view showing the true size of the triangular plate and the projection of the line EFP. (6)

   d) Construct by projection an auxiliary view showing the true length of the line EF and the angle that the line meets the plate. State the length of the line EF and the extended line FP. (5)

(Total: 20 marks)

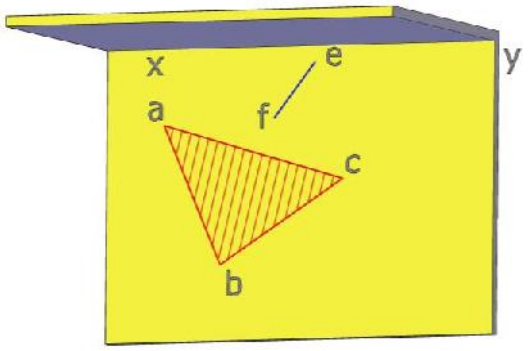

Figure 2a

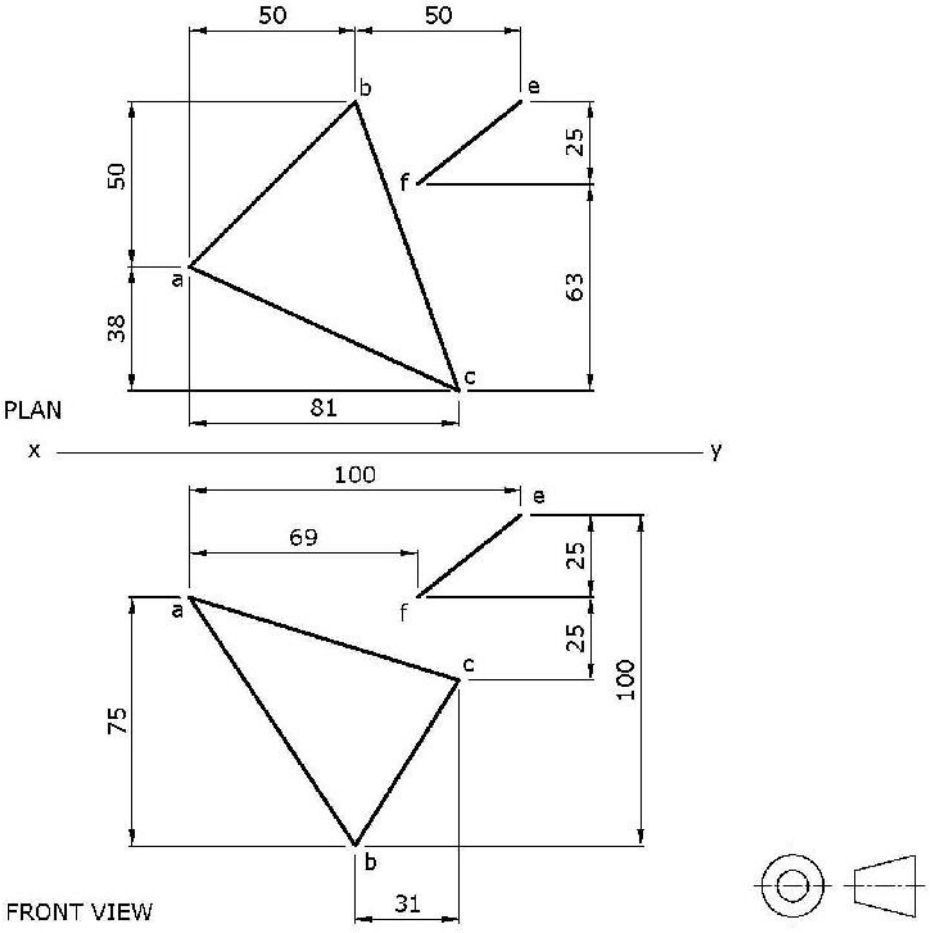

Figure 2b

3. A right cylinder intersecting an oblique truncated cone is illustrated in Figure 3a
   a) Copy, full size, the plan and the incomplete front elevation of the truncated oblique cone and intersecting cylinder shown in Figure 3b. (2.5)
   b) Project an end elevation of the **TWO** geometrical solids. (2.5)
   c) Determine the intersection of the cone and cylinder on the end elevation and show the curve of intersection on the front elevation. (6)
   d) Draw a half surface development of the truncated oblique cone, showing neatly the construction of the true lengths. (9)

(Total: 20 marks)

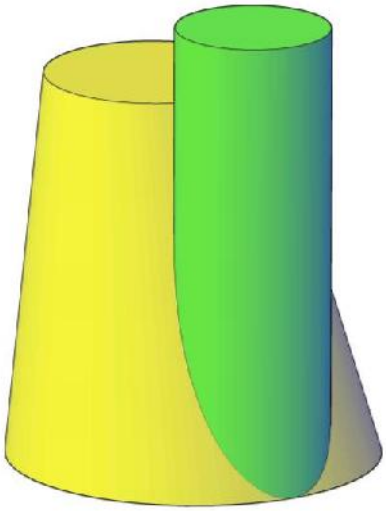

Figure 3a

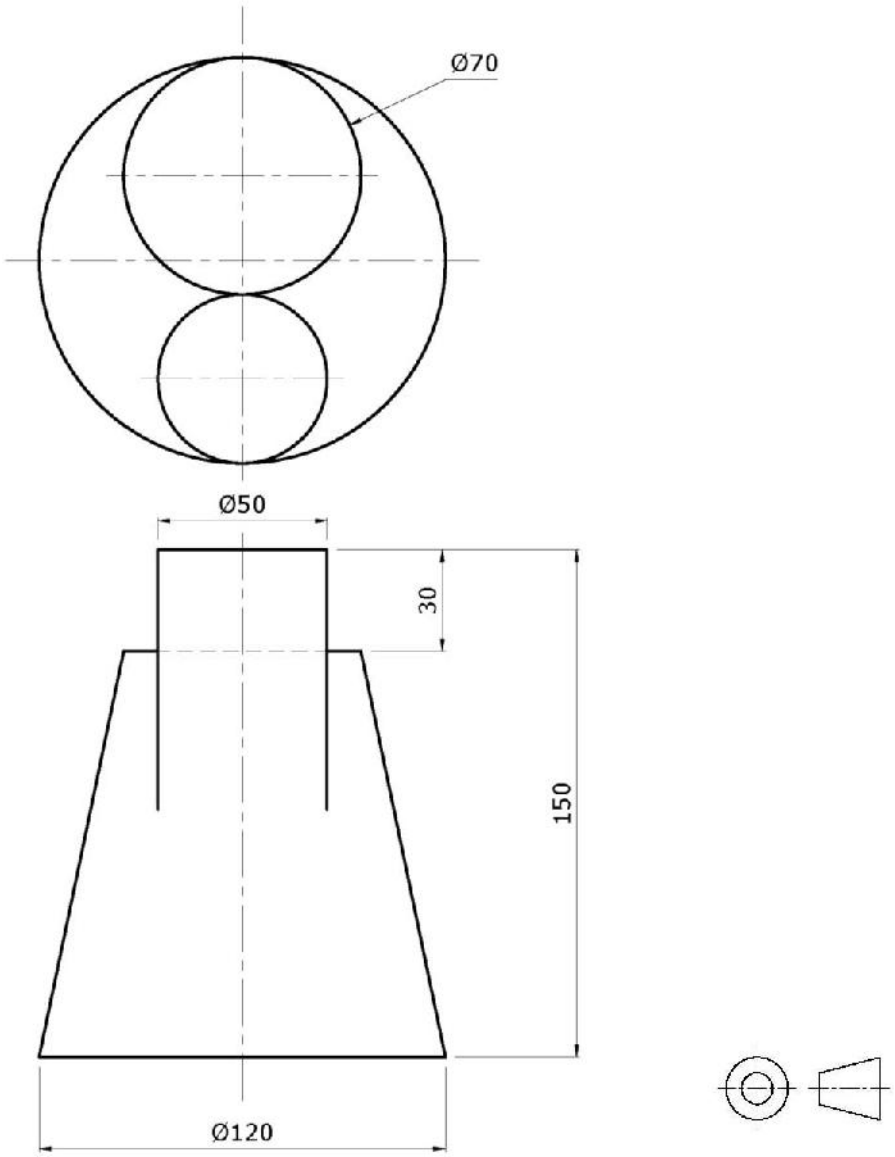

Figure 3b

4. A disc cam, radial arm and roller follower are illustrated in Figure 4a. The follower is constrained to oscillate an angle of 60° to give a maximum lift. The specification of the motion is as follows:

Cam rotation	Follower movement
0° to 90°	From minimum position, follower to rise an angle of 60° with simple harmonic motion.
90° to 150°	Follower to dwell.
150° to 300°	Follower to fall an angle of 60° with uniform acceleration and retardation.
300° to 360°	Follower to dwell.

Disc cam to rotate in an anticlockwise direction.

a) Copy, full size, the details shown in Figure 4b and draw a suitable motion displacement diagram. (8)

b) Construct the cam profile to impart the stated motion to the follower. (12)

(Total: 20 marks)

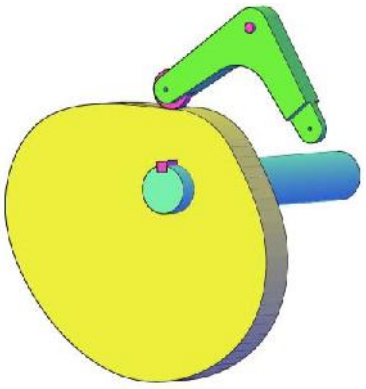

Figure 4a

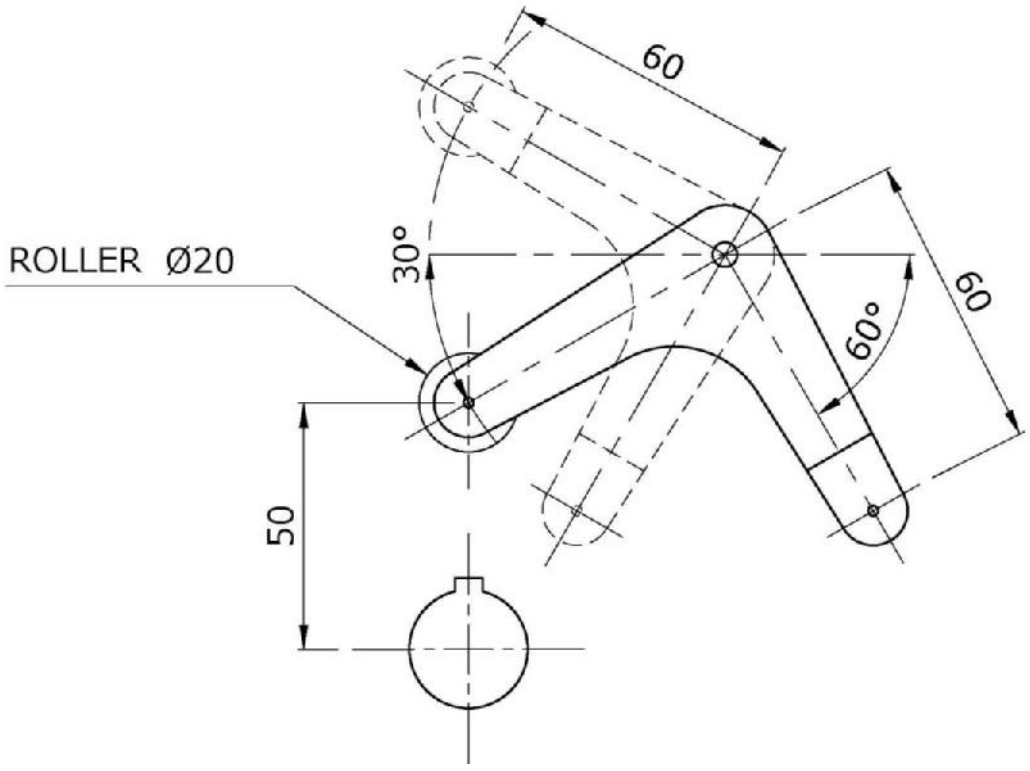

Figure 4b

5. An arrangement of a special screw of a rapid and slow feed mechanism is illustrated in Figure 5a. A left hand single start square thread and a right hand two start square thread were cut on the machined bar. The helices on each thread have been omitted from the elevation shown in Figure 5b.
   Construct, full size, the elevation of the machined bar shown in Figure 5b, containing:
   a) screw A, the left-hand single-start square thread, on the left-hand side; (10)
   b) screw B, the right-hand two-start square thread, on the right-hand side. (10)

   Notes:
   - All visible helices of the square thread are to be shown.
   - Hidden detail is not to be shown.

(Total: 20 marks)

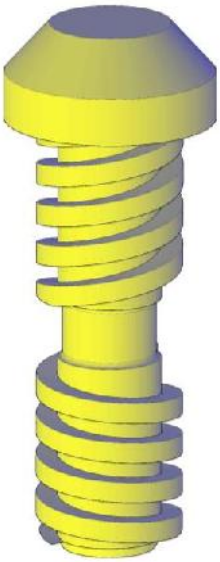

Figure 5a

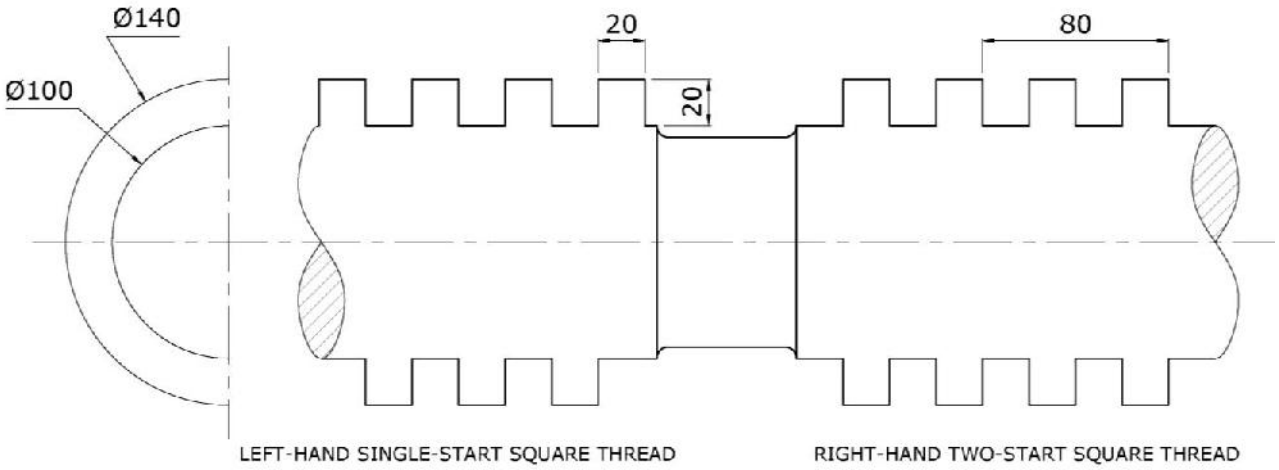

Figure 5b

6. A prism is placed on its pentagonal base between a vertical plane and a horizontal plane. A cylinder resting on its sides is also placed next to the prism. The cylinder has a segment cut off to prevent the solid from rolling. The two geometrical solids are cut by an oblique plane VTH as illustrated in Figure 6a.
   a) Draw, full size, Figure 6b. (5)
   b) Construct an auxiliary elevation showing the oblique plane as an inclined plane, and how the oblique plane cuts the two solids. (5)
   c) Complete the plan showing that part of the prism and cylinder under the oblique plane. (5)
   d) Project a front elevation of the two solids. (5)

(Total: 20 marks)

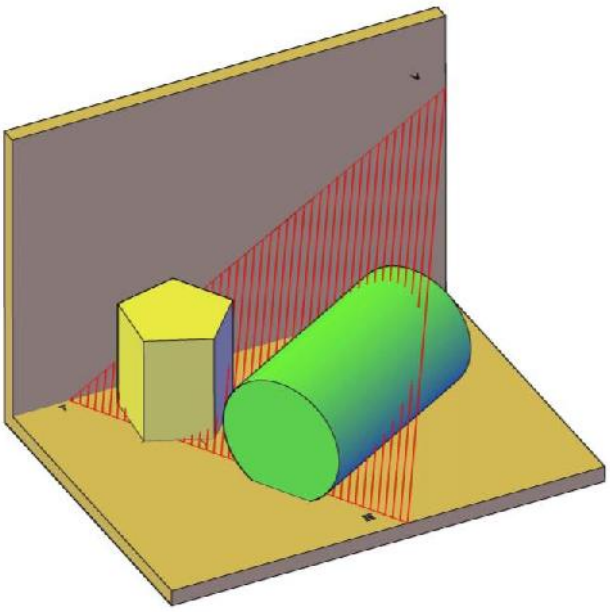

Figure 6a

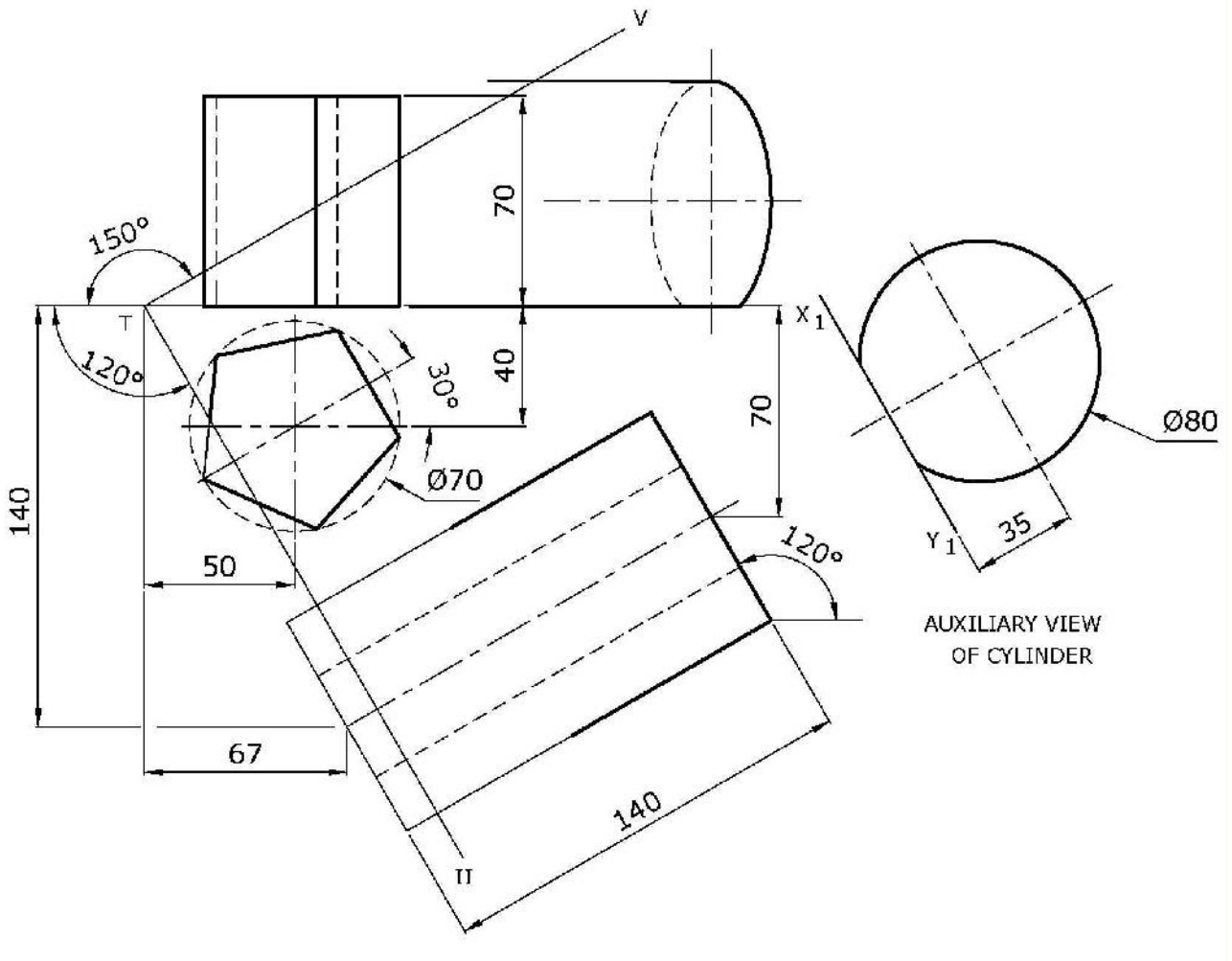

Figure 6b

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2018 FIRST SESSION

SUBJECT:	**Engineering Drawing**
PAPER NUMBER:	II
DATE:	3rd May 2018
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 **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 illustration of a Pop-Up Valve is shown in Figure 1a. Detail orthographic drawings of the components parts of the mechanical Pop-up valve are presented in Figures 1b and 1c on the attached A3 papers.
   The following notes explain how the pop-up valve is assembled;
   - The spring (item 5) is inserted in the spring rod (Item 4), and rests against the 40 mm diameter x 5 mm portion of the spring rod.
   - The spring washer (Item 6) rests at the top portion of the spring and slides on the 12 mm diameter spring rod.
   - The M20 locknut (Item 7) is screwed on the M20 external thread of the adjusting screw (Item 8).
   - The adjusting screw and locknut are assembled into the M20 threaded hole of the body (Item 1).
   - The assembled spring rod, spring and spring washer are fitted in the body (Item 1), and held with the 12 mm diameter top end of the spring rod, sliding into the internal 13 mm hole x 40 deep of the adjusting screw (Item 8).
   - The valve seat (item 2), with the valve (item 3) inserted and held in place, are fitted in the lower part of the body (Item 1). The M76 thread on the valve seat is tightened in the M76 internal thread of the body, with the 13 mm diameter end of the spring rod inserted in the 15 mm diameter x 8 mm deep hole of the valve (Item 3).

   The valve rides in the valve seat and its upward motion is regulated by the distance that the spring rod can move inside the hole in the adjusting screw. The valve is returned by the spring which acts between the flange on the spring rod and the spring washer. The top of the washer presses against the bottom of the adjusting screw.

   Draw, full size, the following views of the assembled Pop-Up Valve:
   a) a sectional elevation along the horizontal centre line X-X shown, showing clearly the assembled parts. Do not show the spring on this view; (38)
   b) an outside elevation looking on the 76 across flats of the hexagon; (12)
   c) Draw:
      i) the plan of the handle of the adjusting screw as a separate view; (4)
      ii) **TWO** turns of the spring showing the construction of the helical spring on the first turn and the final presentation of the helices on the second turn. (Pitch 48 mm, cross-section of spring Ø24 mm, PCD 80 mm.) (6)

   Show the valve in the closed position and assume that the spring is compressed to 63 mm long.

   Use first or third angle projection and draw the projection symbol.

   Do not show hidden detail.

   (Total: 60 marks)

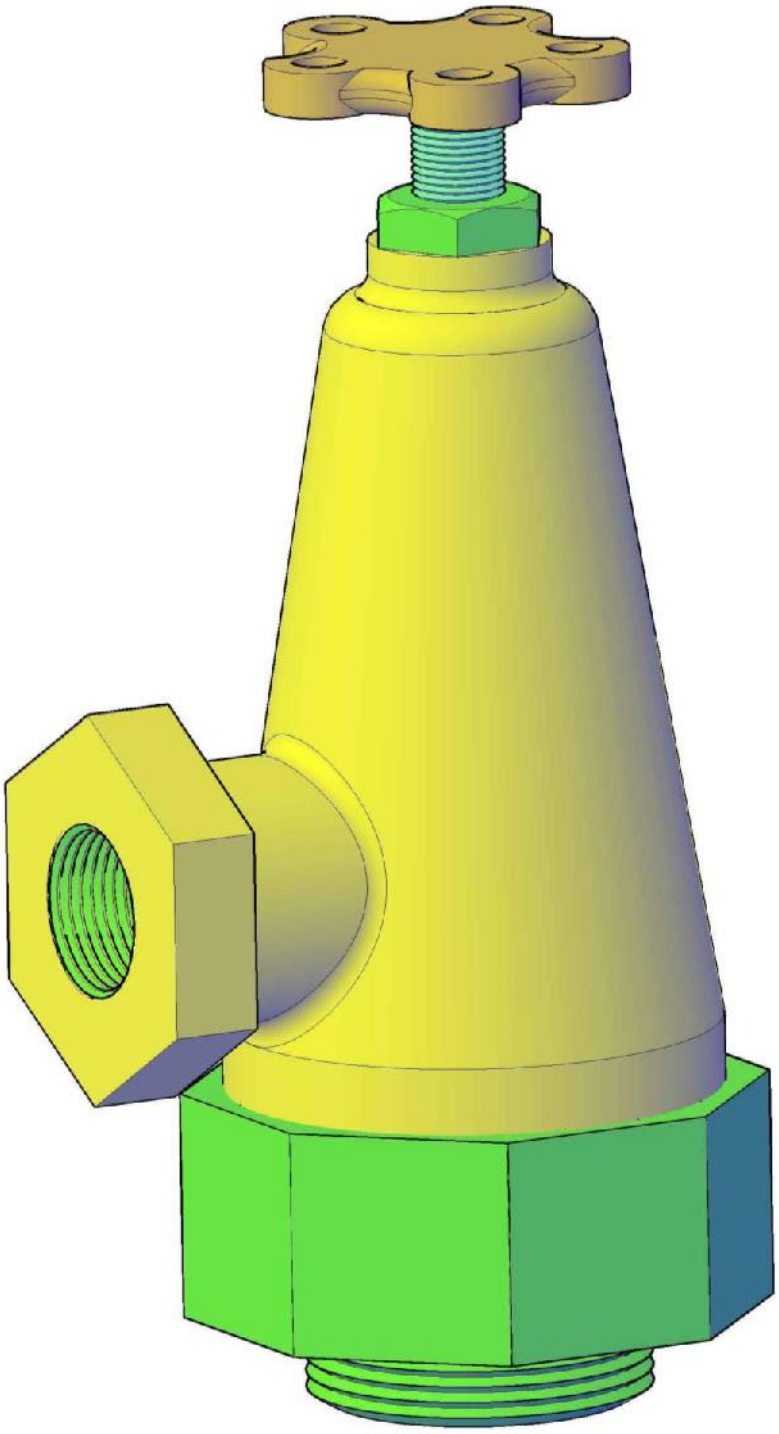


Figure 1a

2. a) A ball or roller bearing consists of four components. Write down the **FOUR** basic components. (2)
   b) Sketch an exploded view showing the components of a typical example of a ball bearing generally used to carry radial loads. Label the components. (6)
   c) i. Name the type of bearing shown in Figure 2a and Figure 2b. State where these bearings are normally used. (2)
      ii. Label the parts (a), (b), (c), (d), (e) and (f) shown in Figure 2a and Figure 2b. (2)
   d) Draw a sectional view of a thrust bearing which is used for axial load:
      i. in one direction only; (3)
      ii. designed to take thrust in either direction parallel to the axis of the shaft. (5)

(Total: 20 marks)

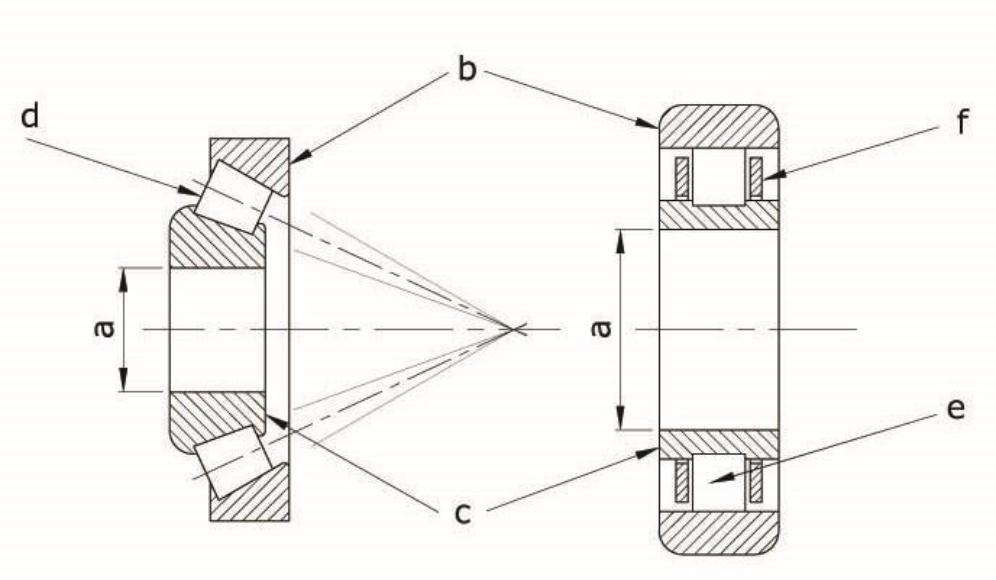


Figure 2a

Figure 2b

3. a) A sectioned view of a plain bush installation is shown in Figure 3a. The bush is installed in the casing to a drive fit combination of Ø 36 H7/p6. The shaft runs in the bush to a combination fit Ø30 H7/g6.
Draw, twice full size, a detailed sectional drawing of the bush. Refer to Table 1 below to obtain the correct value of tolerance. Show the dimensions on the drawing. Present the lower and upper dimension values of the inner and outer diameters of the bush. (6)

Table 1

LIMITS OF TOLERANCE									
NOMINAL SIZE		H7		g6		p6		s6	
Over	Up to	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
3	6	+012	0	-004	-012	+020	+012	+027	+019
6	10	+015	0	-005	-014	+024	+015	+032	+023
10	18	+018	0	-006	-017	+029	+018	+039	+028
18	30	+021	0	-007	-020	+035	+022	+048	+035
30	50	+025	0	-009	-025	+042	+026	+059	+043
50	65	+030	0	-010	-029	+051	+032	+072	+053

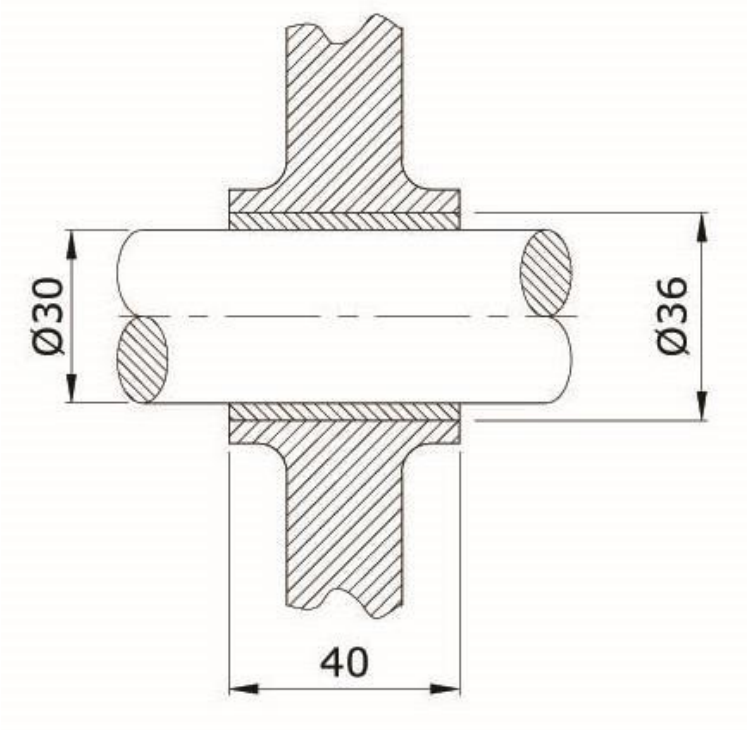


Figure 3a

Question continues on next page

b) Dimensioned drawings of two components from a gear type oil pump are shown in Figure 3b (i) and Figure 3b (ii).
Draw, twice full size:

i) a dimensioned view of the spindle. The spindle runs in the bush to a combination clearance fit Ø16 H7/g6 and machined to a s6 fit at the Ø10 mm end; (7)

ii) a dimensioned sectional view of the bush. The bush is to be a light press fit in the body using a Ø16 H7/p6 combination fit. (5)

Refer to Table 2 below to obtain the correct value of tolerance.

c) Name the material suitable for each item. (2)

(Total: 20 marks)

Table 2

LIMITS OF TOLERANCE									
NOMINAL SIZE		H7		g6		p6		s6	
Over	Up to	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
3	6	+012	0	-004	-012	+020	+012	+027	+019
6	10	+015	0	-005	-014	+024	+015	+032	+023
10	18	+018	0	-006	-017	+029	+018	+039	+028
18	30	+021	0	-007	-020	+035	+022	+048	+035
30	50	+025	0	-009	-025	+042	+026	+059	+043
50	65	+030	0	-010	-029	+051	+032	+072	+053

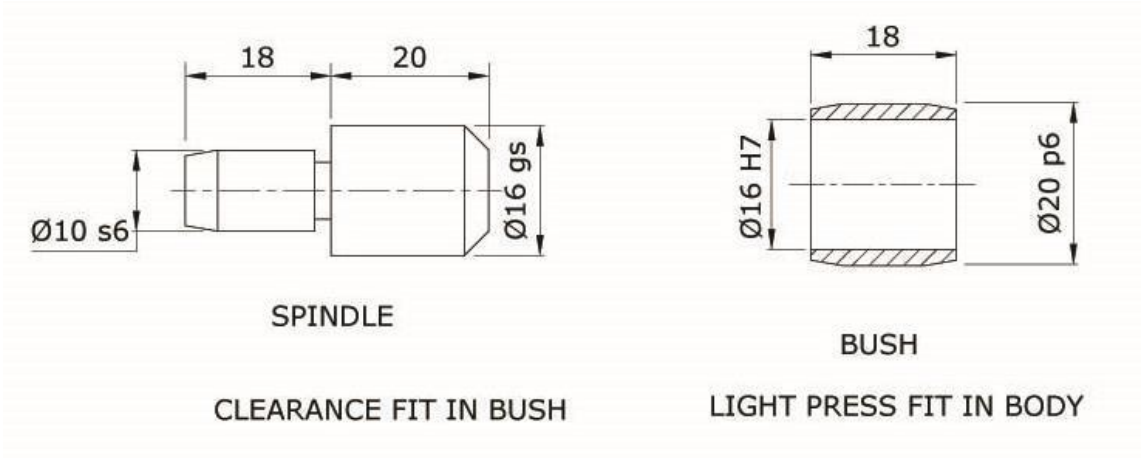


Figure 3b(i)

Figure 3b(ii)

4. The crank lever shown in Figure 4a oscillates about the centre circle and the two links move inwards and outwards. The links are not the same length and width. The left-hand link is assembled to the crank lever by means of a suitable fastener threaded screw in the blind M16 tapped hole of the lever. The right-hand link is assembled to the crank lever by means of an M14 stud in the M14 threaded through hole of the crank lever at the right-hand end. Both links are free to operate.

   Refer to Figure 4b and draw, to a scale of 2:1, a sectional view of the assembled link and crank lever showing the:

   a. left link attached to the crank lever by means of an M16 threaded end fastener; (9)

   b. right link assembled to the crank lever by means of an M14 stud fitted in the through M14 through tapped hole. Include an appropriate locking device to the stud. (11)

   Omitted dimensions should be estimated using engineering judgement.

(Total: 20 marks)

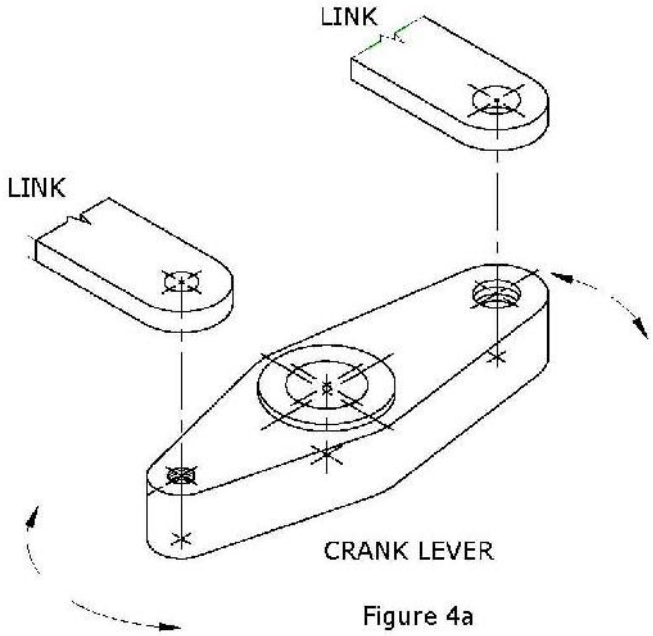


Figure 4a

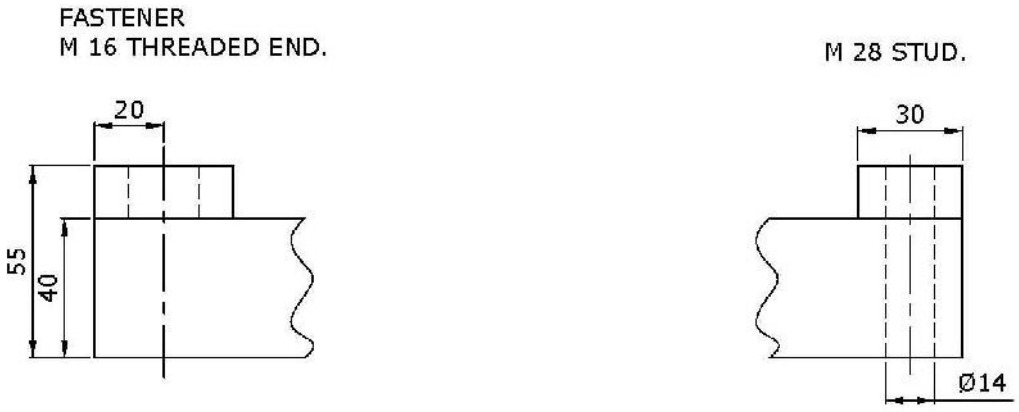


Figure 4b

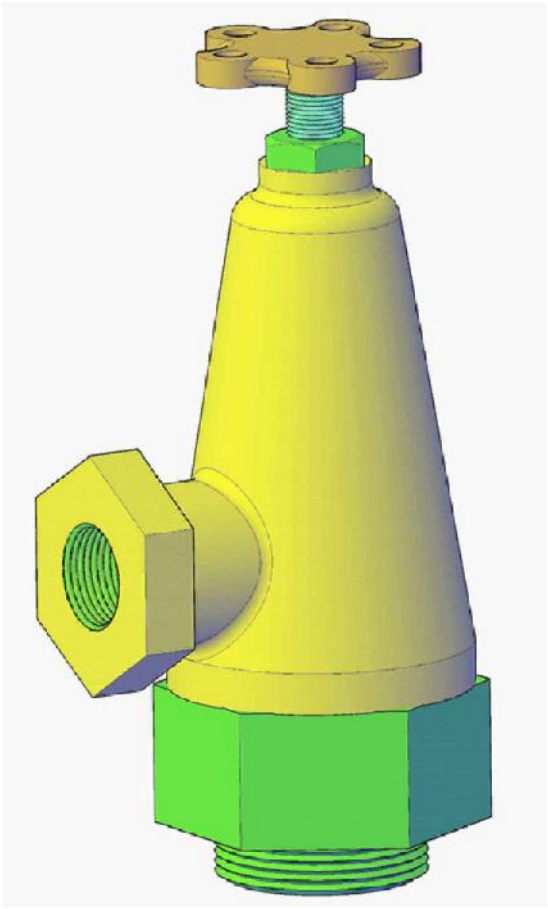
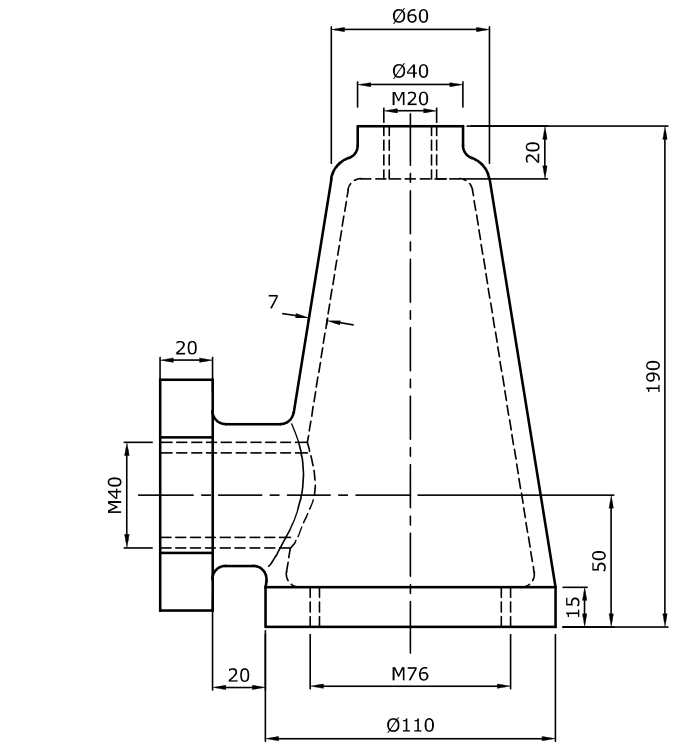
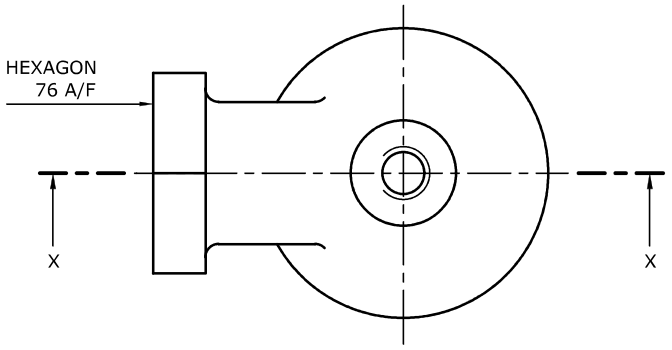


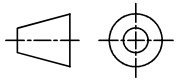
Figure 1a



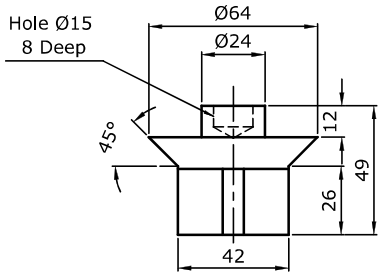


BODY (Item 1)

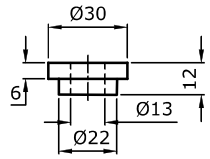
POP - UP VALVE



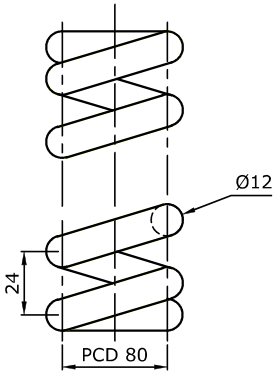
UNIVERSITY OF MALTA	MATRICULATION CERTIFICATE EXAMINATION	AM 09.18m ENGINEERING DRAWING PAPER II QUESTION 1	FIGURE 1(b)



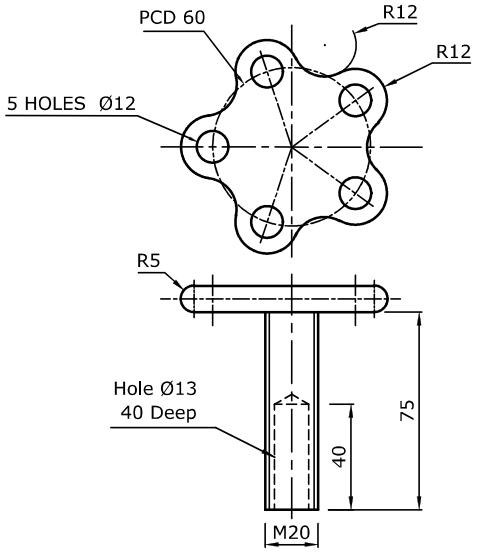
VALVE (Item 3)



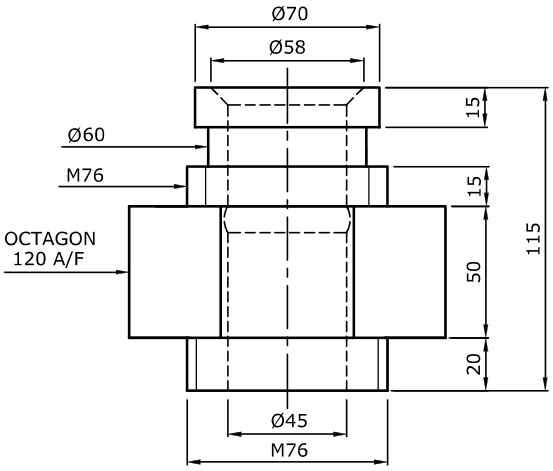
SPRING WASHER (Item 6)



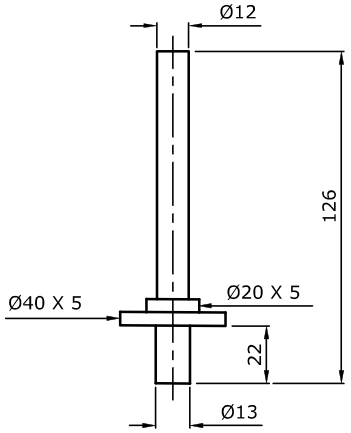
SPRING (Item 5)



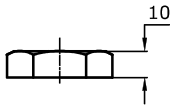
ADJUSTING SCREW (Item 8)



VALVE SEAT (Item 2)



SPRING ROD (Item 4)



M20 LOCKNUT (Item 7)

POP - UP VALVE