MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)

EMM 121: ENGINEERING DRAWING II

DATE: 21/4/2023 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS

- This paper contains **FIVE (5)** questions.
- You are required to answer **THREE (3)** questions only.
- Question **one** is compulsory.
- Attempt any other two questions.
- Question one carries 30 marks and the others carry 20 marks each.
- All symbols have their usual meaning unless specified otherwise.

QUESTION ONE (COMPULSORY) (30 MARKS)

FIGURE (1), shows the components of a machine vice in first-angle orthographic projection.

The complete list of parts is as follows:

Item 1	Jaw	1 off	Cast iron
Item 2	Screw	1 off	Cast iron
Item 3	Clamping plate	1 off	Mild steel
Item 4	Locking plate	1 off	Mild steel
Item 5	Lever	1 off	Mild steel
Item 6	Stop block	1 off	Mild steel
Item 7	M12 hexagonal nut	1 off	Mild steel
Item 8	M6 countersunk screw	1 off	Mild steel
Item 9	Washer Cast iron	4 off	Mild steel
Item10	Base	1 off	Mild steel

Draw, to scale 1:1, a three view assembly drawing showing full-sectional front view of the machine vice in an open position with the jaw 65mm apart between the clamping plates (Item 4) . The square screw thread (Item 3) with Item 6 (lever) and Item 7 (stop block) should be in a horizontal position. Number ALL items on the completed assembly drawing and Include parts list.

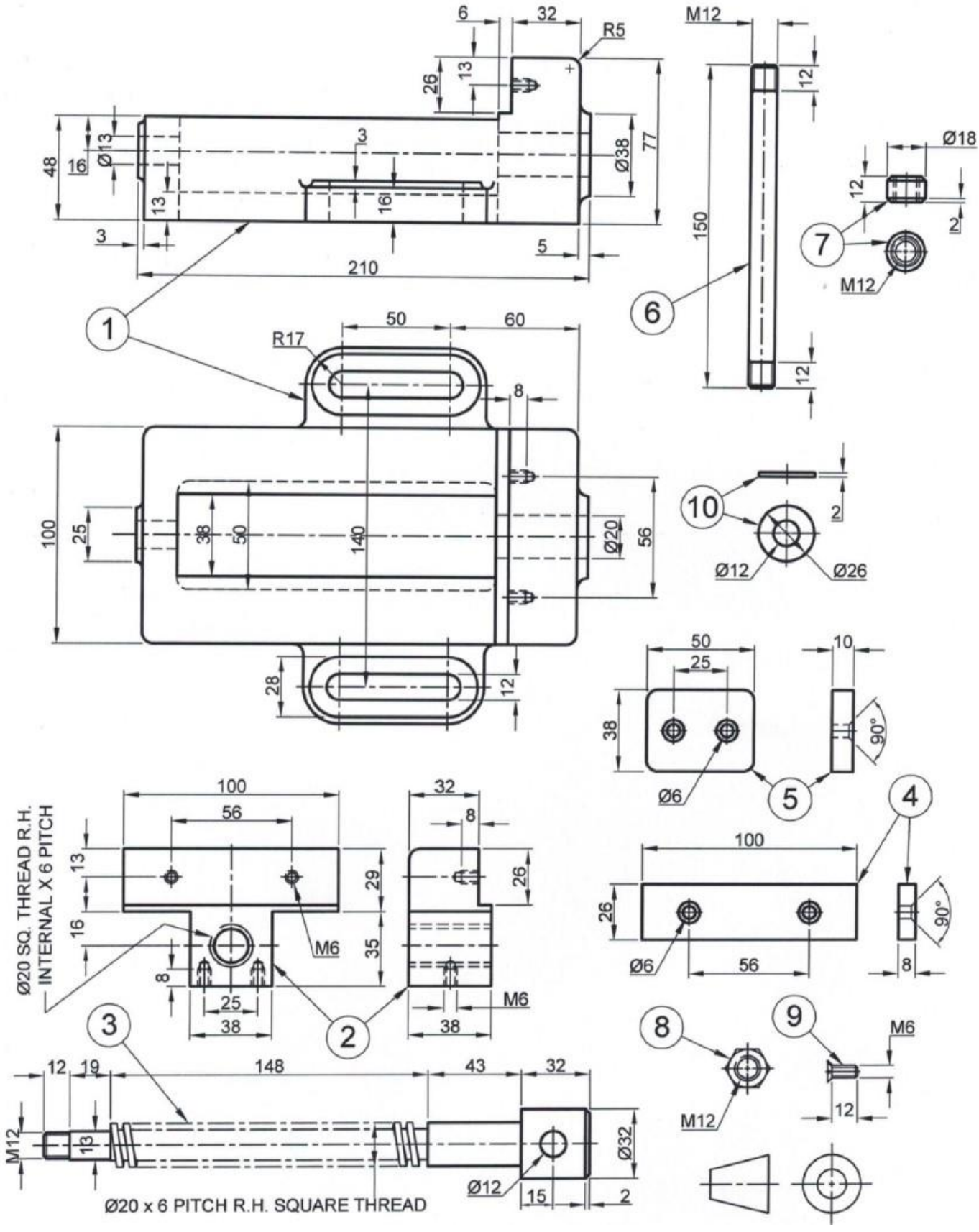


Figure 1: Assembly Drawing

QUESTION TWO (20 MARKS)

FIGURE (2), shows THREE views of a machine part in third-angle orthographic projection.

Draw, to scale 1:1, the following views of the machine part in first-angle orthographic projection:

- A full-sectional front view on cutting plane Z-Z
- A full-sectional left view on sectional plane $Y-Y$ as shown on the front and top views Show only the following dimensions and symbols on the drawing:
- At A: A hole diameter of 36mm with an upper deviation of $+30\mu$m and a lower deviation of -20μm
- At B: Indicate that these planes need to be machined. The roughness value of the surface texture is 12μm.
- At C: Indicate that the plane is parallel to the plane B.

NO hidden details are required.

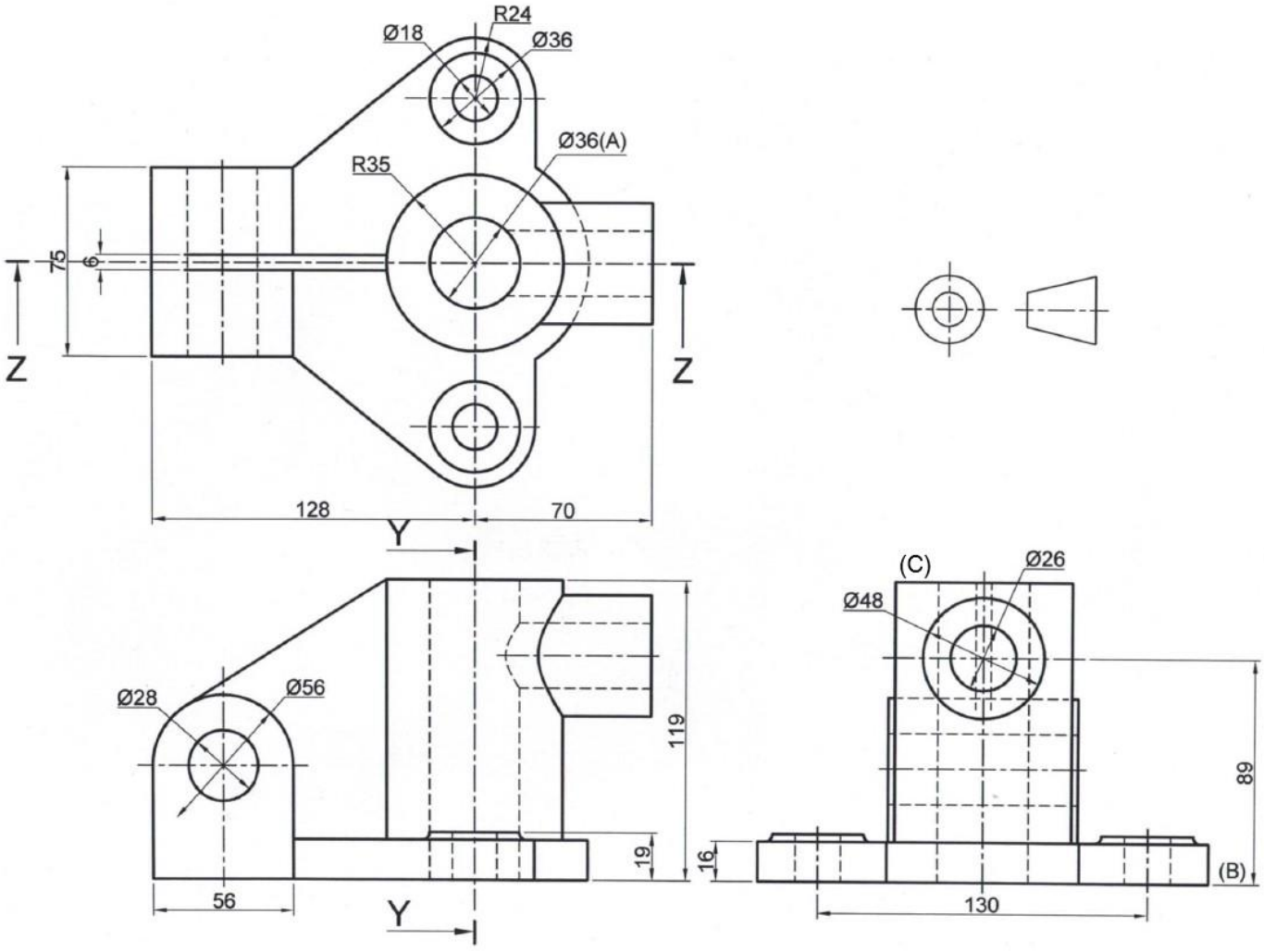


Figure 2: Detail Drawing

QUESTION THREE (20 MARKS)

DIAGRAM SHEET 1 (attached), shows a full-sectional front view of a V-belt drive pulley assembly consisting of the following parts:

- Item 1 - Carrier
- Item 2− Body
- Item 3-Pulley
- Item 4-Spur gear
- Item 5 - Bush
- Item 6 - Shaft
- Item 7− M24 hexagonal nut
- Item 8-M12 hexagonal head screw
- Item 9− Key

a) Draw, to scale 1:1, a detail drawing of the gear (Item 4) in first-angle orthographic projection showing the following views: (8 marks)

i. A half-sectional front view with the top half in section

ii. A side view showing the keyway detail of the hol.

Use the following data:

- Addendum 4mm5mm
- Dedendum 25mm
- Width of gear 96mm
- PCD 28mm
- Hole diameter

Show hidden detail only on the bottom half of the front view.

b) The pulley (Item 3) showing the following views: (6 marks)

- A half-sectional front view with the bottom half in section
- A right view

Insert any FOUR dimensions on the completed detail.

c) The shaft (Item 6) showing the following: A front view, showing the detail of the keyway as well as the thread detail as per conventional representation - NO dash lines are required (6 marks)

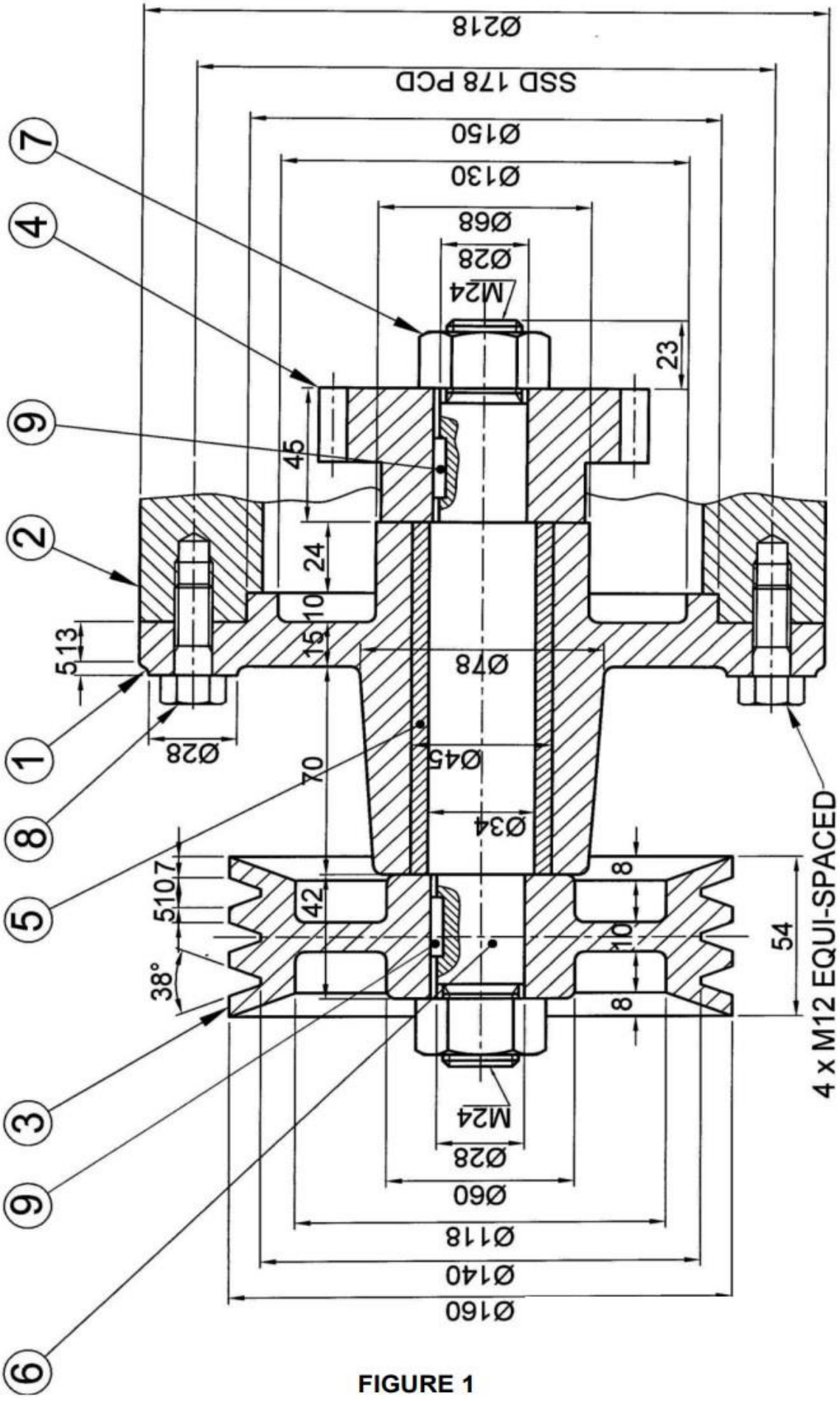

Ø218
SSD 178 PCD
Ø150
Ø130
Ø68
Ø28
M24
23
45
24
10
15
5
13
Ø78
Ø28
70
Ø45
Ø34
5
10
7
42
8
10
8
54
38°
M24
Ø28
Ø60
Ø118
Ø140
Ø160
4 x M12 EQUI-SPACED
1
2
3
4
5
6
7
8
9
9

FIGURE 1

QUESTION FOUR (20 MARKS)

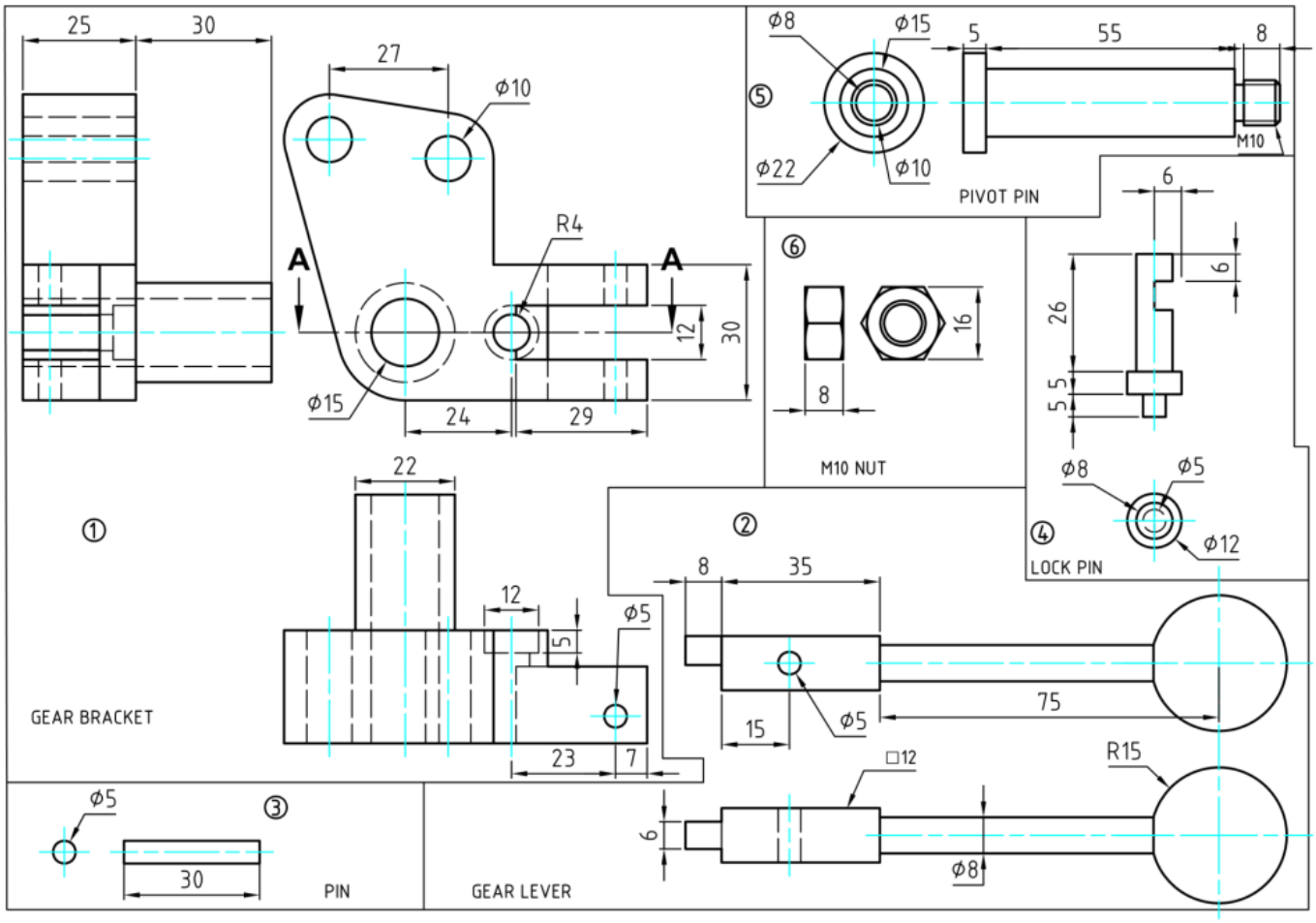
a) With the aid of a diagram illustrate the distinction between the following terms:
   i) Major diameter
   ii) Minor diameter
   iii) Nominal diameter
   iv) Pitch diameter (8 marks)

b) Draw and illustrate the following:
   i) Clearance fit (2 marks)
   ii) Transition fit (2 marks)
   iii) Interference fit (2 marks)

c) Using the data sheet 4500a (selected ISO fits- hole basis) extracted from BS 4500 provided, for the shaft and hole nominal sizes of 10 H9 - e9 calculate:
   i) Maximum diameters
   ii) Minimum diameters (6 marks)

QUESTION FIVE (20 MARKS)

a) Figure 6.5 shows parts of a gear change lever. Draw in third angle projection, the following views:
   I. A front view (5 marks)
   II. A sectional plan view with the cutting plane through A-A (10 marks)
   III. An end views. (5 marks)

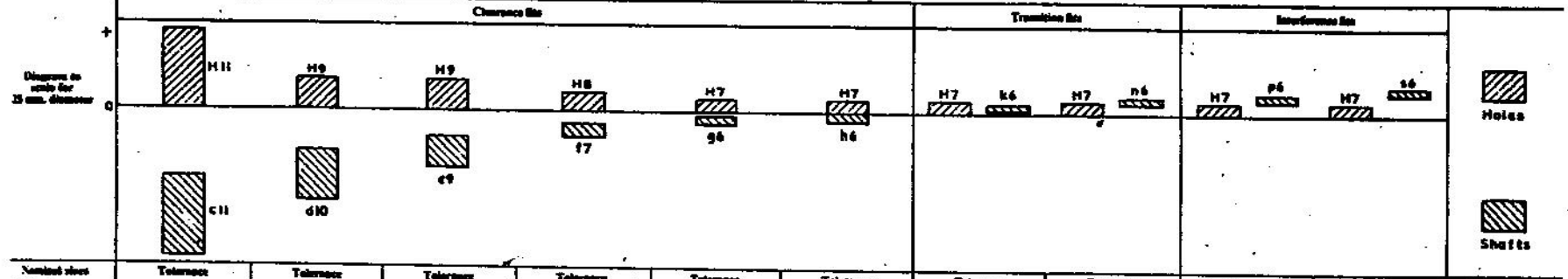

25
30
27
ϕ10
R4
A
A
ϕ15
24
29
12
30
①
GEAR BRACKET
22
12
5
ϕ5
23
7
②
8
35
15
ϕ5
75
□12
6
ϕ8
R15
ϕ8
③
ϕ5
30
PIN
GEAR LEVER
⑤
ϕ8
ϕ15
ϕ22
ϕ10
PIVOT PIN
5
55
8
M10
⑥
8
16
M10 NUT
6
6
26
5
5
④
ϕ8
ϕ5
ϕ12
LOCK PIN

Extracted from BS 4500:

BRITISH STANDARD

SELECTED ISO FITS—HOLE BASIS

Data Sheet 4500A



Nominal sizes		Clearance fits										Transition fits				Interference fits				Nominal sizes	
Over	To	Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance			
		H11	c11	H9	d10	H9	e9	H8	f7	H7	g6	H7	h6	H7	k6	H7	n6	H7	p6	H7	s6		
mm	mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	0·001 mm	mm	mm
—	3	+60 0	−60 −120	+25 0	−20 −60	+25 0	−14 −39	+14 0	−6 −16	+10 0	−2 −8	+10 0	−6 −8	+10 0	+6 +0	+10 0	+10 +4	+10 0	+12 +6	+10 0	+20 +14	—	3
3	6	+75 0	−70 −145	+30 0	−30 −78	+30 0	−20 −50	+18 0	−10 −22	+12 0	−4 −12	+12 0	−8 0	+12 0	+9 +1	+12 0	+16 +8	+12 0	+20 +12	+12 0	+27 +19	3	6
6	10	+90 0	−80 −170	+36 0	−40 −98	+36 0	−25 −61	+22 0	−13 −28	+15 0	−5 −14	+15 0	−9 0	+15 0	+10 +1	+15 0	+19 +10	+15 0	+24 +15	+15 0	+32 +23	6	10
10	18	+110 0	−95 −205	+43 0	−50 −120	+43 0	−32 −75	+27 0	−16 −34	+18 0	−6 −17	+18 0	−11 0	+18 0	+12 +1	+18 0	+23 +12	+18 0	+29 +18	+18 0	+39 +28	10	18
18	30	+130 0	−110 −240	+52 0	−65 −149	+52 0	−40 −92	+33 0	−20 −41	+21 0	−7 −20	+21 0	−13 0	+21 0	+15 +2	+21 0	+28 +15	+21 0	+35 +22	+21 0	+48 +35	18	30
30	40	+160 0	−120 −280	+62 0	−80 −180	+62 0	−50 −112	+39 0	−25 −50	+25 0	−9 −25	+25 0	−16 0	+25 0	+18 +3	+25 0	+33 +17	+25 0	+42 +26	+25 0	+59 +43	30	40
40	50	+160 0	−130 −290																			40	50
50	65	+190 0	−140 −330	+74 0	−100 −220	+74 0	−60 −134	+46 0	−30 −60	+30 0	−10 −29	+30 0	−19 0	+30 0	+21 +2	+30 0	+39 +20	+30 0	+51 +32	+30 0	+72 +53	50	65
65	80	+190 0	−150 −340																	+30 0	+78 +59	65	80
80	100	+220 0	−170 −390	+87 0	−120 −260	+87 0	−72 −159	+54 0	−36 −71	+35 0	−12 −34	+35 0	−22 0	+35 0	+25 +3	+35 0	+45 +23	+35 0	+59 +37	+35 0	+93 +71	80	100
100	120	+220 0	−180 −400																	+35 0	+101 +79	100	120
120	140	+250 0	−200 −450	+100 0	−145 −305	+100 0	−84 −185	+63 0	−43 −83	+40 0	−14 −39	+40 0	−25 0	+40 0	+28 +3	+40 0	+52 +27	+40 0	+68 +43	+40 0	+117 +92	120	140
140	160	+250 0	−210 −460																	+40 0	+125 +100	140	160
160	180	+250 0	−230 −480																	+40 0	+133 +108	160	180
180	200	+290 0	−240 −530	+115 0	−170 −355	+115 0	−100 −215	+72 0	−50 −96	+46 0	−15 −44	+46 0	−29 0	+46 0	+33 +4	+46 0	+60 +31	+46 0	+79 +50	+46 0	+151 +122	180	200
200	225	+290 0	−260 −550																	+46 0	+159 +130	200	225
225	250	+290 0	−280 −570																	+46 0	+169 +140	225	250
250	280	+320 0	−300 −620	+130 0	−190 −400	+130 0	−110 −240	+81 0	−56 −108	+52 0	−17 −49	+52 0	−32 0	+52 0	+36 +4	+52 0	+66 +34	+52 0	+88 +56	+52 0	+190 +158	250	280
280	315	+320 0	−330 −650																	+52 0	+202 +170	280	315
315	355	+360 0	−360 −720	+140 0	−210 −440	+140 0	−125 −265	+89 0	−62 −119	+57 0	−18 −54	+57 0	−36 0	+57 0	+40 +4	+57 0	+73 +37	+57 0	+98 +62	+57 0	+226 +190	315	355
355	400	+360 0	−400 −760																	+57 0	+244 +208	355	400
400	450	+400 0	−440 −840	+155 0	−230 −480	+155 0	−135 −290	+97 0	−68 −131	+63 0	−20 −60	+63 0	−40 0	+63 0	+45 +5	+63 0	+80 +40	+63 0	+108 +68	+63 0	+272 +232	400	450
450	500	+400 0	−480 −880																	+63 0	+292 +252	450	500
		Slack fit		Loose fit		Easy fit		Normal fit		Close fit		Slide fit		Push fit		Drive fit		Press fit		Force fit			

British Standard data sheet BS 4500A; selected ISO fits – hole basis