UNIVERSITY OF BOLTON

OFF CAMPUS DIVISION

WESTERN INTERNATIONAL COLLEGE

BENG (HONS) MECHANICAL ENGINEERING

SEMESTER ONE EXAMINATION 2024/25

GRAPHICAL COMMUNICATIONS AND COMPUTER MODELLING

MODULE NO: AME4065

Date: Saturday, 11 January 2025 **Time: 10:00am – 12:00pm**

INSTRUCTIONS TO CANDIDATES:

Complete the following questions using a pencil for diagrams and pen for written answers. Write your student number, course and today's date above.

The marks for each question are shown. The total number of marks available is 100, 5 marks of which are allocated for overall neatness, clarity and the use of standard lines.

If you are unsure of what to do, ask your tutor. Separate the sheets if necessary but replace them in order at the end of the exam.

BS EN 20286-2 Tolerance Tables are included in this exam paper from page 11 to 14.

You have TWO hours to complete the test.

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1. Write out in full the meaning of the following Standard Drawing abbreviation seen on engineering drawings:

- NTS …….. **(1 mark)**
- PATT No. …….. **(1 mark)**
- SPEC ……..…….. **(1 mark)**

[TOTAL 3 MARKS]

2. Write the standard abbreviation for the following when required on an engineering drawing:

- STANDARD ……**(1 mark)**
- PITCH CIRCLE DIAMETER ……**(1 mark)**
- UNDERCUT ……**(1 mark)**

[TOTAL 3 MARKS]

3. Examine the drawing of various hole-finishing tools as shown in the **figure 3** below. Classify each tool by its function and state its name on the blank line provided.

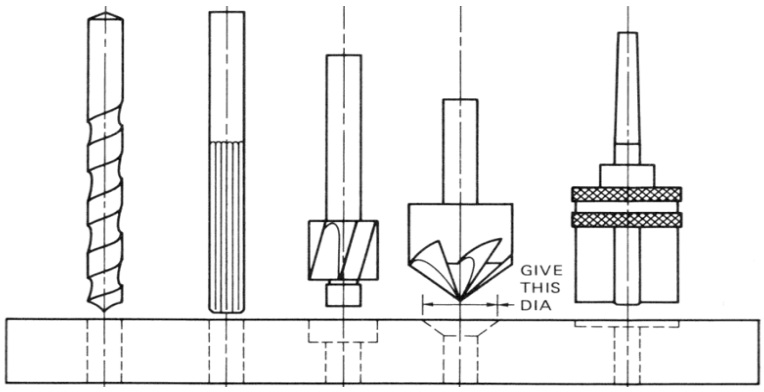

Figure 3: Types of Hole-Preparation and Finishing Tools

i. Tool for creating the initial hole: _____ (1 mark)

ii. Tool for finishing the hole to a precise diameter: _____ (1 mark)

iii. Tool for enlarging the hole to accommodate a fastener's head: _____ (1 mark)

Question 3 continued over the page…

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Question 3 continued…

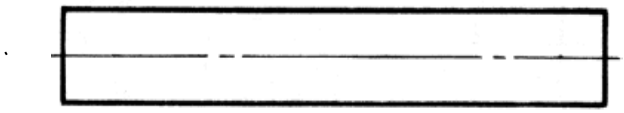
iv. Tool for creating a chamfer at the hole entrance: _____ **(1 mark)**

v. Tool for producing a flat surface around the hole entrance: _____**(1 mark)**

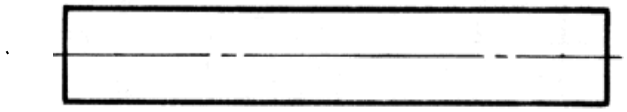
[TOTAL 5 MARKS]

4. Using the partially completed figures below, sketch the standard representation for the following features which might appear on an engineering drawing:

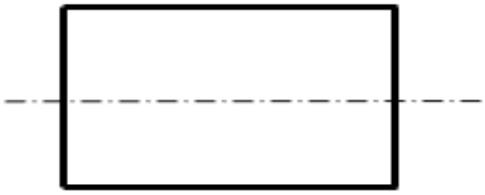
- **Conventional sign of a round bar** **(3 marks)**



- **Hexagonal headed screw** **(3 marks)**



- **A Straight Knurl on a shaft** **(3 marks)**



[TOTAL 9 MARKS]

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5. A cross-sectional view of a shaft, bush bearing and housing assembly is shown in the **figure Q5** below. In this arrangement, the shaft is designed for a "close running" fit within the bush bearing, while the bush bearing is installed as a "press fit" within the housing.

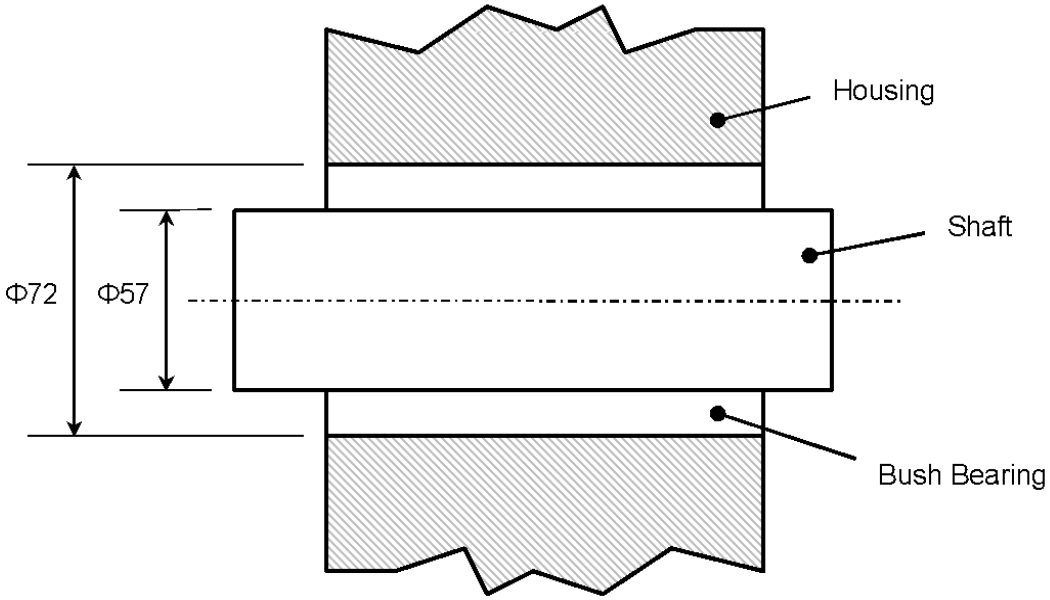

Figure Q5: Cross-sectional view of a shaft, bush bearing and housing assembly

Using the BS EN 20286-2 Tolerance Tables provided, classify the type of fit for each pairing, identify the tolerance limits, and fill in the required values in the **Table Q5** below for the fits between the components.

Question 5 continued over the page…

Question 5 continued…

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Table Q5: Fits and Tolerance table

Between Components	Grade of Tolerance	Type of Fit	Limits of Size for:	Size of Tolerance
Bush/Shaft	H7 g6		Bush	
			Shaft	
Housing/Bush	H7 p6		Housing	
			Bush	

[TOTAL 12 MARKS]

6. State name and describe the meaning of the following Geometrical Tolerance symbols:

a) ∥ ……
(3 marks)

b) ⌭ ……
(3 marks)

c) ⌯ ……
(3 marks)

[TOTAL 9 MARKS]

Please turn the page

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7. State the meaning of the following Geometrical Tolerance statement(s) as seen on an engineering drawing depicted in **Figure Q7** below:

(All dimensions in mm)

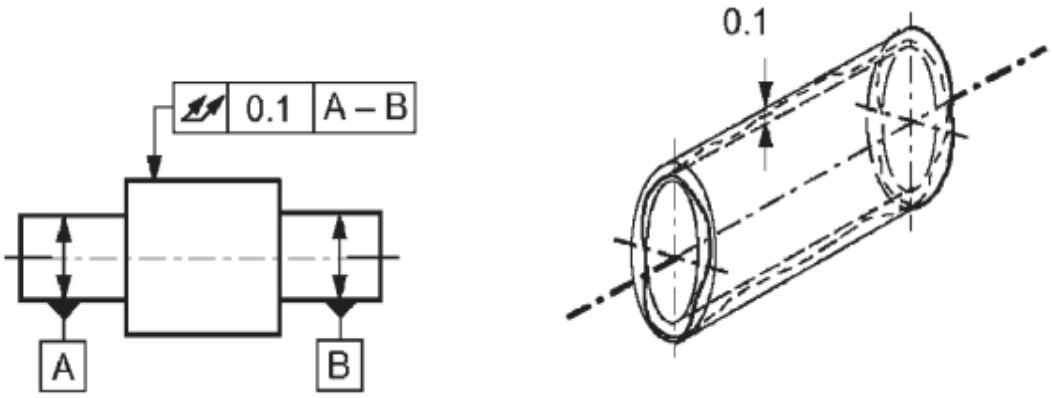

Figure Q7: Tolerance of Cylindrical surface Relative to Datum Axis A–B

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……

[TOTAL 8 MARKS]

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8. An isometric drawing of a tool post is given below in **Figure Q8**. The drawing is not to the scale. Use front view (F.V.) shown below with an arrow for drawing reference.

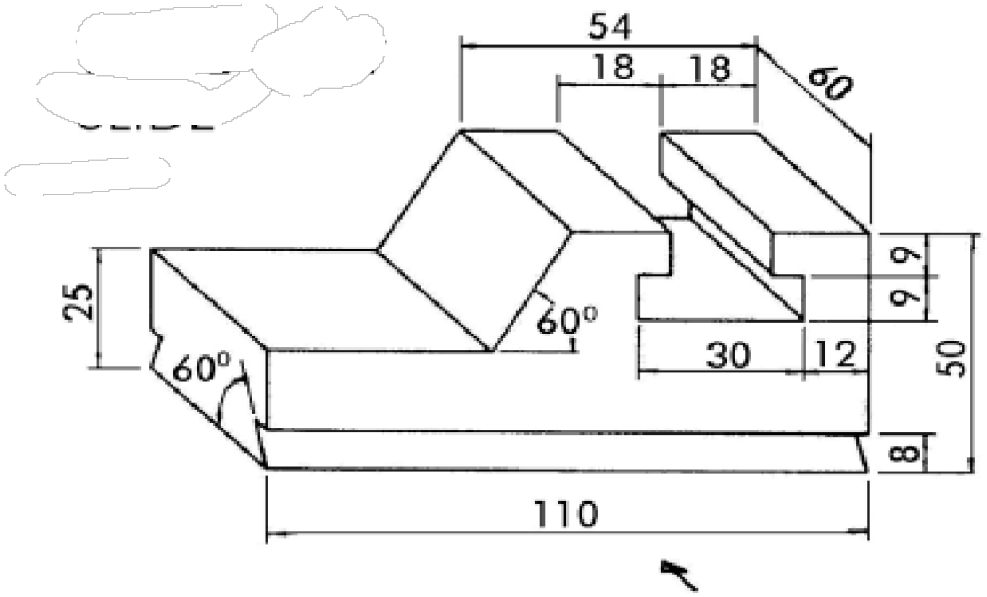

Figure Q8: Tool Post

Sketch in 1st Angle Projection, the Elevation and Plan view of the given drawing with proper projection symbol and student number in title block.

a) Elevation View **(6 marks)**
b) Plan View **(4 marks)**
c) Student number: 1 mark and Projection symbol: 1 mark **(2 marks)**

[TOTAL 12 MARKS]

9. **Page 11** shows a partially completed Orthographic drawing of a section through a Lever. The Plan View is already drawn and the Section View is missing.

The cutting plane passes longitudinally through the centre of the web and section plane is given in the Top view of the lever.

Sketch in 3rd Angle Projection, the Sectional Elevation of the Lever**.** The overall dimensions are given in the isometric view of the lever.
Supply all sectioning information as necessary. Put your student number in the title block.

[TOTAL 14 MARKS]

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10. Shown below is the '**Universal Coupling Parts'** drawing on **page 9**, the components that make up a Universal Coupling Assembly. Each part is dimensioned appropriately with two views for reference. (The drawing is in mm):
Use a pencil and setsquares; draw an **assembly drawing** using **page 12** of the booklet. Show all the parts assembled in their correct positions and hatched according to drawing conventions.

a) Complete Front View in good proportion **(10 marks)**

b) Sectioning of the assembly drawing **(4 marks)**

c) Balloon reference the assembly **(2 marks)**

d) Create Part list of the assembly **(4 marks)**

[TOTAL 20 MARKS]

END OF QUESTIONS
PLEASE TURN THE PAGE FOR SUPPLEMENTARY INFORMATION AND ANSWER SHEETS

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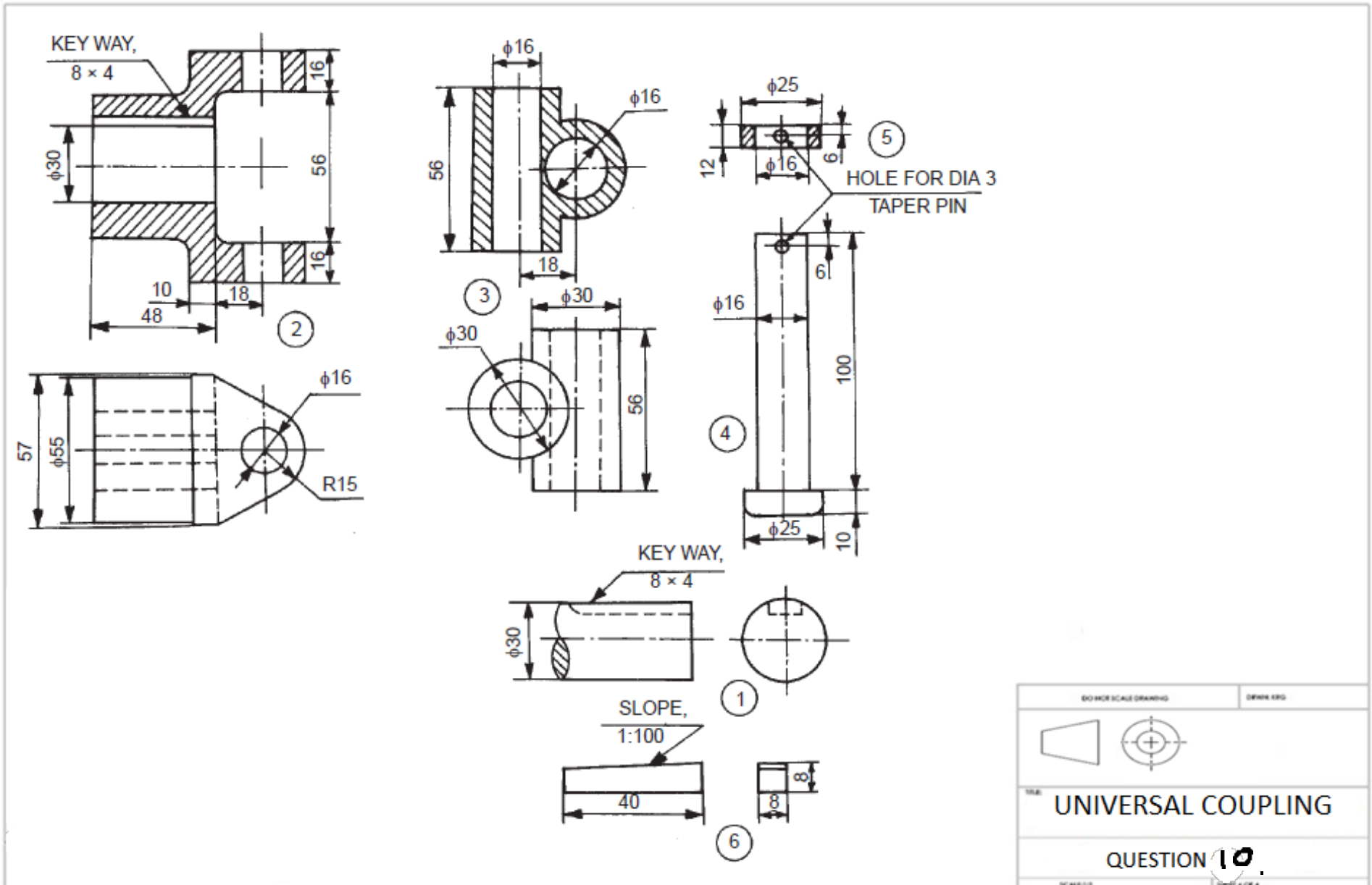

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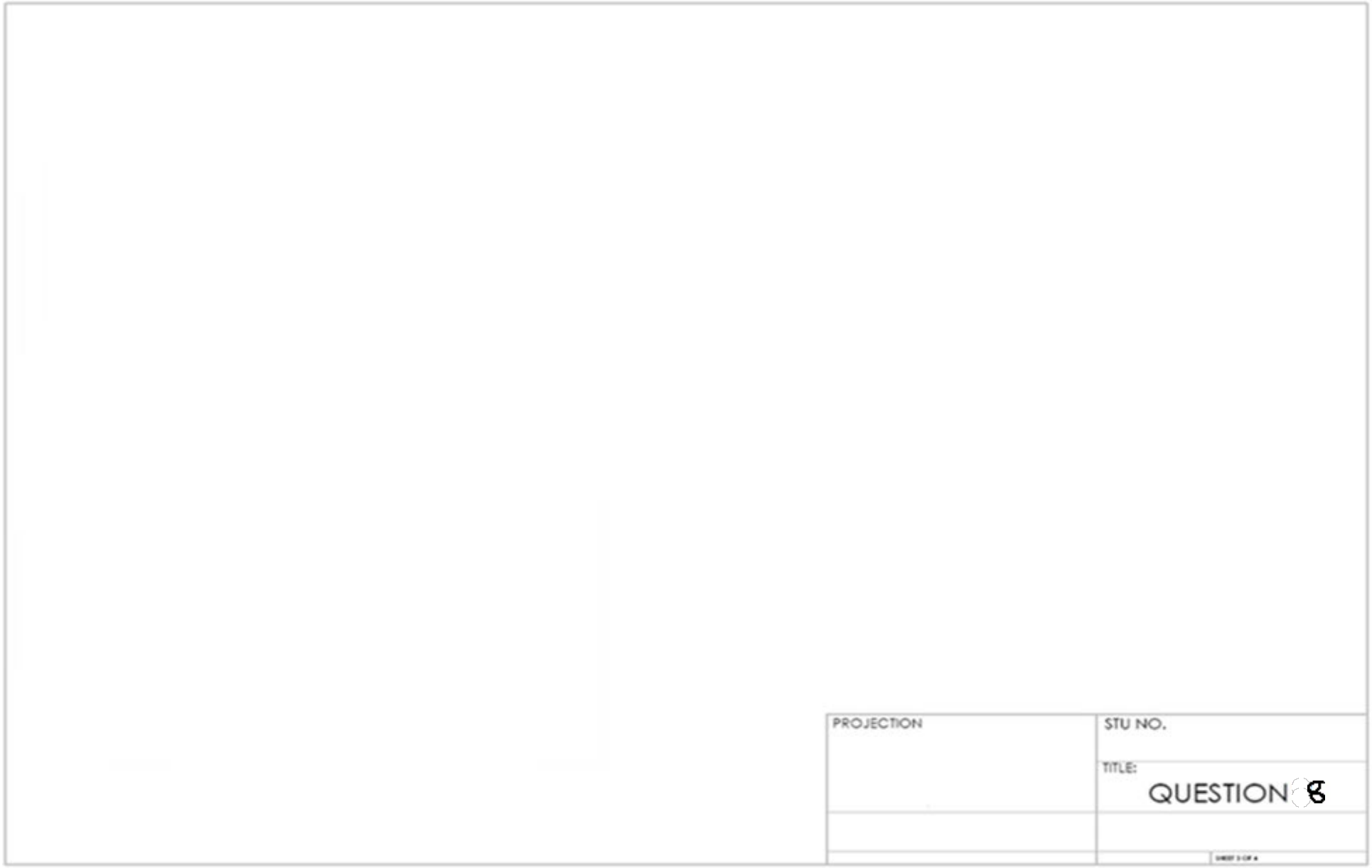

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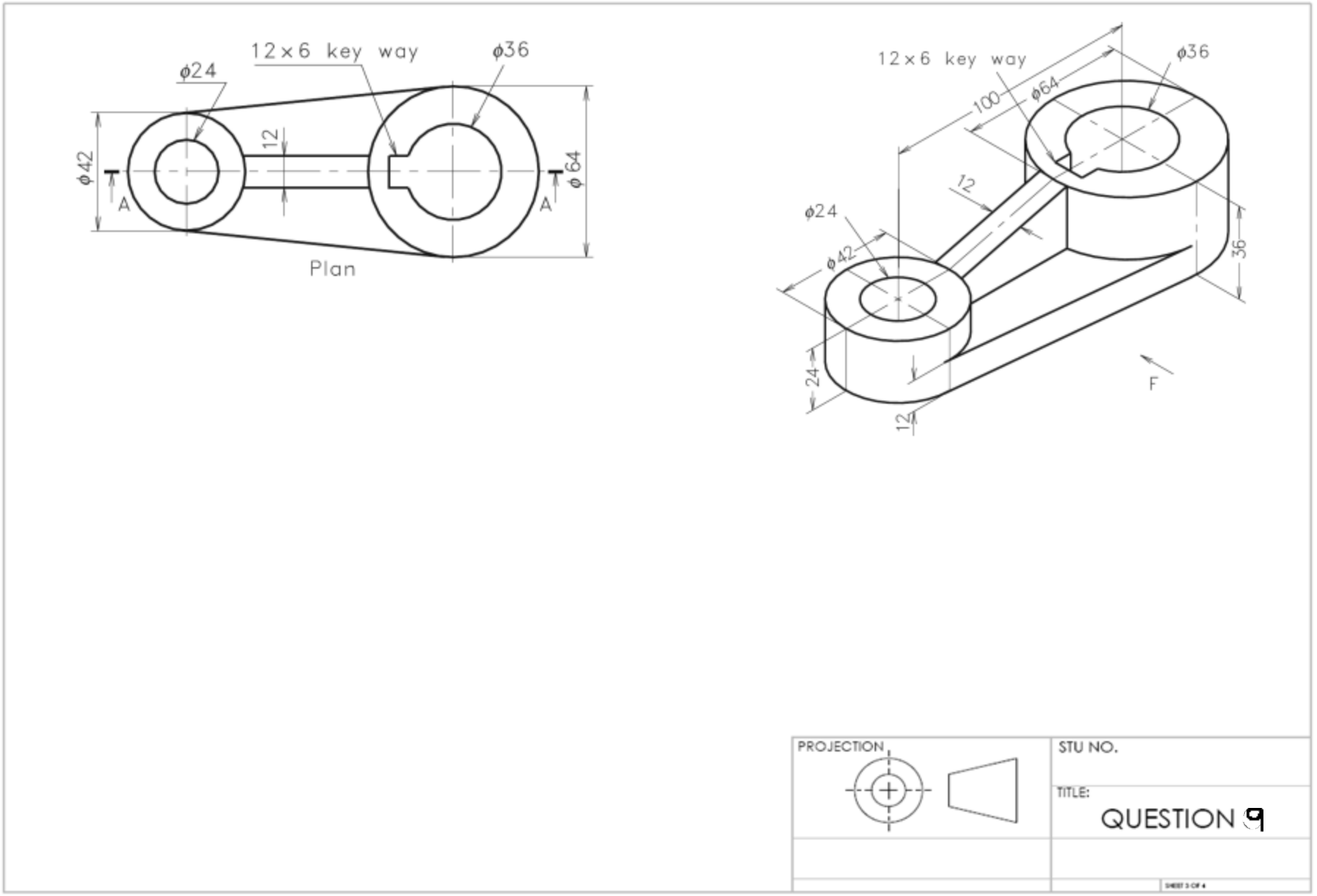

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ISO Tolerances for Holes (ISO 286-2)																			
Nominal hole sizes (mm)																			
over	3	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355
inc.	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355	400
micrometres																			
E6	+28 +20	+34 +25	+43 +32	+53 +40	+66 +50		+79 + 60		+94 +72		+110 +85			+129 +100			+142 +110		+161 +125	
E7	+32 +20	+40 +25	+50 +32	+61 +40	+75 +50		+90 + 60		+107 +72		+125 +85			+146 +100			+162 +110		+185 +125	
E11	+95 +20	+115 +25	+142 +32	+170 +40	+210 +50		+250 + 60		+292 +72		+335 +85			+390 +100			+430 +110		+485 +125	
E12	+140 +20	+175 +25	+212 +32	+250 +40	+300 +50		+360 + 60		+422 +72		+485 +85			+560 +100			+630 +110		+695 +125	
E13	+200 +20	+245 +25	+302 +32	+370 +40	+440 +50		+520 + 60		+612 +72		+715 +85			+820 +100			+920 +110		+1 015 +125	
F6	+18 +10	+22 +13	+27 +16	+33 +20	+41 +2		+49 + 30		+58 +36		+68 43			+79 +50			+88 +56		+98 +62	
F7	+22 +10	+28 +13	+34 +16	+41 +20	+50 +25		+60 + 30		+71 +36		+83 43			+96 +50			+108 +56		+119 +62	
F8	+28 +10	+35 +13	+43 +16	+53 +20	+64 +25		+76 + 30		+90 +36		+106 43			+122 +50			+137 +56		+151 +62	
G6	+12 +4	+14 +5	+17 +6	+20 +7	+25 +9		+29 +10		+34 + 12		+39 +14			+44 +15			+49 +17		+54 +18	
G7	+16 +4	+20 +5	+24 +6	+28 +7	+34 +9		+40 +10		+47 + 12		+54 +14			+61 +15			+69 +17		+75 +18	
G8	+22 +4	+27 +5	+33 +6	+40 +7	+48 +9		+56 +10		+66 + 12		+77 +14			+87 +15			+98 +17		+107 +18	
H6	+8 0	+9 0	+11 0	+13 0	+16 0		+19 0		+22 0		+25 0			+29 0			+32 0		+36 0	
H7	+12 0	+15 0	+18 0	+21 0	+25 0		+30 0		+35 0		+40 0			+46 0			+52 0		+57 0	
H8	+18 0	+22 0	+27 0	+33 0	+39 0		+46 0		+54 0		+63 0			+72 0			+81 0		+89 0	
H9	+30 0	+36 0	+43 0	+52 0	+62 0		+74 0		+87 0		+100 0			+115 0			+130 0		+140 0	
H10	+48 0	+58 0	+70 0	+84 0	+100 0		+120 0		+140 0		+160 0			+185 0			+210 0		+230 0	
H11	+75 0	+90 0	+110 0	+130 0	+160 0		+190 0		+220 0		+250 0			+290 0			+320 0		+360 0	
J6	+5 -3	+5 -4	+6 -5	+8 -5	+10 -6		+13 -6		+16 -6		+18 -7			+22 -7			+25 -7		+29 -7	
J7	+6 -6	+8 -7	+10 -8	+12 -9	+14 -11		+18 -12		+22 -13		+26 -14			+30 -16			+36 -16		+39 -18	
J8	+10 -8	+12 -10	+15 -12	+20 -13	+24 -15		+28 -18		+34 -20		+41 -22			+47 -25			+55 -26		+60 -29	
JS6	+4 -4	+4.5 -4.5	+5.5 -5.5	+6.5 -6.5	+8 -8		+9.5 -9.5		+11 -11		+12.5 -12.5			+14.5 -14.5			+16 -16		+18 -18	

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JS7	+6 -6	+7.5 -7.5	+9 -9	+10.5 -10.5	+12.5 -12.5	+15 -15		+17.5 -17.5		+20 -20			+23 -23			+26 -26		+28.5 -28.5	
JS8	+9 -9	+11 -11	+13.5 -13.5	+16.5 -16.5	+19.5 -19.5	+23 -23		+27 -27		+31.5 -31.5			+36 -36			+40.5 -40.5		+44.5 -44.5	
K6	+2 -6	+2 -7	+2 -9	+2 -11	+3 -13	+4 -15		+4 -18		+4 -21			+5 -24			+5 -27		+7 -29	
K7	+3 -9	+5 -10	+6 -12	+6 -15	+7 -18	+9 -21		+10 -25		+12 -28			+13 -33			+16 -36		+17 -40	
K8	+5 -13	+6 -16	+8 -19	+10 -23	+12 -27	+14 -32		+16 -38		+20 -43			+22 -50			+25 -56		+28 -61	
M6	-1 -9	-3 -12	-4 -15	-4 -17	-4 -20	-5 -24		-6 -28		-8 -33			-8 -37			-9 -41		-10 -46	
M7	0 -12	0 -15	0 -18	0 -21	0 -25	0 -30		0 -35		0 -40			0 -46			0 -52		0 -57	
M8	+2 -16	+1 -21	+2 -25	+4 -29	+5 -34	+5 -41		+6 -48		+8 -55			+9 -63			+9 -72		+11 -78	
N6	-5 -13	-7 -16	-9 -20	-11 -24	-12 -28	-14 -33		-16 -38		-20 -45			-22 -51			-25 -57		-26 -62	
N7	-4 -16	-4 -19	-5 -23	-7 -28	-8 -33	-9 -39		-10 -45		-12 -52			-14 -60			-14 -66		-16 -73	
N8	-2 -20	-3 -25	-3 -30	-3 -36	-3 -42	-4 -50		-4 -58		-4 -67			-5 -77			-5 -86		-5 -94	
P6	-9 -17	-12 -21	-15 -26	-18 -31	-21 -37	-26 -45		-30 -52		-36 -61			-41 -70			-47 -79		-51 -87	
P7	-8 -20	-9 -24	-11 -29	-14 -35	-17 -42	-21 -51		-24 -59		-28 -68			-33 -79			-36 -88		-41 -98	
P8	-12 -30	-15 -37	-18 -45	-22 -55	-26 -65	-32 -78		-37 -91		-43 -106			-50 -122			-56 -137		-62 -151	
R6	-12 -20	-16 -25	-20 -31	-24 -37	-29 -45	-35 -54	-37 -56	-44 -66	-47 -69	-56 -81	-58 -83	-61 -86	-68 -97	-71 -100	-75 -104	-85 -117	-89 -121	-97 -133	-103 -139
R7	-11 -23	-13 -28	-16 -34	-20 -41	-25 -50	-30 -60	-32 -62	-38 -73	-41 -76	-48 -88	-50 -90	-53 -93	-60 -106	-63 -109	-67 -113	-74 -126	-78 -130	-87 -144	-93 -150

ISO Tolerances for Shafts (ISO 286-2)																				
Nominal Shaft Sizes (mm)																				
over	3	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355
inc.	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355	400
micrometres																				
a12	-270 -390	-280 -430	-290 -470	-300 -510	-310 -560	-320 -570	-340 -640	-360 -660	-380 -730	-410 -760	-460 -860	-520 -920	-580 -980	-660 -1120	-740 -1200	-820 -1280	-920 -1440	-1050 -1570	-1200 -1770	-1350 -1920
d6	-30 -38	-40 -49	-50 -61	-65 -78	-80 -96		-100 -119		-120 -142		-145 -170			-170 -199			-190 -222		-210 -246	
e6	-20 -28	-25 -34	-32 -43	-40 -53	-50 -66		-60 -79		-72 -94		-85 -110			-100 -129			-110 -142		-125 -161	
e13	-20 - 200	-25 - 245	-32 - 302	-40 - 370	-50 -440		-60 -520		-72 -612		-85 -715			-100 -820			-110 -920		-125 -1015	

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f5	-10 -15	-13 -19	-16 -24	-20 -29	-25 -36	-30 -43	-36 -51	-43 -61	-50 -70	-56 -79	-62 -87
f6	-10 -18	-13 -22	-16 -27	-20 -33	-25 -41	-30 -49	-36 -58	-43 -68	-50 -79	-56 -88	-62 -98
f7	-10 -22	-13 -28	-16 -34	-20 -41	-25 -50	-30 -60	-36 -71	-43 -83	-50 -96	-56 -108	-62 -119
g5	-4 -9	-5 -11	-6 -14	-7 -16	-9 -20	-10 -23	-12 -27	-14 -32	-15 -35	-17 -40	-18 -43
g6	-4 -12	-5 -14	-6 -17	-7 -20	-9 -25	-10 -29	-12 -34	-14 -39	-15 -44	-17 -49	-18 -54
g7	-4 -16	-5 -20	-6 -24	-7 -28	-9 -34	-10 -40	-12 -47	-14 -54	-15 -61	-17 -69	-18 -75
h4	-0 -4	-0 -4	-0 -5	-0 -6	-0 -7	-0 -8	-0 -10	-0 -12	-0 -14	-0 -16	-0 -18
h5	-0 -5	-0 -6	-0 -8	-0 -9	-0 -11	-0 -13	-0 -15	-0 -18	-0 -20	-0 -23	-0 -25
h6	-0 -8	-0 -9	-0 -11	-0 -13	-0 -16	-0 -19	-0 -22	-0 -25	-0 -29	-0 -32	-0 -36
h7	-0 -12	-0 -15	-0 -18	-0 -21	-0 -25	-0 -30	-0 -35	-0 -40	-0 -46	-0 -52	-0 -57
h8	-0 -18	-0 -22	-0 -27	-0 -33	-0 -39	-0 -46	-0 -54	-0 -63	-0 -72	-0 -81	-0 -89
h9	-0 -30	-0 -36	-0 -43	-0 -52	-0 -62	-0 -74	-0 -87	-0 -100	-0 -115	-0 -130	-0 -140
h10	-0 -48	-0 -58	-0 -70	-0 -84	-0 -100	-0 -120	-0 -140	-0 -160	-0 -185	-0 -210	-0 -230
h11	-0 -75	-0 -90	-0 -110	-0 -130	-0 -160	-0 -190	-0 -220	-0 -250	-0 -290	-0 -320	-0 -360
h12	-0 -120	-0 -150	-0 -180	-0 -210	-0 -250	-0 -300	-0 -350	-0 -400	-0 -460	-0 -520	-0 -570
j5	+3 -2	+4 -2	+5 -3	+5 -4	+6 -5	+6 -7	+6 -9	+7 -11	+7 -13	+7 -16	+7 -18
j6	+6 -2	+7 -2	+8 -3	+9 -4	+11 -5	+12 -7	+13 -9	+14 -11	+16 -13	+16 -16	+18 -18
j7	+8 -4	+10 -5	+12 -6	+13 -8	+15 -10	+18 -12	+20 -15	+22 -18	+25 -21	+26 -26	+29 -28
js5	+2.5 -2.5	+3 -3	+4 -4	+4.5 -4.5	+5.5 -5.5	+6.5 -6.5	+7.5 -7.5	+9 -9	+10 -10	+11.5 -11.5	+12.5 -12.5
js6	+4 -4	+4.5 -4.5	+5.5 -5.5	+6.5 -6.5	+8 -8	+9.5 -9.5	+11 -11	+12.5 -12.5	+14.5 -14.5	+16 -16	+18 -18
js7	+6 -6	+7.5 -7.5	+9 -9	+10.5 -10.5	+12.5 -12.5	+15 -15	+17.5 -17.5	+20 -20	+23 -23	+26 -26	+28.5 -28.5
k5	+6 +1	+7 +1	+9 +1	+11 +2	+13 +2	+15 +2	+18 +3	+21 +3	+24 +4	+27 +4	+29 +4
k6	+9 +1	+10 +1	+12 +1	+15 +2	+18 +2	+21 +2	+25 +3	+28 +3	+33 +4	+36 +4	+40 +4
k7	+13 +1	+16 +1	+19 +1	+23 +2	+27 +2	+32 +2	+38 +3	+43 +3	+50 +4	+56 +4	+61 +4
m5	+9 +4	+12 +6	+15 +7	+17 +8	+20 +9	+24 +11	+28 +13	+33 +15	+37 +17	+43 +20	+46 +21
m6	+12 +4	+15 +6	+18 +7	+21 +8	+25 +9	+30 +11	+35 +13	+40 +15	+46 +17	+52 +20	+57 +21
m7	+16 +4	+21 +6	+25 +7	+29 +8	+34 +9	+41 +11	+48 +13	+55 +15	+63 +17	+72 +20	+78 +21
n5	+13 +8	+16 +10	+20 +12	+24 +15	+28 +17	+33 +20	+38 +23	+45 +27	+51 +31	+57 +34	+62 +37

University of Bolton
Off Campus Division – Western International College
BEng (Hons) Mechanical Engineering
Semester One Examination 2024/2025
Graphical Communications and Computer Modelling
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n6	+16 +8	+19 +10	+23 +12	+28 +15	+33 +17	+39 +20		+45 +23		+52 +27			+60 +31			+66 +34		+73 +37		
n7	+20 +8	+25 +10	+30 +12	+36 +15	+42 +17	+50 +20		+58 +23		+67 +27			+77 +31			+86 +34		+94 +37		
p5	+17 +12	+21 +15	+26 +18	+31 +22	+37 +26	+45 +32		+52 +37		+61 +43			+70 +50			+79 +56		+87 +62		
p6	+20 +12	+24 +15	+29 +18	+35 +22	+42 +26	+51 +32		+59 +37		+68 +43			+79 +50			+88 +56		+98 +62		
r6	+23 +15	+28 +19	+34 +23	+41 +28	+50 +34	+60 +41	+62 +43	+73 +51	+76 +54	+88 +63	+90 +65	+93 +68	+106 +77	+109 +80	+113 +84	+126 +94	+130 +98	+144 +108	+150 +114	

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