

NANYANG TECHNOLOGICAL UNIVERSITY
SEMESTER 1 EXAMINATION 2015-2016
MA2005 - ENGINEERING GRAPHICS

November/December 2015

Time Allowed: 2½ hours

Seat Number :

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Matriculation Number:

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INSTRUCTIONS TO CANDIDATES

1. This Question and Answer (Q & A) Book contains **FOUR (4)** questions and comprises **FIFTEEN (15)** pages.
2. Answer **ALL** the questions and all questions carry equal marks.
3. Write your answers for all the questions in the Q & A Book.
4. Do not write your name on the Q & A Book.
5. Write your matriculation number on the front page of this Q & A Book.
6. Candidates are **NOT** allowed to remove any page from the Q & A Book.
7. This Q & A Book, used or unused, must not be removed from the Examination Hall. It **MUST BE HANDED IN** at the end of the examination.
8. This is a **CLOSED - BOOK** examination.

EXAMINER'S USE ONLY	
Questions	Marks
1	
2	
3a	
3b	
4	
Total	

- 1(a) A support as shown in Figure 1(a) is presented in **Third Angle Projection**. Draw all the incomplete views of the object showing all the construction lines and outlines with hidden details clearly.

(12 marks)

/ 12

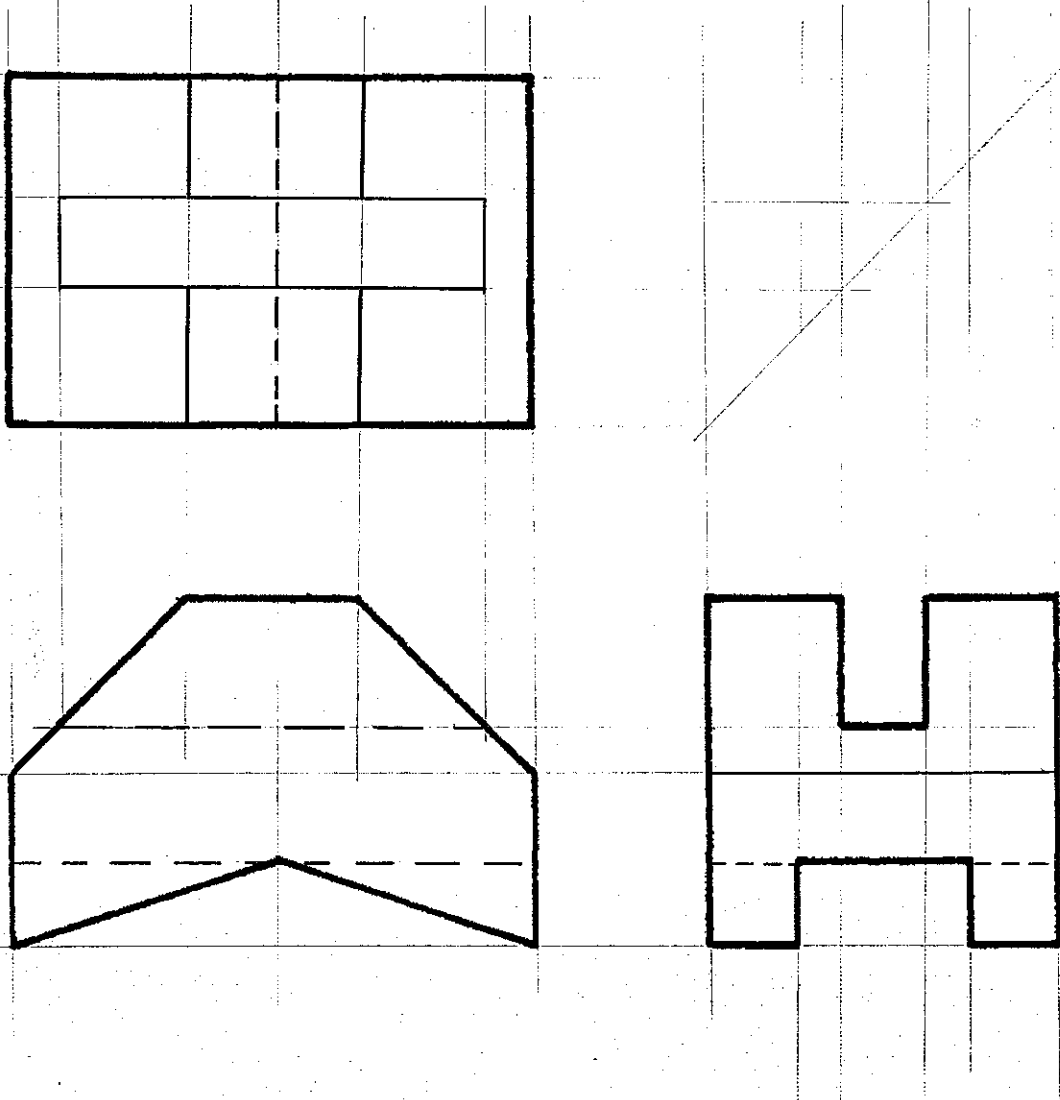


Figure 1(a)

1(b) Figure 1(b) shows the front elevation and the plan of a plane D-E-F in First Angle Projection. Draw the true shape of the plane D-E-F.

(13 marks)

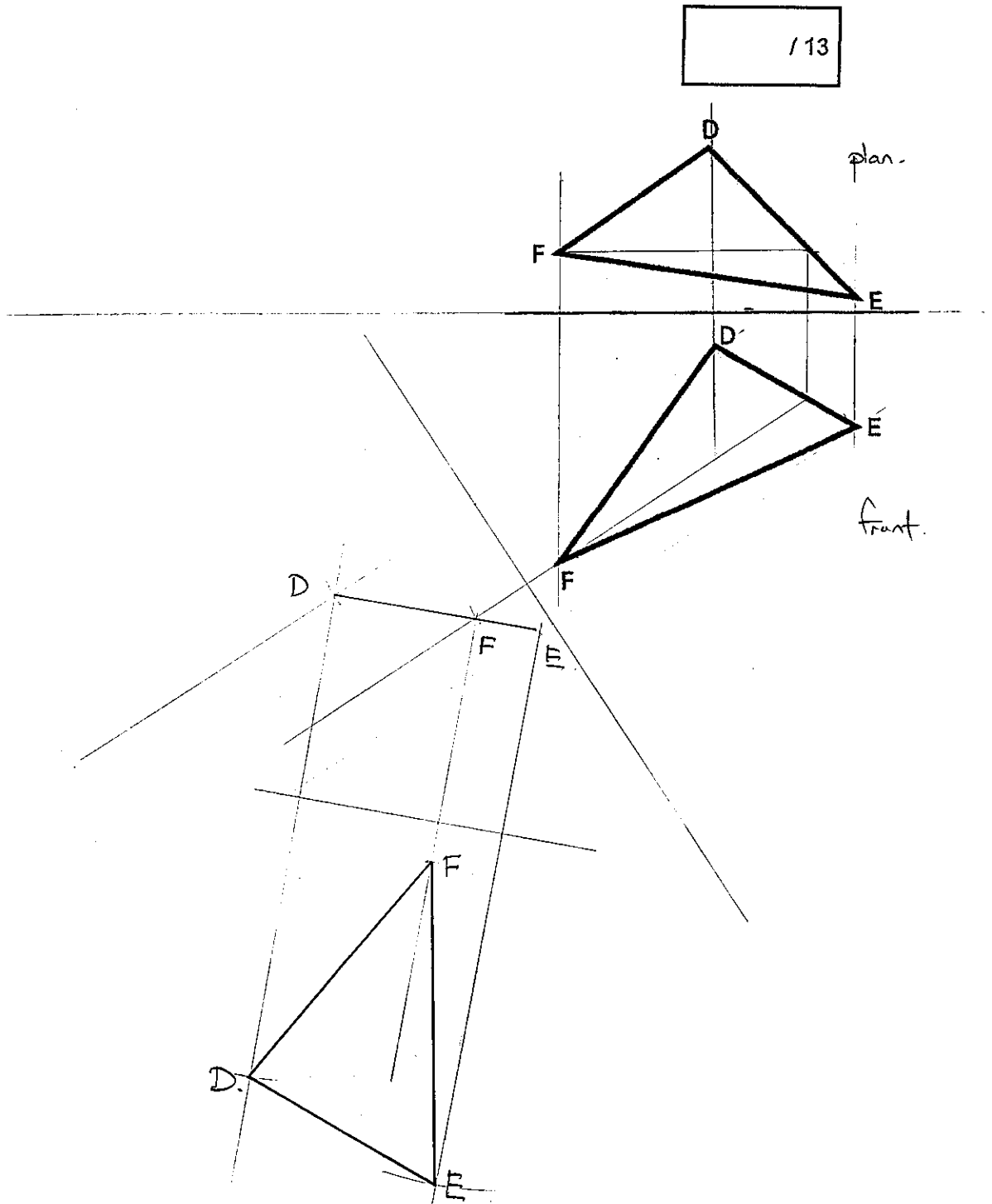


Figure 1(b)

2(a) Figure 2(a) shows the orthographic views of a base support presented in **First Angle Projection**. Using the isometric paper provided, draw full size the isometric drawing of the object so that point **A** will be the lowest point in the drawing. Hidden details are not required. Each grid unit represents 5 mm.

(12 marks)

/ 12

Note: Each grid unit represents 5 mm

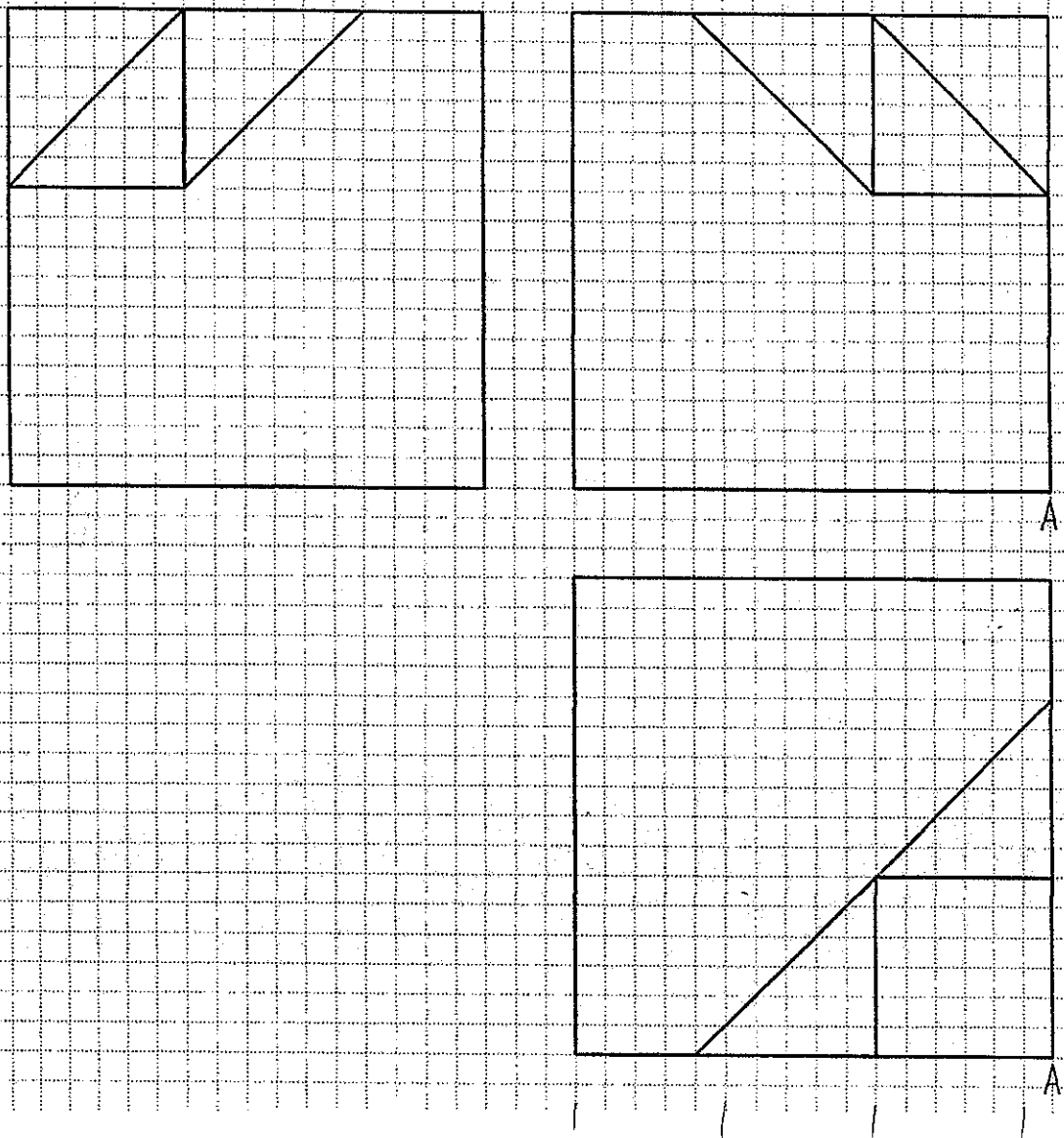
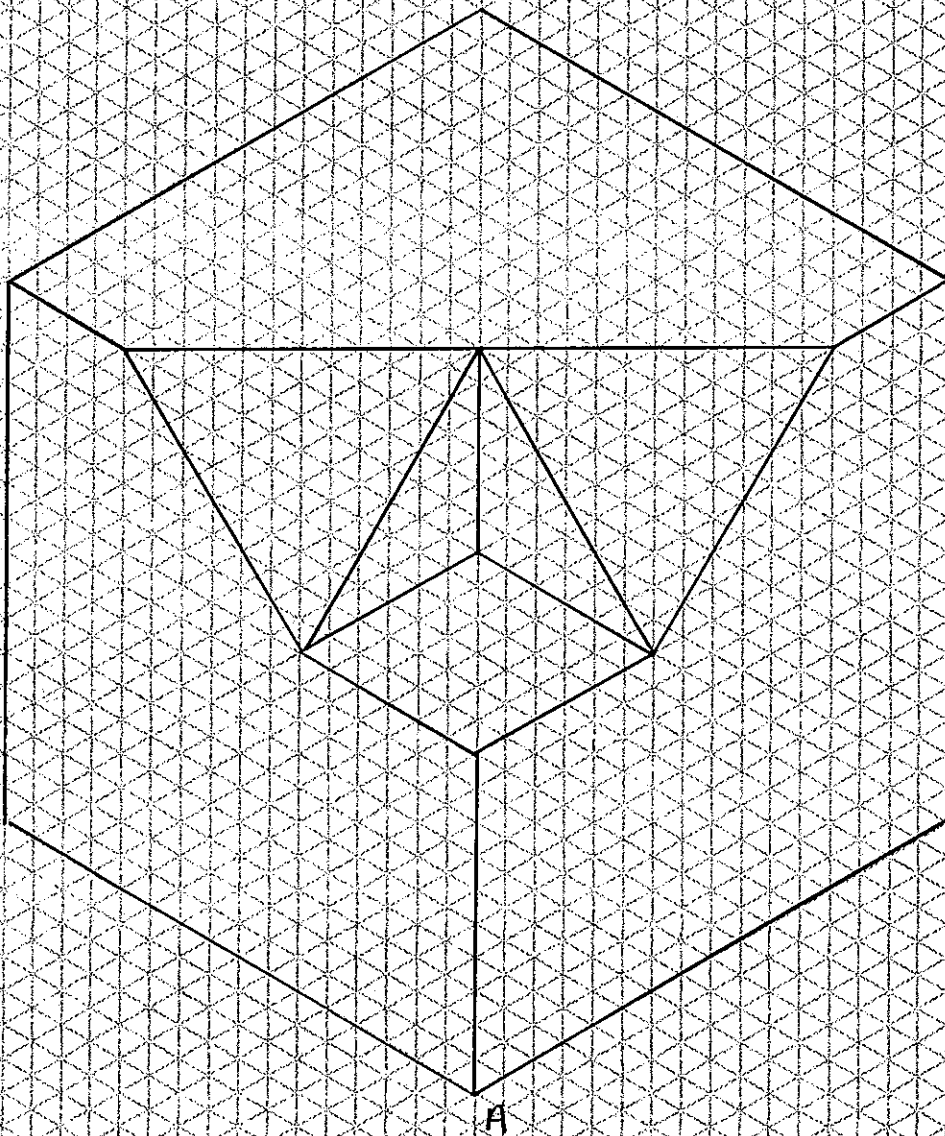


Figure 2(a)

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Note: Each grid unit represents 5 mm



A

MA2005

2(b) Figure 2(b) shows the plan and front elevation of an upright pyramid intersecting a prism in **Third Angle Projection**. Draw its development of the pyramid. Begin the pattern with the seam at 0-1 and seam allowance is not required.

(13 marks)

/ 13

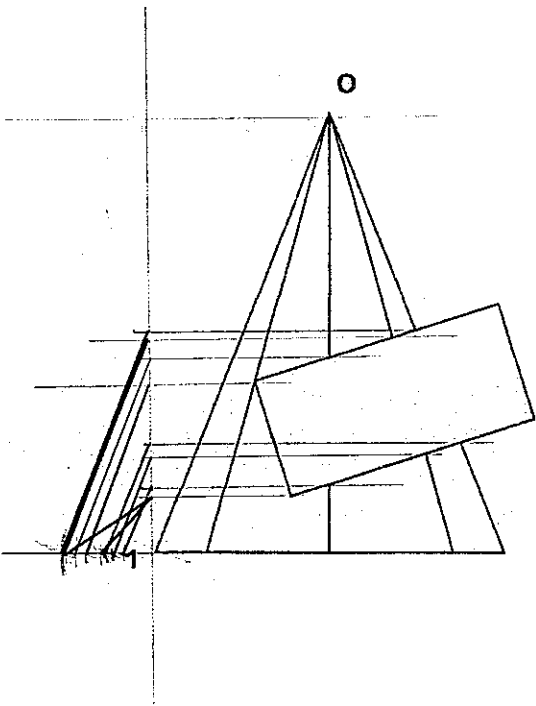
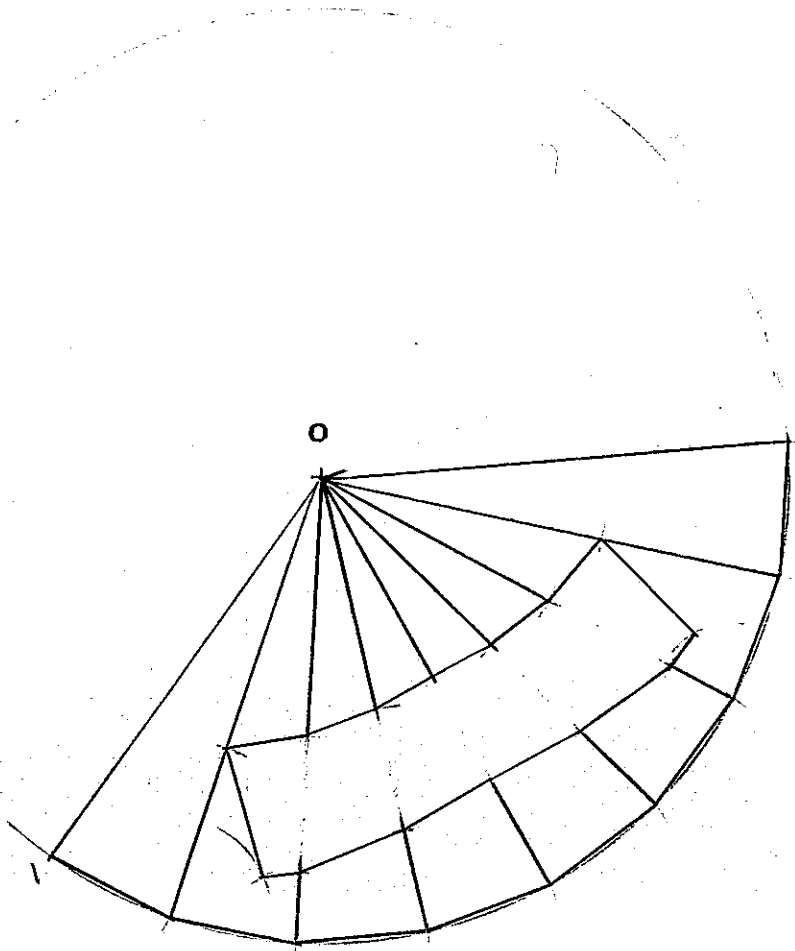
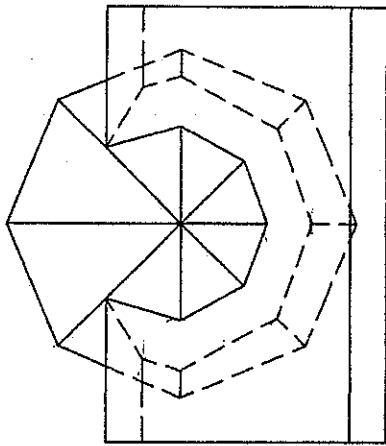


Figure 2(b)

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- 3(a) A support as shown in Figure 3(a) is presented in the **Third Angle Projection**. Draw a sectional view on A-A of the object showing all the construction lines and outlines clearly. Hidden lines are not required.

(13 marks)

/ 13

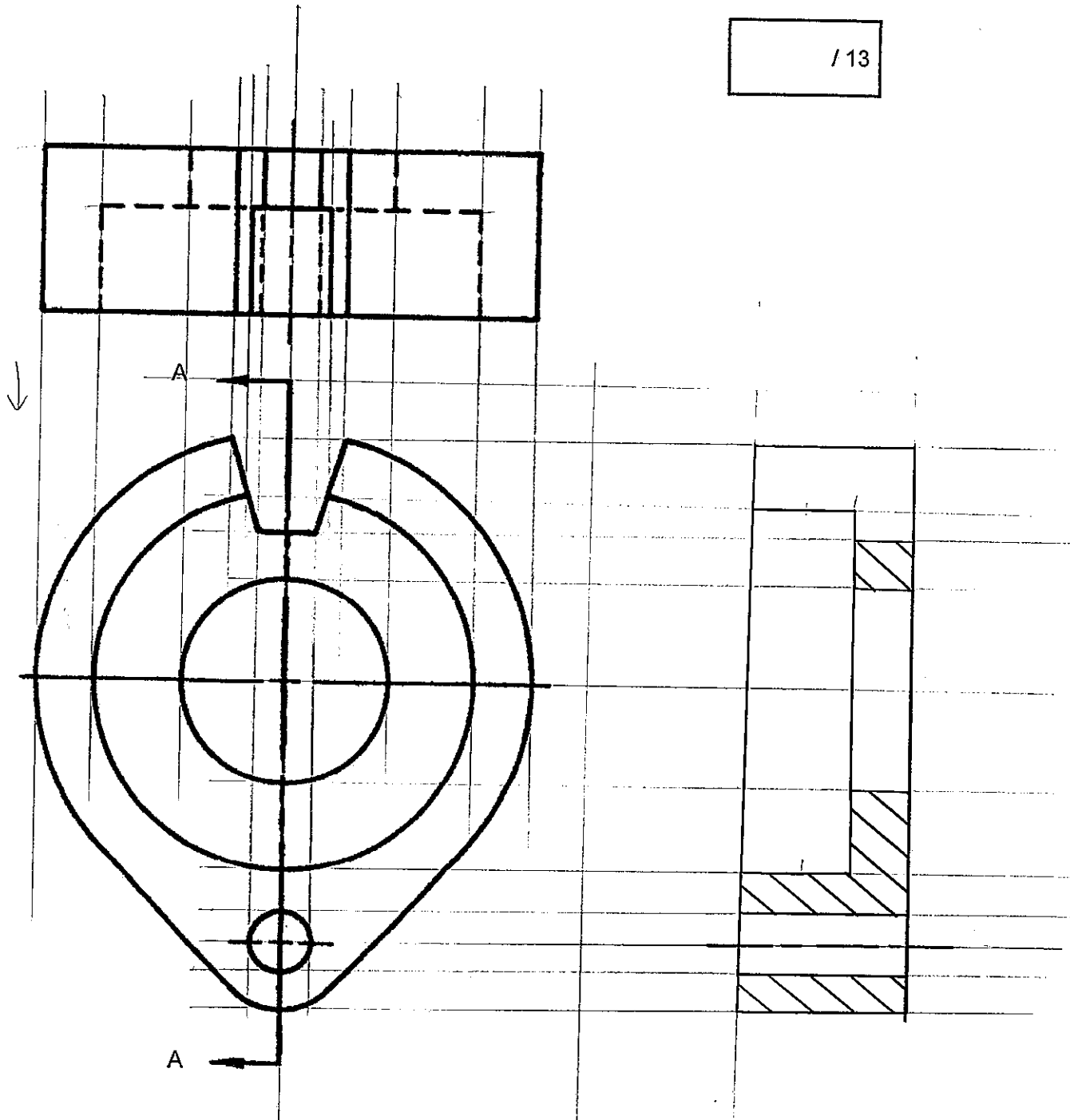


Figure 3(a)

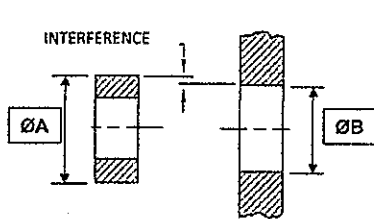
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to allow for workings.

3(b) Using the Tables in the Appendix, determine and enter the missing dimensions into each of the Tables as shown in Figure 3(b).

(12 marks)

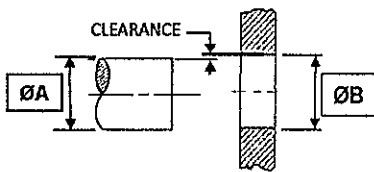
/ 12



		ØA	ØB
Basic dimension		--	55.750
-	Upper limit	55.809	55.775
	Lower limit	55.793	55.750

$\text{max interference} = 0.059$
 $= -\text{MMC}(\text{Hole } \phi B) + \text{MMC}(\text{Shaft } \phi A)$
 $= -55.750 + \text{MMC}(\text{shaft})$
 $\therefore \text{MMC}(\text{shaft } \phi A) = 55.809$

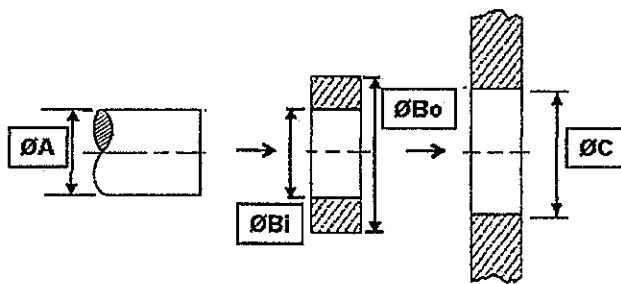
Bushing A to have a tolerance of 0.016 and a maximum interference of 0.059.



		ØA	ØB
Basic dimension		95.600	--
-	Upper limit	95.600	95.990
	Lower limit	95.380	95.580

$\text{max clearance} = 0.610$
 $= \text{LMC}(\phi B) - \text{LMC}(\phi A)$
 $= 95.990 - \text{LMC}(\phi A)$
 $\therefore \text{LMC}(\phi A) = 95.380$

Shaft A to have a tolerance of 0.220 and a maximum clearance of 0.610



Shaft A Bushing B Housing C

Fitting between B & C		ØBo	ØC
Type of Fit	Basic dimension	108.500	--
H7/g6	Upper limit	108.500	108.389
	Lower limit	108.478	108.354

Fitting between A & B		ØBi	ØA
Type of Fit	Basic dimension	55.750	--
H7/g6	Upper limit	55.775	55.741
	Lower limit	55.750	55.725

Fitting conditions:

Force drive fit between bushing B and housing C; sliding fit between shaft A and bushing B.

Figure 3(b)

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4(a) Determine and enter the missing data into the Table as shown in Figure 4(a).
(5 marks)

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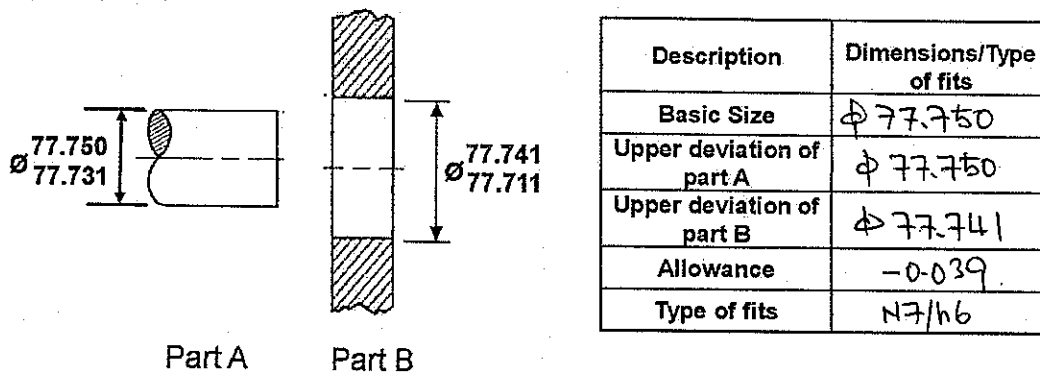
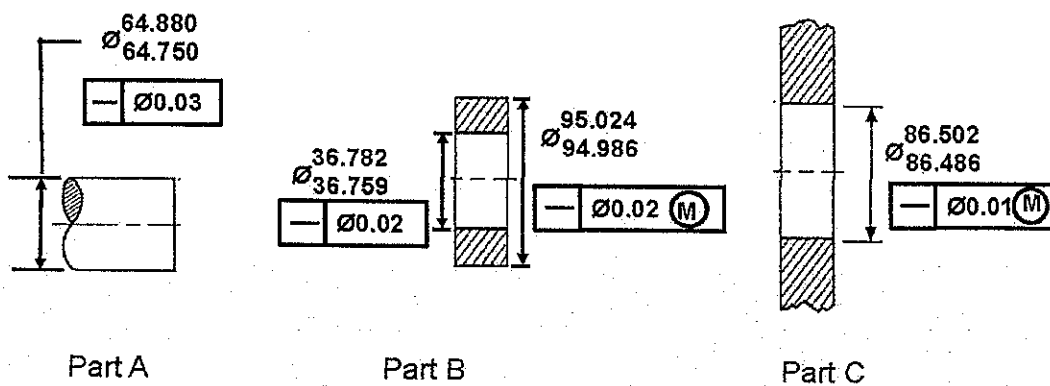


Figure 4(a)

4(b) Determine and enter the virtual conditions into the Table as shown in Figure 4(b).
(4 marks)

/ 4



Part	Virtual condition
A	$\phi 64.910$
B (inner ϕ)	$\phi 36.739$
B (outer ϕ)	$\phi 95.044$
C	$\phi 86.476$

Figure 4(b)

4(c) In order to assemble correctly, the centre of the hole and boss shown in Figure 4(c) must not vary by more than 0.05 mm and 0.1 mm respectively in any direction from their true positions when both are at their **Maximum Material Condition (MMC)**. Enter suitable tolerance symbols, tolerances and dimensions, where appropriate, in the sketch provided in Figure 4(d). In addition, determine and enter the minimum and maximum distances into the Table in Figure 4(d).

(16 marks)

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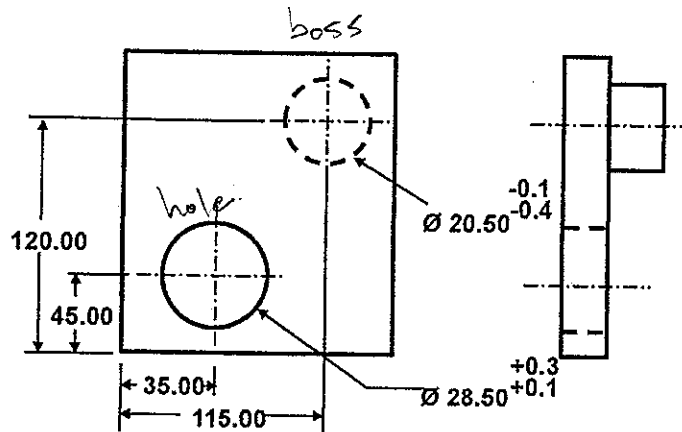
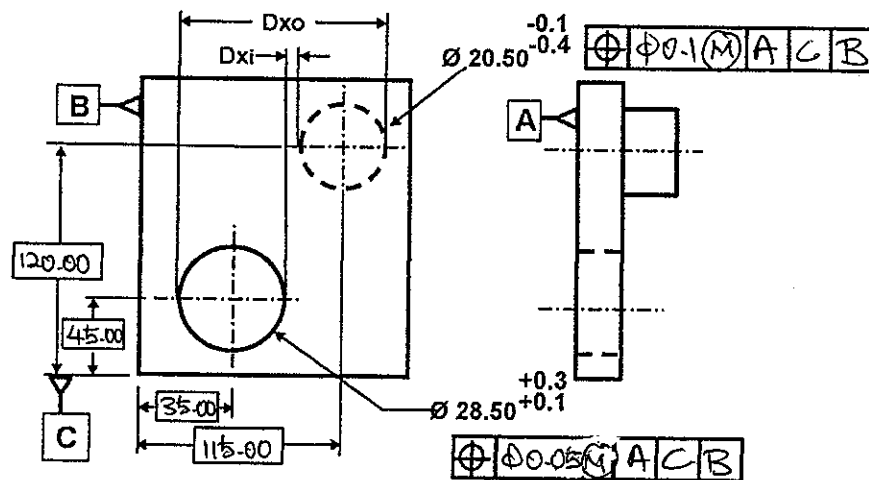


Figure 4(c)



Conditions	Minimum Dxi	Maximum Dxi	Minimum Dxo	Maximum Dxo
Both hole and boss are at MMC	30.85	31.15	—	—
Both hole and boss are at LMC	—	—	129.47	130.33

Figure 4(d)

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Appendix – Preferred hole and shaft basis fits

a) Preferred Hole Basis Clearance Fits (Dimensions in mm)																
Up to and including	Loose Running			Free Running			Close Running			Sliding			Locational Clearance			
	Hole H11	Shaft c11	Fit (RC8-9)	Hole H9	Shaft d9	Fit (RC7)	Hole H8	Shaft f7	Fit (RC4)	Hole H7	Shaft g6	Fit (RC2)	Hole H7	Shaft h6	Fit (LC1-4)	
1	Max	1.060	0.940	0.180	1.025	0.980	0.070	1.014	0.994	0.030	1.010	0.998	0.018	1.010	1.000	0.016
	Min	1.000	0.880	0.060	1.000	0.955	0.020	1.000	0.984	0.006	1.000	0.992	0.002	1.000	0.994	0.000
1.2	Max	1.260	1.140	0.180	1.225	1.180	0.070	1.214	1.194	0.030	1.210	1.198	0.018	1.210	1.200	0.016
	Min	1.200	1.080	0.060	1.200	1.155	0.020	1.200	1.184	0.006	1.200	1.192	0.002	1.200	1.194	0.000
1.6	Max	1.660	1.540	0.180	1.625	1.580	0.070	1.614	1.594	0.030	1.610	1.598	0.018	1.610	1.600	0.016
	Min	1.600	1.480	0.060	1.600	1.555	0.020	1.600	1.584	0.006	1.600	1.592	0.002	1.600	1.594	0.000
2	Max	2.060	1.940	0.180	2.025	1.980	0.070	2.014	1.994	0.030	2.010	1.998	0.018	2.010	2.000	0.016
	Min	2.000	1.880	0.060	2.000	1.955	0.020	2.000	1.984	0.006	2.000	1.992	0.002	2.000	1.994	0.000
2.5	Max	2.560	2.440	0.180	2.525	2.480	0.070	2.514	2.494	0.030	2.510	2.498	0.018	2.510	2.500	0.016
	Min	2.500	2.380	0.060	2.500	2.453	0.020	2.500	2.484	0.006	2.500	2.492	0.002	2.500	2.494	0.000
3	Max	3.060	2.940	0.180	3.025	2.980	0.070	3.014	2.994	0.030	3.010	2.998	0.018	3.010	3.000	0.016
	Min	3.000	2.880	0.060	3.000	2.955	0.020	3.000	2.984	0.006	3.000	2.992	0.002	3.000	2.994	0.000
4	Max	4.075	3.930	0.220	4.030	3.970	0.090	4.018	3.990	0.040	4.012	3.996	0.024	4.012	4.000	0.020
	Min	4.000	3.855	0.070	4.000	3.940	0.030	4.000	3.978	0.010	4.000	3.988	0.004	4.000	3.992	0.000
5	Max	5.075	4.930	0.220	5.030	4.970	0.090	5.018	4.990	0.040	5.012	4.996	0.024	5.012	5.000	0.020
	Min	5.000	4.855	0.070	5.000	4.940	0.030	5.000	4.978	0.010	5.000	4.988	0.004	5.000	4.992	0.000
6	Max	6.075	5.930	0.220	6.030	5.970	0.090	6.018	5.990	0.040	6.012	5.996	0.024	6.012	6.000	0.020
	Min	6.000	5.855	0.070	6.000	5.940	0.030	6.000	5.978	0.010	6.000	5.988	0.004	6.000	5.992	0.000
8	Max	8.090	7.920	0.260	8.036	7.960	0.112	8.022	7.987	0.050	8.015	7.995	0.029	8.015	8.000	0.024
	Min	8.000	7.830	0.080	8.000	7.924	0.040	8.000	7.972	0.013	8.000	7.986	0.006	8.000	7.991	0.000
10	Max	10.090	9.920	0.260	10.036	9.960	0.112	10.022	9.987	0.050	10.015	9.995	0.029	10.015	10.000	0.024
	Min	10.000	9.830	0.080	10.000	9.924	0.040	10.000	9.972	0.013	10.000	9.986	0.005	10.000	9.991	0.000
12	Max	12.110	11.905	0.315	12.043	11.950	0.136	12.027	11.984	0.061	12.018	11.994	0.035	12.018	12.000	0.029
	Min	12.000	11.795	0.093	12.000	11.907	0.050	12.000	11.966	0.016	12.000	11.983	0.006	12.000	11.989	0.000
16	Max	16.110	15.905	0.315	16.043	15.950	0.136	16.027	15.984	0.061	16.018	15.994	0.035	16.018	16.000	0.029
	Min	16.000	15.795	0.093	16.000	15.907	0.050	16.000	15.966	0.016	16.000	15.983	0.006	16.000	15.989	0.000
20	Max	20.130	19.890	0.370	20.052	19.935	0.169	20.033	19.980	0.074	20.021	19.993	0.041	20.021	20.000	0.034
	Min	20.000	19.760	0.110	20.000	19.883	0.065	20.000	19.959	0.020	20.000	19.980	0.007	20.000	19.987	0.000
25	Max	25.130	24.890	0.370	25.052	24.935	0.169	25.033	24.980	0.074	25.021	24.993	0.042	25.021	25.000	0.034
	Min	25.000	24.760	0.110	25.000	24.883	0.065	25.000	24.959	0.020	25.000	24.980	0.007	25.000	24.987	0.000
30	Max	30.130	29.890	0.370	30.052	29.935	0.169	30.033	29.980	0.074	30.021	29.993	0.041	30.021	30.000	0.034
	Min	30.000	29.760	0.110	30.000	29.883	0.065	30.000	29.959	0.020	30.000	29.980	0.007	30.000	29.987	0.000
40	Max	40.160	39.880	0.440	40.062	39.920	0.204	40.039	39.975	0.089	40.025	39.991	0.050	40.025	40.000	0.041
	Min	40.000	39.720	0.120	40.000	39.858	0.080	40.000	39.950	0.025	40.000	39.975	0.009	40.000	39.984	0.000
50	Max	50.160	49.870	0.450	50.062	49.920	0.204	50.039	49.975	0.089	50.025	49.991	0.050	50.025	50.000	0.041
	Min	50.000	49.710	0.130	50.000	49.858	0.080	50.000	49.950	0.025	50.000	49.975	0.009	50.000	49.984	0.000
60	Max	60.190	59.860	0.520	60.074	59.900	0.248	60.046	59.970	0.106	60.030	59.990	0.059	60.030	60.000	0.049
	Min	60.000	59.670	0.140	60.000	59.826	0.100	60.000	59.940	0.030	60.000	59.971	0.010	60.000	59.981	0.000
80	Max	80.190	79.850	0.530	80.074	79.900	0.248	80.046	79.970	0.106	80.030	79.990	0.059	80.030	80.000	0.049
	Min	80.000	79.660	0.150	80.000	79.826	0.100	80.000	79.940	0.030	80.000	79.971	0.010	80.000	79.981	0.000
100	Max	100.220	99.830	0.610	100.087	99.880	0.294	100.054	99.964	0.125	100.035	99.988	0.069	100.035	100.000	0.057
	Min	100.000	99.610	0.170	100.000	99.793	0.120	100.000	99.929	0.036	100.000	99.966	0.012	100.000	99.978	0.000
120	Max	120.220	119.820	0.620	120.087	119.880	0.294	120.054	119.964	0.125	120.035	119.988	0.069	120.035	120.000	0.057
	Min	120.000	119.600	0.180	120.000	119.793	0.120	120.000	119.929	0.036	120.000	119.966	0.012	120.000	119.978	0.000
160	Max	160.250	159.790	0.710	160.100	159.855	0.345	160.063	159.957	0.146	160.040	159.986	0.079	160.040	160.000	0.065
	Min	160.000	159.540	0.210	160.000	159.755	0.145	160.000	159.917	0.043	160.000	159.961	0.014	160.000	159.975	0.000

b) Preferred Hole Basis Interference Fits (Dimensions in mm)																
Up to and including	Locational Transition			Locational Transition			Locational Interference			Medium Drive Fit			Force Fit			
	Hole	Shaft	Fit	Hole	Shaft	Fit	Hole	Shaft	Fit	Hole	Shaft	Fit	Hole	Shaft	Fit	
	H7	k6	(LT)	H7	n6	(LT)	H7	p6	(LN)	H7	s6	(FN2)	H7	u6	(FN4-5)	
1	Max	1.010	1.006	0.010	1.010	1.010	0.006	1.010	1.012	0.004	1.010	1.020	-0.004	1.010	1.024	-0.008
	Min	1.000	1.000	-0.006	1.000	1.004	-0.010	1.000	1.006	-0.012	1.000	1.014	-0.020	1.000	1.018	-0.024
1.2	Max	1.210	1.206	0.010	1.210	1.210	0.006	1.210	1.212	0.004	1.210	1.220	-0.004	1.210	1.224	-0.008
	Min	1.200	1.200	-0.006	1.200	1.204	-0.010	1.200	1.206	-0.012	1.200	1.214	-0.020	1.200	1.218	-0.024
1.6	Max	1.610	1.606	0.010	1.610	1.610	0.006	1.610	1.612	0.004	1.610	1.620	-0.004	1.610	1.624	-0.008
	Min	1.600	1.600	-0.006	1.600	1.604	-0.010	1.600	1.606	-0.012	1.600	1.614	-0.020	1.600	1.618	-0.024
2	Max	2.010	2.006	0.010	2.010	2.010	0.006	2.010	2.010	0.004	2.010	2.020	-0.004	2.010	2.024	-0.008
	Min	2.000	2.000	-0.006	2.000	2.004	-0.010	2.000	2.006	-0.012	2.000	2.014	-0.020	2.000	2.018	-0.024
2.5	Max	2.510	2.506	0.010	2.510	2.510	0.006	2.510	2.512	0.004	2.510	2.520	-0.004	2.510	2.524	-0.008
	Min	2.500	2.500	-0.006	2.500	2.504	-0.010	2.500	2.506	-0.012	2.500	2.514	-0.020	2.500	2.518	-0.024
3	Max	3.010	3.006	0.010	3.010	3.010	0.006	3.010	3.012	0.004	3.010	3.020	-0.004	3.010	3.024	-0.008
	Min	3.000	3.000	-0.006	3.000	3.004	-0.010	3.000	3.006	-0.012	3.000	3.014	-0.020	3.000	3.018	-0.024
4	Max	4.012	4.009	0.011	4.012	4.016	0.004	4.012	4.020	0.000	4.012	4.027	-0.007	4.012	4.031	-0.011
	Min	4.000	4.001	-0.009	4.000	4.008	-0.016	4.000	4.012	-0.020	4.000	4.019	-0.027	4.000	4.023	-0.031
5	Max	5.012	5.009	0.011	5.012	5.016	0.004	5.012	5.020	0.000	5.012	5.027	-0.007	5.012	5.031	-0.011
	Min	5.000	5.001	-0.009	5.000	5.008	-0.016	5.000	5.012	-0.020	5.000	5.019	-0.027	5.000	5.023	-0.031
6	Max	6.012	6.009	0.011	6.012	6.016	0.004	6.012	6.020	0.000	6.012	6.027	-0.007	6.012	6.031	-0.011
	Min	6.000	6.001	-0.009	6.000	6.008	-0.016	6.000	6.012	-0.020	6.000	6.019	-0.027	6.000	6.023	-0.031
8	Max	8.015	8.010	0.014	8.015	8.019	0.005	8.015	8.024	0.000	8.015	8.032	-0.008	8.015	8.037	-0.013
	Min	8.000	8.001	-0.010	8.000	8.010	-0.019	8.000	8.015	-0.024	8.000	8.023	-0.032	8.000	8.028	-0.037
10	Max	10.015	10.010	0.014	10.015	10.019	0.005	10.015	10.024	0.000	10.015	10.032	-0.008	10.015	10.037	-0.013
	Min	10.000	10.001	-0.010	10.000	10.010	-0.019	10.000	10.015	-0.024	10.000	10.023	-0.032	10.000	10.028	-0.037
12	Max	12.018	12.012	0.017	12.018	12.023	0.006	12.018	12.029	0.000	12.018	12.039	-0.010	12.018	12.044	-0.015
	Min	12.000	12.001	-0.012	12.000	12.012	-0.023	12.000	12.018	-0.029	12.000	12.028	-0.039	12.000	12.033	-0.044
16	Max	16.018	16.012	0.017	16.018	16.023	0.006	16.018	16.029	0.000	16.018	16.039	-0.010	16.018	16.044	-0.015
	Min	16.000	16.001	-0.012	16.000	16.012	-0.023	16.000	16.018	-0.029	16.000	16.028	-0.039	16.000	16.033	-0.044
20	Max	20.021	20.015	0.019	20.021	20.028	0.006	20.021	20.035	-0.001	20.021	20.048	-0.014	20.021	20.054	-0.020
	Min	20.000	20.002	-0.015	20.000	20.015	-0.028	20.000	20.022	-0.035	20.000	20.035	-0.048	20.000	20.041	-0.054
25	Max	25.021	25.015	0.019	25.021	25.028	0.006	25.021	25.035	-0.001	25.021	25.048	-0.014	25.021	25.061	-0.027
	Min	25.000	25.002	-0.015	25.000	25.015	-0.028	25.000	25.022	-0.035	25.000	25.035	-0.048	25.000	25.048	-0.061
30	Max	30.021	30.015	0.019	30.021	30.028	0.006	30.021	30.035	-0.001	30.021	30.048	-0.014	30.021	30.061	-0.027
	Min	30.000	30.002	-0.015	30.000	30.015	-0.028	30.000	30.022	-0.035	30.000	30.035	-0.048	30.000	30.048	-0.061
40	Max	40.025	40.018	0.023	40.025	40.033	0.008	40.025	40.042	-0.001	40.025	40.059	-0.018	40.025	40.076	-0.035
	Min	40.000	40.002	-0.018	40.000	40.017	-0.033	40.000	40.026	-0.042	40.000	40.043	-0.059	40.000	40.060	-0.076
50	Max	50.025	50.018	0.023	50.025	50.033	0.008	50.025	50.042	-0.001	50.025	50.059	-0.018	50.025	50.086	-0.045
	Min	50.000	50.002	-0.018	50.000	50.017	-0.033	50.000	50.026	-0.042	50.000	50.043	-0.059	50.000	50.070	-0.086
60	Max	60.030	60.021	0.028	60.030	60.039	0.010	60.030	60.051	-0.002	60.030	60.072	-0.023	60.030	60.106	-0.057
	Min	60.000	60.002	-0.021	60.000	60.020	-0.039	60.000	60.032	-0.051	60.000	60.053	-0.072	60.000	60.087	-0.106
80	Max	80.030	80.021	0.028	80.030	80.039	0.010	80.030	80.051	-0.002	80.030	80.078	-0.029	80.030	80.121	-0.072
	Min	80.000	80.002	-0.021	80.000	80.020	-0.039	80.000	80.032	-0.051	80.000	80.059	-0.078	80.000	80.102	-0.121
100	Max	100.035	100.025	0.032	100.035	100.045	0.012	100.035	100.059	-0.002	100.035	100.093	-0.036	100.035	100.146	-0.089
	Min	100.000	100.003	-0.025	100.000	100.023	-0.045	100.000	100.037	-0.059	100.000	100.071	-0.093	100.000	100.124	-0.146
120	Max	120.035	120.025	0.032	120.035	120.045	0.012	120.035	120.059	-0.002	120.035	120.101	-0.044	120.035	120.166	-0.109
	Min	120.000	120.003	-0.025	120.000	120.023	-0.045	120.000	120.037	-0.059	120.000	120.079	-0.101	120.000	120.144	-0.166
160	Max	160.040	160.028	0.037	160.045	160.052	0.018	160.040	160.068	-0.003	160.040	160.125	-0.060	160.040	160.215	-0.150
	Min	160.000	160.003	-0.028	160.000	160.027	-0.052	160.000	160.043	-0.068	160.000	160.100	-0.125	160.000	160.190	-0.215

c) Preferred Shaft Basis Clearance Fits (Dimensions in mm)																
Up to and including	Loose Running			Free Running			Close Running			Sliding			Locational Clearance			
	Hole C11	Shaft h11	Fit (RC8-9)	Hole D9	Shaft h9	Fit (RC7)	Hole F8	Shaft h7	Fit (RC4)	Hole G7	Shaft h6	Fit (RC2)	Hole H7	Shaft h6	Fit (LC1-4)	
1	Max	1.120	1.000	0.180	1.045	1.000	0.070	1.020	1.000	0.030	1.012	1.000	0.018	1.010	1.000	0.016
	Min	1.060	0.940	0.600	1.020	0.975	0.020	1.006	0.990	0.006	1.002	0.994	0.002	1.000	0.994	0.000
1.2	Max	1.320	1.200	0.180	1.245	1.200	0.070	1.220	1.200	0.030	1.212	1.200	0.018	1.210	1.200	0.016
	Min	1.260	1.140	0.600	1.220	1.175	0.020	1.206	1.190	0.006	1.202	1.194	0.002	1.200	1.194	0.000
1.6	Max	1.720	1.600	0.180	1.645	1.600	0.070	1.620	1.600	0.030	1.612	1.600	0.018	1.610	1.600	0.016
	Min	1.660	1.540	0.600	1.620	1.575	0.020	1.606	1.590	0.006	1.602	1.594	0.002	1.600	1.594	0.000
2	Max	2.120	2.000	0.180	2.045	2.000	0.070	2.020	2.000	0.030	2.012	2.000	0.018	2.010	2.000	0.016
	Min	2.060	1.940	0.600	2.020	1.975	0.020	2.006	1.990	0.006	2.002	1.994	0.002	2.000	1.994	0.000
2.5	Max	2.620	2.500	0.180	2.545	2.500	0.070	2.520	2.500	0.030	2.512	2.500	0.018	2.510	2.500	0.016
	Min	2.560	2.440	0.060	2.520	2.475	0.020	2.506	2.490	0.006	2.502	2.494	0.002	2.500	2.494	0.000
3	Max	3.120	3.000	0.180	3.045	3.000	0.070	3.020	3.000	0.030	3.012	3.000	0.018	3.010	3.000	0.016
	Min	3.060	2.940	0.600	3.020	2.975	0.020	3.006	2.990	0.006	3.002	2.994	0.002	3.000	2.994	0.000
4	Max	4.145	4.000	0.220	4.060	4.000	0.090	4.028	4.000	0.040	4.016	4.000	0.024	4.012	4.000	0.020
	Min	4.070	3.925	0.070	4.030	3.970	0.030	4.010	3.988	0.010	4.004	3.992	0.004	4.000	3.992	0.000
5	Max	5.145	5.000	0.220	5.060	5.000	0.090	5.028	5.000	0.040	5.016	5.000	0.024	5.012	5.000	0.020
	Min	5.070	4.925	0.070	5.030	4.970	0.030	5.010	4.988	0.010	5.004	4.992	0.004	5.000	4.992	0.000
6	Max	6.145	6.000	0.220	6.060	6.000	0.090	6.028	6.000	0.040	6.016	6.000	0.024	6.012	6.000	0.020
	Min	6.070	5.925	0.070	6.030	5.970	0.030	6.010	5.988	0.010	6.004	5.992	0.004	6.000	5.992	0.000
8	Max	8.170	8.000	0.260	8.076	8.000	0.112	8.035	8.000	0.050	8.020	8.000	0.029	8.015	8.000	0.024
	Min	8.080	7.910	0.080	8.040	7.964	0.040	8.013	7.985	0.013	8.005	7.991	0.005	8.000	7.991	0.000
10	Max	10.170	10.000	0.260	10.076	10.000	0.112	10.035	10.000	0.050	10.020	10.000	0.029	10.015	10.000	0.024
	Min	10.080	9.910	0.080	10.040	9.964	0.040	10.013	9.985	0.013	10.005	9.991	0.005	10.000	9.991	0.000
12	Max	12.205	12.000	0.315	12.093	12.000	0.136	12.043	12.000	0.061	12.024	12.000	0.035	12.018	12.000	0.029
	Min	12.095	11.890	0.095	12.050	11.957	0.050	12.016	11.982	0.016	12.006	11.989	0.006	12.000	11.989	0.000
16	Max	16.205	16.000	0.315	16.093	16.000	0.136	16.043	16.000	0.061	16.024	16.000	0.035	16.018	16.000	0.029
	Min	16.095	15.890	0.095	16.050	15.957	0.050	16.016	15.982	0.016	16.006	15.989	0.006	16.000	15.989	0.000
20	Max	20.240	20.000	0.370	20.117	20.000	0.169	20.053	20.000	0.074	20.028	20.000	0.041	20.021	20.000	0.034
	Min	20.110	19.870	0.110	20.065	19.948	0.065	20.020	19.979	0.020	20.007	19.987	0.007	20.000	19.987	0.000
25	Max	25.240	25.000	0.370	25.117	25.000	0.169	25.053	25.000	0.074	25.028	25.000	0.041	25.021	25.000	0.034
	Min	25.110	24.870	0.110	25.065	24.948	0.065	25.020	24.979	0.020	25.007	24.987	0.007	25.000	24.987	0.000
30	Max	30.240	30.000	0.370	30.117	30.000	0.169	30.053	30.000	0.074	30.028	30.000	0.041	30.021	30.000	0.034
	Min	30.110	29.870	0.110	30.065	29.948	0.065	30.020	29.979	0.020	30.007	29.987	0.007	30.000	29.987	0.000
40	Max	40.280	40.000	0.440	40.142	40.000	0.204	40.064	40.000	0.089	40.034	40.000	0.050	40.025	40.000	0.041
	Min	40.120	39.840	0.120	40.080	39.938	0.080	40.025	39.975	0.025	40.009	39.984	0.009	40.000	39.984	0.000
50	Max	50.290	50.000	0.450	50.142	50.000	0.204	50.064	50.000	0.089	50.034	50.000	0.050	50.025	50.000	0.041
	Min	50.130	49.840	0.130	50.080	49.938	0.080	50.025	49.975	0.025	50.009	49.984	0.009	50.000	49.984	0.000
60	Max	60.330	60.000	0.520	60.174	60.000	0.248	60.076	60.000	0.106	60.040	60.000	0.059	60.030	60.000	0.049
	Min	60.140	59.810	0.140	60.100	59.926	0.100	60.030	59.975	0.030	60.010	59.981	0.010	60.000	59.981	0.000
80	Max	80.340	80.000	0.530	80.174	80.000	0.248	80.076	80.000	0.106	80.040	80.000	0.059	80.030	80.000	0.049
	Min	80.150	79.810	0.150	80.100	79.926	0.100	80.030	79.970	0.030	80.010	79.981	0.010	80.000	79.981	0.000
100	Max	100.390	100.000	0.610	100.207	100.000	0.294	100.090	100.000	0.125	100.047	100.000	0.069	100.035	100.000	0.057
	Min	100.170	99.780	0.170	100.120	99.913	0.120	100.036	99.965	0.036	100.012	99.978	0.012	100.000	99.978	0.000
120	Max	120.400	120.000	0.620	120.207	120.000	0.294	120.090	120.000	0.125	120.047	120.000	0.069	120.035	120.000	0.057
	Min	120.180	119.780	0.180	120.120	119.913	0.120	120.036	119.965	0.036	120.012	119.978	0.012	120.000	119.978	0.000
160	Max	160.460	160.000	0.710	160.245	160.000	0.345	160.105	160.000	0.146	160.054	160.000	0.079	160.040	160.000	0.065
	Min	160.210	159.750	0.210	160.145	159.900	0.145	160.043	159.960	0.043	160.014	159.975	0.014	160.000	159.975	0.000

Up to and including		d) Preferred Shaft Basis Interference Fits (Dimensions in mm)														
		Locational Transition			Locational Transition			Locational Interference			Medium Drive Fit			Force Fit		
		Hole K7	Shaft h6	Fit (LT)	Hole N7	Shaft h6	Fit (LT)	Hole P7	Shaft h6	Fit (LN)	Hole S7	Shaft h6	Fit (FN2)	Hole U7	Shaft h6	Fit (FN4-5)
1	Max	1.000	1.000	0.006	0.996	1.000	0.002	0.994	1.000	0.000	0.986	1.000	-0.008	0.982	1.000	-0.012
	Min	0.990	0.994	-0.010	0.986	0.994	-0.014	0.984	0.994	-0.016	0.976	0.994	-0.024	0.972	0.994	-0.028
1.2	Max	1.200	1.200	0.006	1.196	1.200	0.002	1.194	1.200	0.000	1.186	1.200	-0.008	1.182	1.200	-0.012
	Min	1.190	1.194	-0.010	1.186	1.194	-0.014	1.184	1.194	-0.016	1.176	1.194	-0.024	1.172	1.194	-0.028
1.6	Max	1.600	1.600	0.006	1.596	1.600	0.002	1.594	1.600	0.000	1.586	1.600	-0.008	1.582	1.600	-0.012
	Min	1.590	1.594	-0.010	1.586	1.594	-0.014	1.584	1.594	-0.016	1.576	1.594	-0.024	1.572	1.594	-0.028
2	Max	2.000	2.000	0.006	1.996	2.000	0.002	1.994	2.000	0.000	1.986	2.000	-0.008	1.982	2.000	-0.012
	Min	1.990	1.994	-0.010	1.986	1.994	-0.014	1.984	1.994	-0.016	1.976	1.994	-0.024	1.972	1.994	-0.028
2.5	Max	2.500	2.500	0.006	2.496	2.500	0.002	2.494	2.500	0.000	2.486	2.500	-0.008	2.482	2.500	-0.012
	Min	2.490	2.494	-0.010	2.486	2.494	-0.014	2.484	2.494	-0.016	2.476	2.494	-0.024	2.472	2.494	-0.028
3	Max	3.000	3.000	0.006	2.996	3.000	0.002	2.994	3.000	0.000	2.986	3.000	-0.008	2.982	3.000	-0.012
	Min	2.990	2.994	-0.010	2.986	2.994	-0.014	2.984	2.994	-0.016	2.976	2.994	-0.024	2.972	2.994	-0.028
4	Max	4.003	4.000	0.011	3.996	4.000	0.004	3.992	4.000	0.000	3.985	4.000	-0.007	3.981	4.000	-0.011
	Min	3.991	3.992	-0.009	3.984	3.992	-0.016	3.980	3.992	-0.020	3.973	3.992	-0.027	3.969	3.992	-0.031
5	Max	5.003	5.000	0.011	4.996	5.000	0.004	4.992	5.000	0.000	4.985	5.000	-0.007	4.981	5.000	-0.011
	Min	4.991	4.992	-0.009	4.986	4.992	-0.016	4.980	4.992	-0.020	4.973	4.992	-0.027	4.969	4.992	-0.031
6	Max	6.003	6.000	0.011	5.996	6.000	0.004	5.992	6.000	0.000	5.985	6.000	-0.007	5.981	6.000	-0.011
	Min	5.991	5.992	-0.009	5.984	5.992	-0.016	5.980	5.992	-0.020	5.973	5.992	-0.027	5.969	5.992	-0.031
8	Max	8.005	8.000	0.014	7.996	8.000	0.005	7.991	8.000	0.000	7.983	8.000	-0.008	7.978	8.000	-0.013
	Min	7.990	7.991	-0.010	7.981	7.991	-0.019	7.976	7.991	-0.024	7.968	7.991	-0.032	7.963	7.991	-0.037
10	Max	10.005	10.000	0.014	9.996	10.000	0.005	9.991	10.000	0.000	9.983	10.000	-0.008	9.978	10.000	-0.013
	Min	9.990	9.991	-0.010	9.981	9.991	-0.019	9.976	9.991	-0.024	9.968	9.991	-0.032	9.963	9.991	-0.037
12	Max	12.006	12.000	0.017	11.995	12.000	0.006	11.989	12.000	0.000	11.979	12.000	-0.010	11.974	12.000	-0.015
	Min	11.988	11.989	-0.012	11.977	11.989	-0.023	11.971	11.989	-0.029	11.961	11.989	-0.039	11.956	11.989	-0.044
16	Max	16.006	16.000	0.017	15.995	16.000	0.006	15.989	16.000	0.000	15.979	16.000	-0.010	15.974	16.000	-0.015
	Min	15.988	15.989	-0.012	15.977	15.989	-0.023	15.971	15.989	-0.029	15.961	15.989	-0.039	15.956	15.989	-0.044
20	Max	20.006	20.000	0.019	19.993	20.000	0.006	19.986	20.000	-0.001	19.973	20.000	-0.014	19.967	20.000	-0.020
	Min	19.985	19.987	-0.015	19.972	19.987	-0.028	19.965	19.987	-0.035	19.952	19.987	-0.048	19.946	19.987	-0.054
25	Max	25.006	25.000	0.019	24.993	25.000	0.006	24.986	25.000	-0.001	24.973	25.000	-0.014	24.966	25.000	-0.027
	Min	24.985	24.987	-0.015	24.972	24.987	-0.028	24.965	24.987	-0.035	24.952	24.987	-0.048	24.939	24.987	-0.061
30	Max	30.006	30.000	0.019	29.993	30.000	0.006	29.986	30.000	-0.001	29.973	30.000	-0.014	29.966	30.000	-0.027
	Min	29.985	29.987	-0.015	29.972	29.987	-0.028	29.965	29.987	-0.035	29.952	29.987	-0.048	29.939	29.987	-0.061
40	Max	40.007	40.000	0.023	39.992	40.000	0.008	39.983	40.000	-0.001	39.966	40.000	-0.018	39.949	40.000	-0.035
	Min	39.982	39.984	-0.018	39.967	39.984	-0.033	39.958	39.984	-0.042	39.941	39.984	-0.059	39.924	39.984	-0.076
50	Max	50.007	50.000	0.023	49.992	50.000	0.008	49.983	50.000	-0.001	49.966	50.000	-0.018	49.939	50.000	-0.045
	Min	49.982	49.984	-0.018	49.967	49.984	-0.033	49.958	49.984	-0.042	49.941	49.984	-0.059	49.914	49.984	-0.086
60	Max	60.009	60.000	0.028	59.991	60.000	0.010	59.979	60.000	-0.002	59.958	60.000	-0.023	59.924	60.000	-0.057
	Min	59.979	59.981	-0.021	59.961	59.981	-0.039	59.949	59.981	-0.051	59.928	59.981	-0.072	59.894	59.981	-0.106
80	Max	80.009	80.000	0.028	79.991	80.000	0.010	79.979	80.000	-0.002	79.952	80.000	-0.029	79.909	80.000	-0.072
	Min	79.979	79.981	-0.021	79.961	79.981	-0.039	79.949	79.981	-0.051	79.922	79.981	-0.078	79.879	79.981	-0.121
100	Max	100.010	100.000	0.032	99.990	100.000	0.012	99.976	100.000	-0.002	99.942	100.000	-0.036	99.889	100.000	-0.089
	Min	99.975	99.978	-0.025	99.955	99.978	-0.045	99.941	99.978	-0.059	99.907	99.978	-0.093	99.854	99.978	-0.146
120	Max	120.010	120.000	0.032	119.990	120.000	0.012	119.976	120.000	-0.002	119.934	120.000	-0.044	119.869	120.000	-0.109
	Min	119.975	119.978	-0.025	119.955	119.978	-0.045	119.941	119.978	-0.059	119.899	119.978	-0.101	119.834	119.978	-0.166
160	Max	160.012	160.000	0.037	159.988	160.000	0.013	159.972	160.000	-0.003	159.915	160.000	-0.060	159.825	160.000	-0.150
	Min	159.972	159.975	-0.028	159.948	159.975	-0.052	159.932	159.975	-0.068	159.875	159.975	-0.125	159.785	159.975	-0.215

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NANYANG TECHNOLOGICAL UNIVERSITY
SEMESTER 2 EXAMINATION 2016-2017
MA2005 - ENGINEERING GRAPHICS

April/May 2017

Time Allowed: 2½ hours

Seat Number :

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Matriculation Number:

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INSTRUCTIONS TO CANDIDATES

1. This Question and Answer (Q & A) Book contains **FOUR (4)** questions and comprises **FIFTEEN (15)** pages.
2. Answer **ALL** the questions and all questions carry equal marks.
3. Write your answers for all the questions in the Q & A Book.
4. Do not write your name on the Q & A Book.
5. Write your matriculation number on the front page of this Q & A Book.
6. Candidates are **NOT** allowed to remove any page from the Q & A Book.
7. This Q & A Book, used or unused, must not be removed from the Examination Hall. It **MUST BE HANDED IN** at the end of the examination.
8. This is a **CLOSED - BOOK** examination.

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Questions	Marks
1	
2	
3a	
3b	
4	
Total	

8

- 1(a) A support as shown in Figure 1(a) is presented in **First Angle Projection**. Draw and complete the incomplete front elevation and plan of the object showing all the construction lines and outlines with hidden details clearly. (12 marks)

/ 12

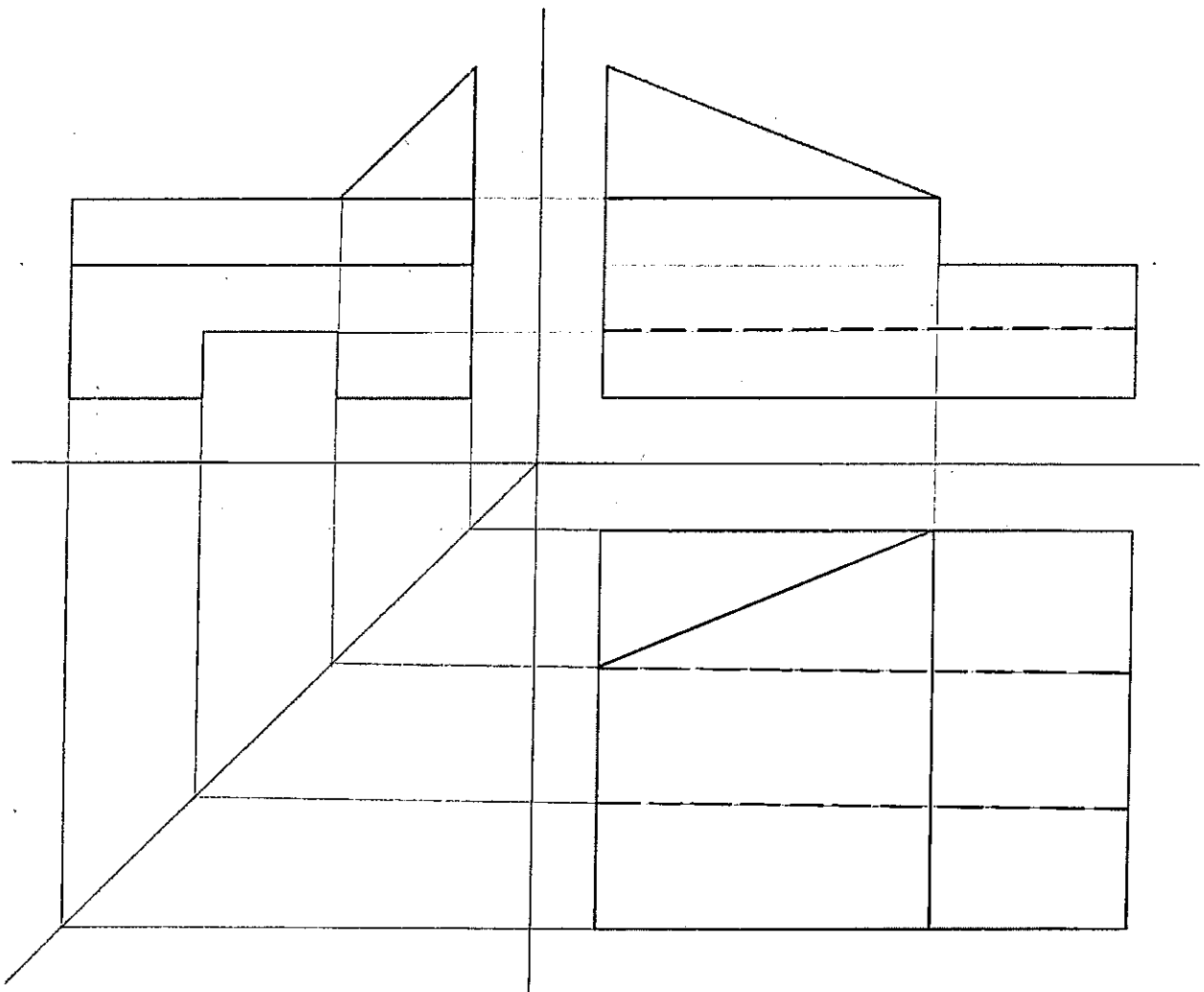
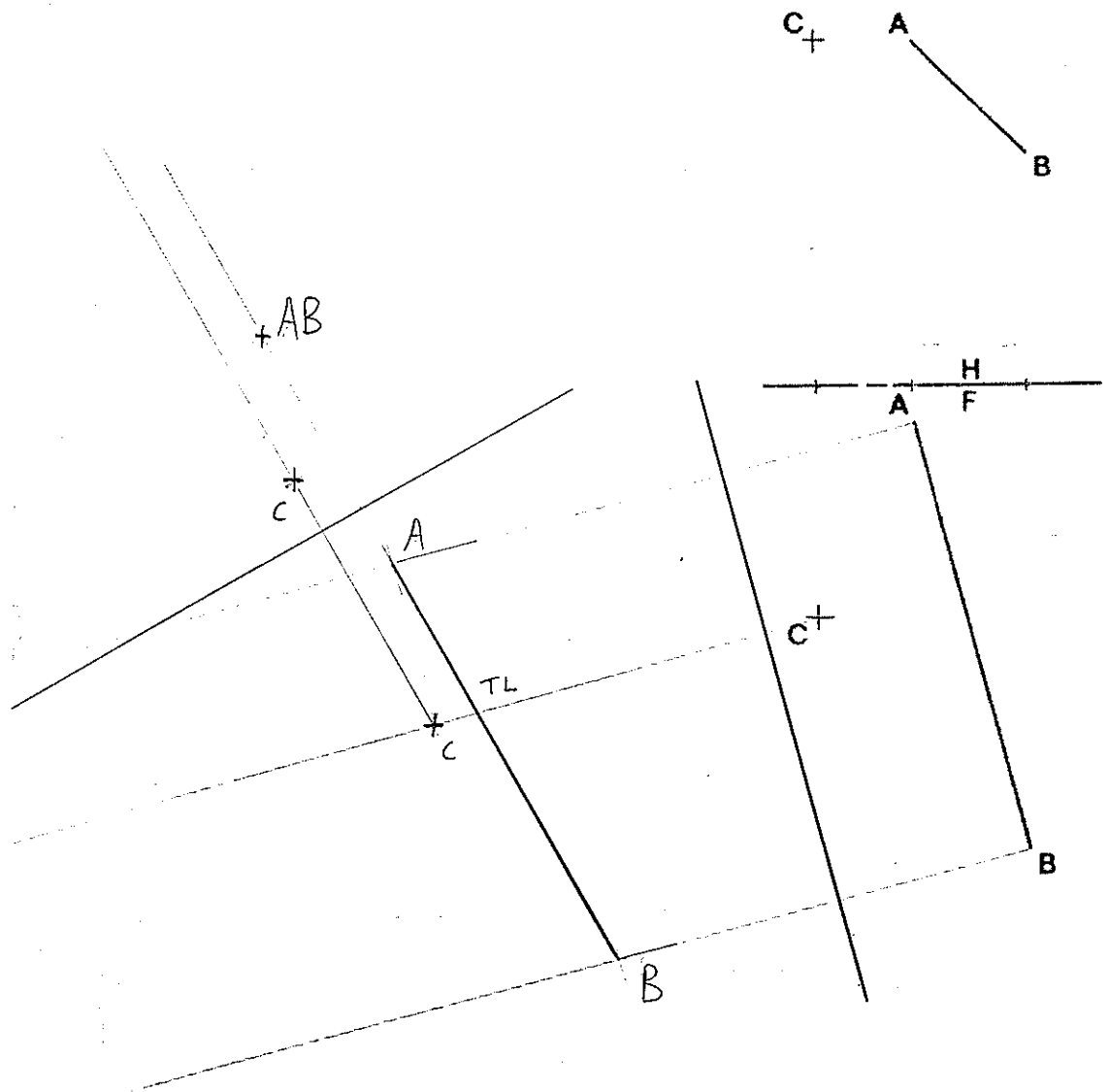


Figure 1(a)

1(b) Two views of a point **C** and a line **AB** as shown in Figure 1(b) are given in the **Third Angle Projection**. Draw and thereafter measure the shortest distance from the point **C** to the line **AB**.
(13 marks)

/ 13



SHORTEST DISTANCE = 20 mm

Figure 1(b)

2(a) Figure 2(a) shows the orthographic views of a support presented in **First Angle Projection**. Using the isometric paper provided, draw full size the isometric drawing of the object so that point **A** will be the lowest point in the drawing. Hidden details are not required. Each grid unit represents 5 mm.

(12 marks)

/ 12

Note: Each grid unit represents 5 mm

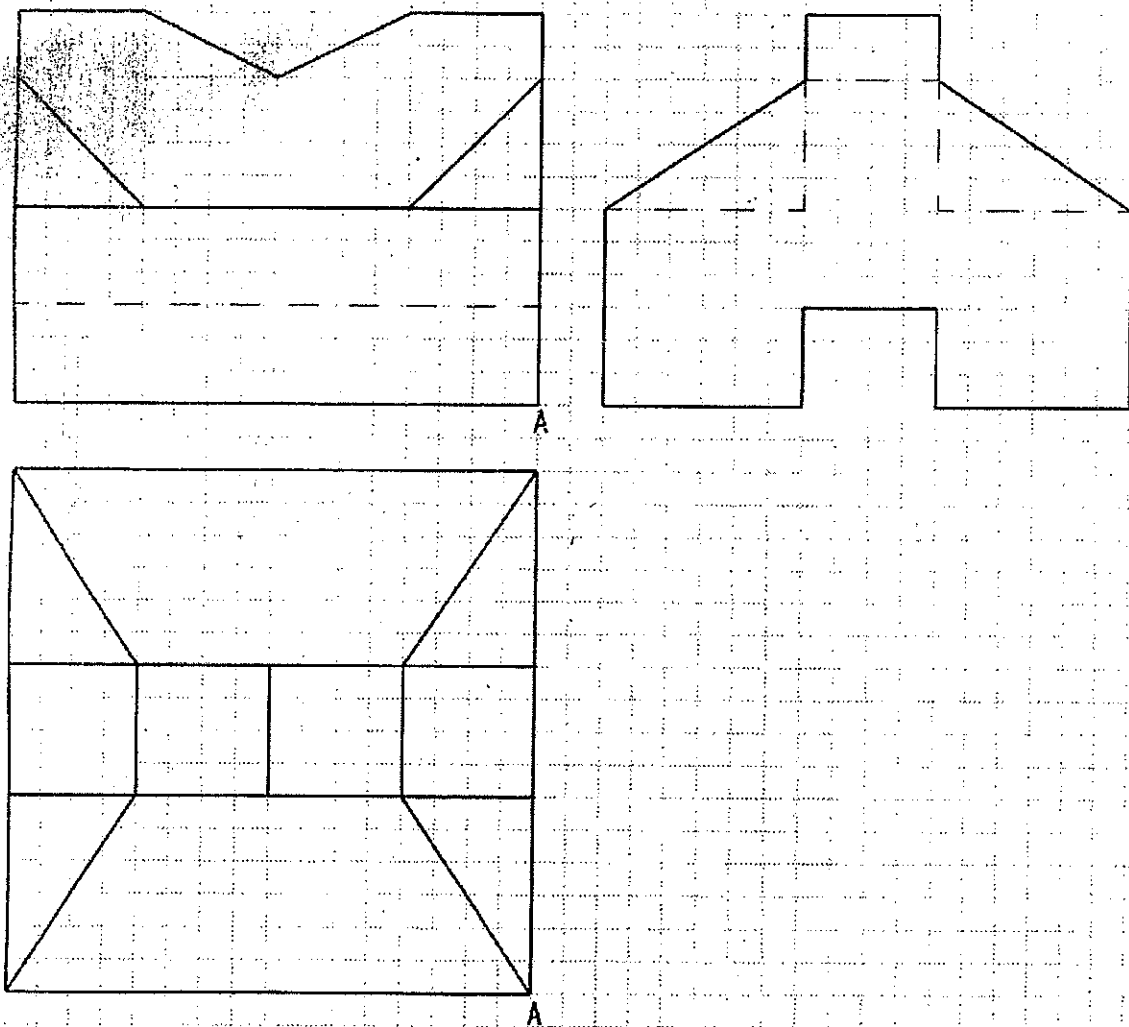
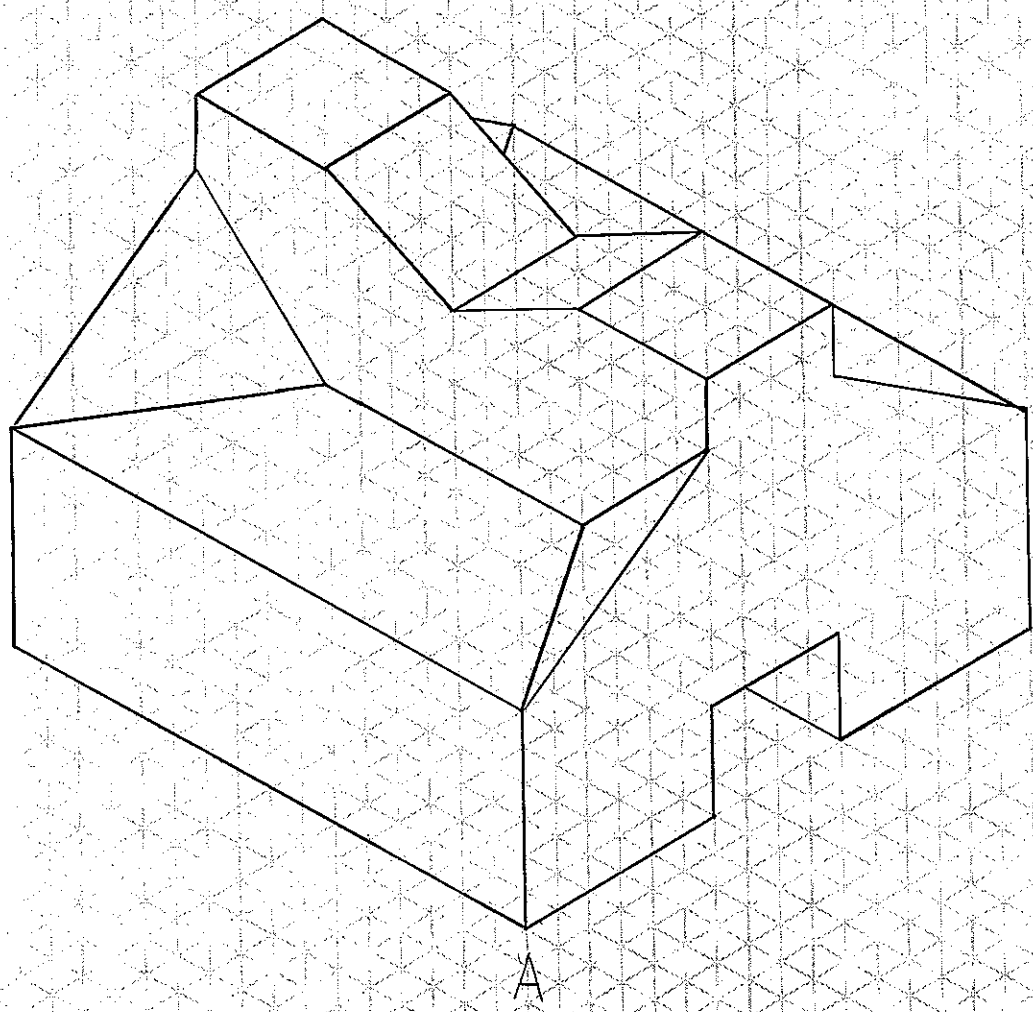


Figure 2(a)

Note: Each grid unit represents 5 mm



2(b) Figure 2(b) shows the plan and front elevation of a transition oblique pyramid in **First Angle Projection**. Draw its development of the pyramid. Begin the pattern with the seam at **A1** and seam allowance is not required.

(13 marks)

/ 13

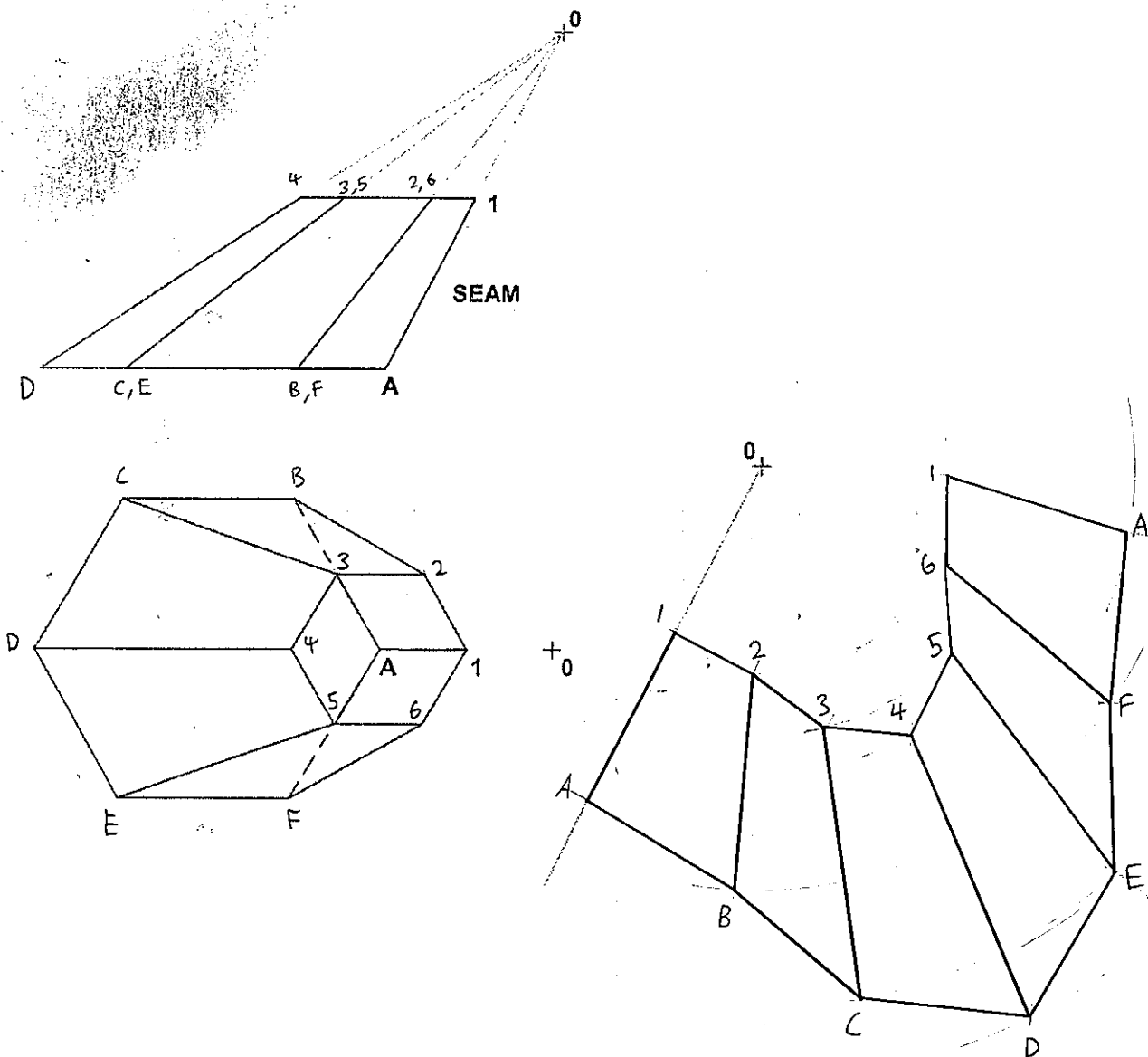


Figure 2(b)

3(a) An object as shown in Figure 3(a) is presented in the **Third Angle Projection**. Draw a half sectional view on **A-A** of the object showing all the construction lines and outlines clearly. Hidden lines are not required.

(13 marks)

/ 13

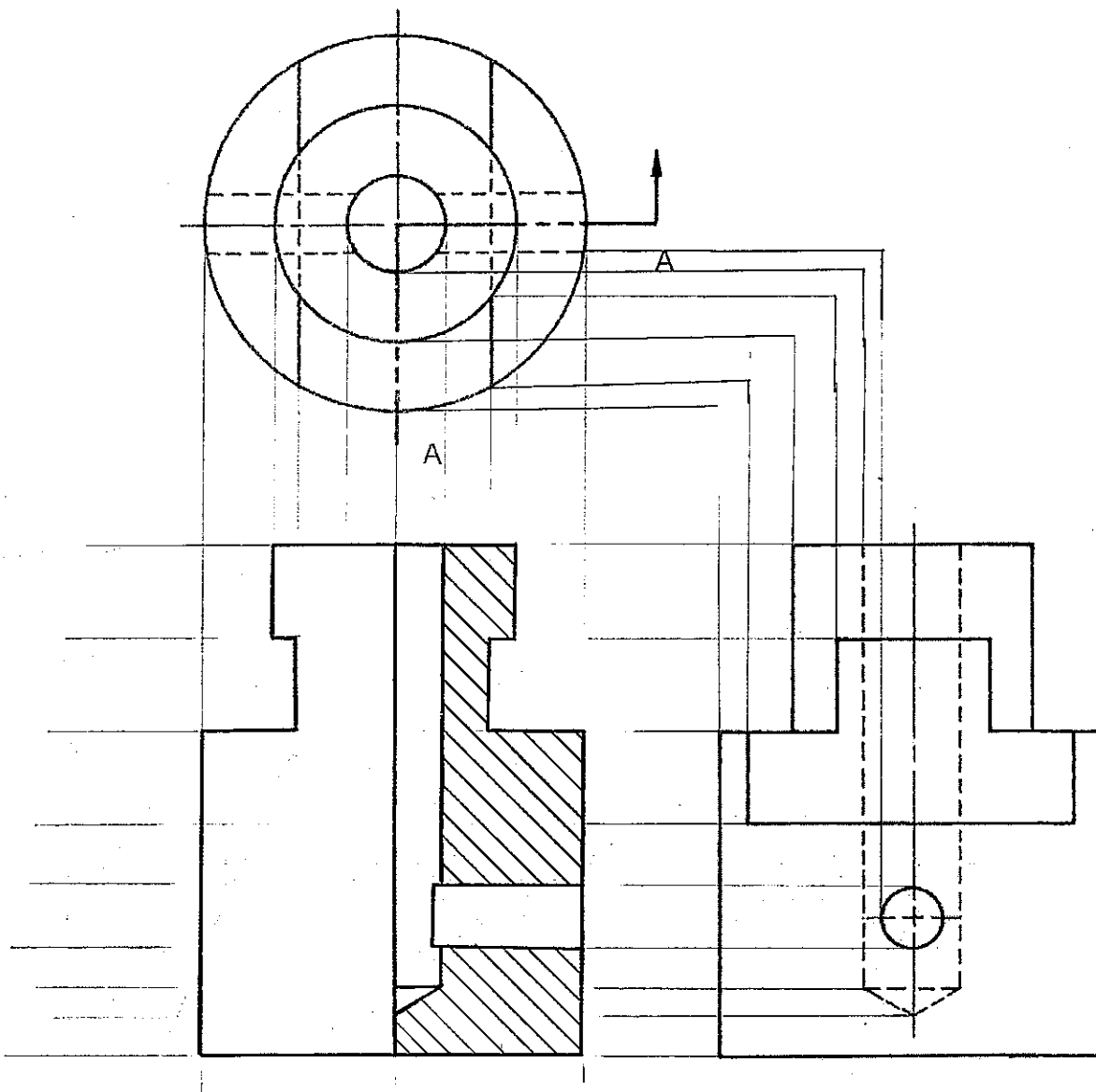
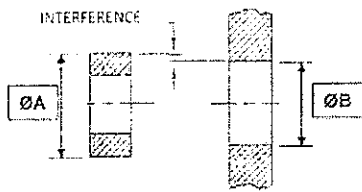


Figure 3(a)

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to allow for workings.

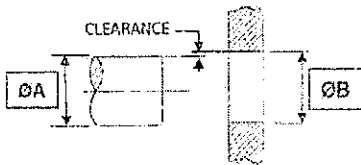
3(b) Using the tables in the Appendix, determine and enter the missing dimensions into each of the tables as shown in Figure 3(b). (12 marks)

/ 12



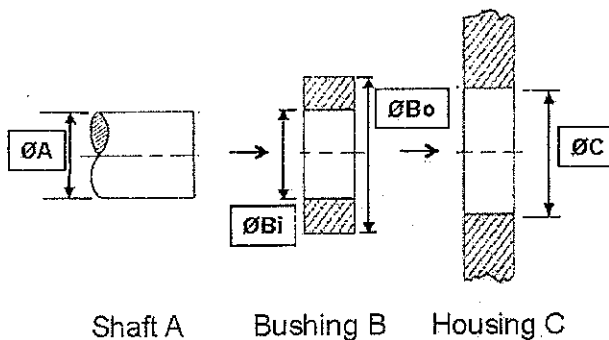
		ØA	ØB
--	Basic dimension	--	95.650
	Upper limit	95.904	95.710
	Lower limit	95.795	95.650

Bushing A to have a tolerance of 0.109 and a minimum interference of 0.085.



		ØA	ØB
--	Basic dimension	115.650	--
	Upper limit	115.650	115.735
	Lower limit	115.614	115.708

Shaft A to have a tolerance of 0.036 and a minimum clearance of 0.058



Fitting between B & C		ØBo	ØC
Type of Fit	Basic dimension	--	75.250
H7/s6	Upper limit	75.328	75.280
	Lower limit	75.309	75.250

Fitting between A & B		ØBi	ØA
Type of Fit	Basic dimension	--	48.750
G7/h6	Upper limit	48.784	48.750
	Lower limit	48.759	48.734

Fitting conditions:
Medium drive fit between bushing B and housing C; Sliding fit between shaft A and bushing B.

Figure 3(b)

4(a) Determine and enter the missing data into the table as shown in Figure 4(a). (5 marks)

/ 5

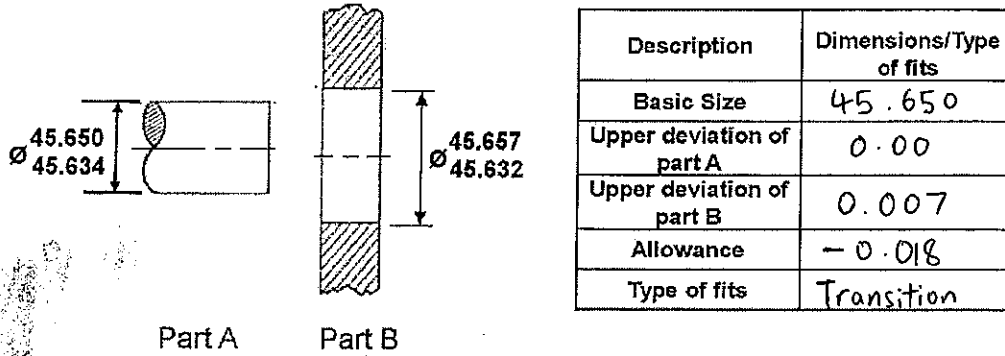
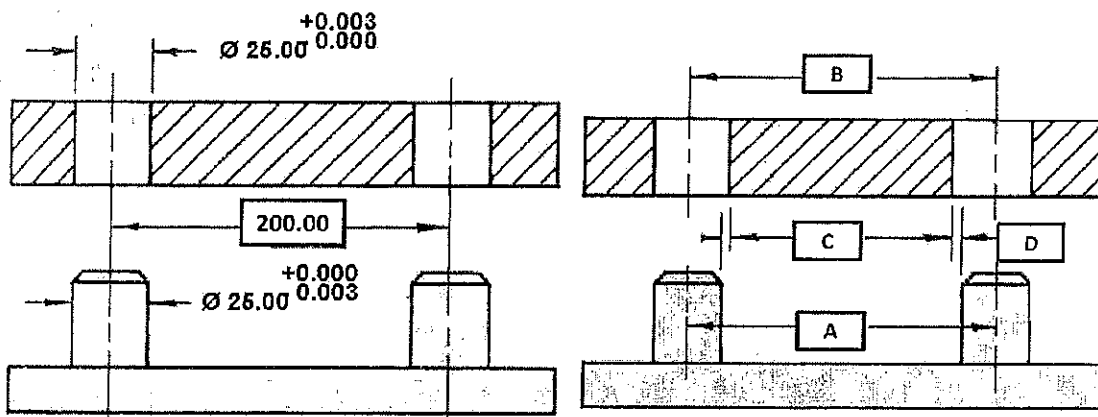


Figure 4(a)

4(b) Determine and enter the missing data as shown in Figure 4(b). (4 marks)

(4 marks)

/ 4



	Maximum permissible distance (A)	Minimum permissible distance (B)	(C)	(D)
Both holes and bosses are at their Least Material Condition (LMC)	200.00	200.00	149.994	150.006

Figure 4(b)

4(c) A pin rests freely inside a hole located on the top right corner of a boss. The centre of the hole and boss shown in Figure 4(c) must not vary by more than 0.01 mm and 0.015 mm respectively in any direction from their true positions when both are at their **Maximum Material Condition (MMC)**. Enter suitable tolerance symbols, tolerances and dimensions, where appropriate, in the sketch provided in Figure 4(d). In addition, determine and enter the minimum and maximum distances as shown in the table within Figure 4(d).

(16 marks)

/ 16

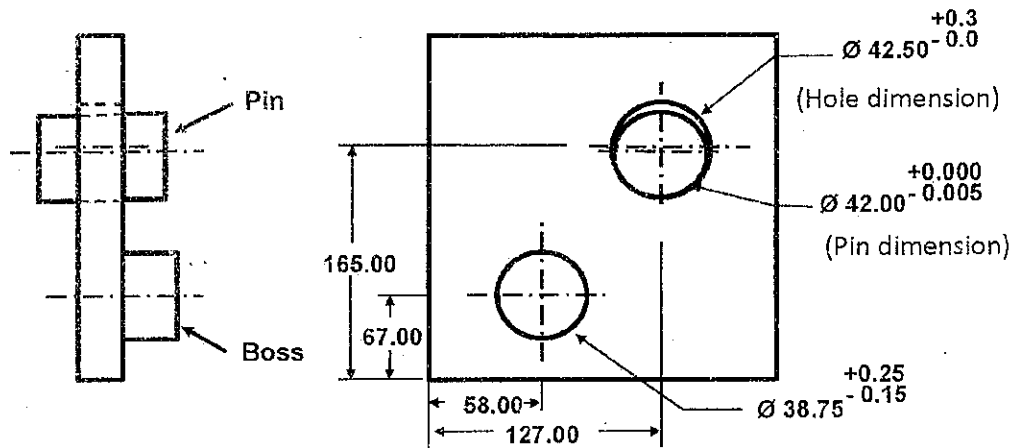
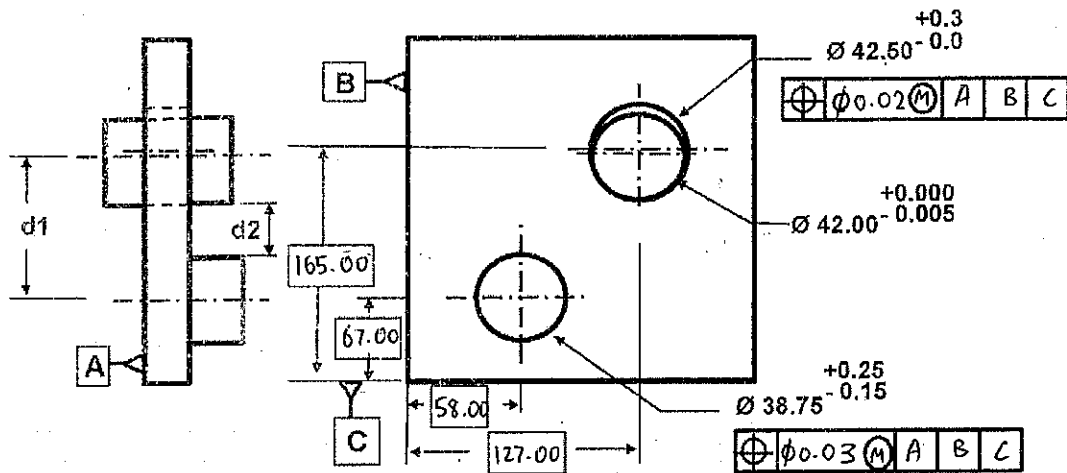


Figure 4(c)



Conditions	Minimum d1	Maximum d1	Minimum d2	Maximum d2
Pin, hole and boss are at LMC	---	---	56.925	57.675
Pin, hole and boss are at MMC	97.725	98.275	---	---

Figure 4(d)

End of Paper

NANYANG TECHNOLOGICAL UNIVERSITY
SEMESTER 2 EXAMINATION 2018-2019
MA2005 - ENGINEERING GRAPHICS

April/May 2019

Time Allowed: 2 1/2 hours

Seat Number :

Matriculation Number:

/ 12

1(a) Figure 1(a) shows a solid triangular prism intersect with a solid rectangular prism is presented in Third Angle Projection. Draw the incomplete front elevation of the object showing all the construction lines and outlines with hidden details clearly. (12 marks)

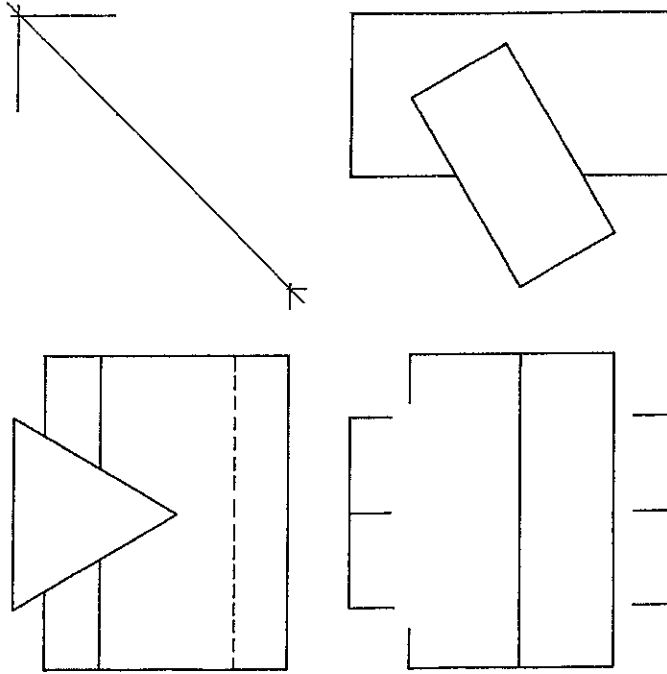


Figure 1(a)

INSTRUCTIONS TO CANDIDATES

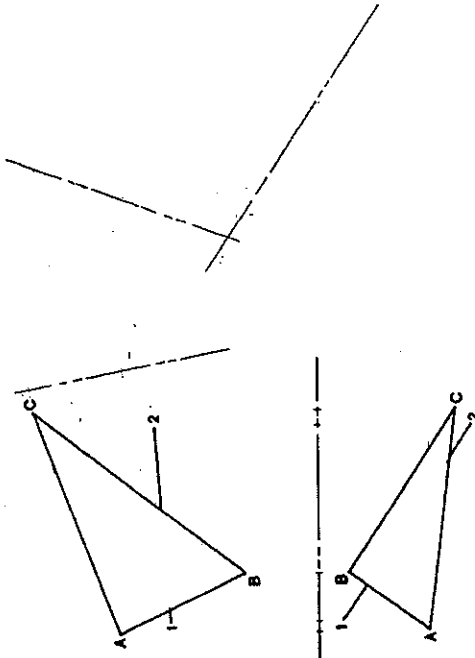
1. This Question and Answer (Q & A) Book contains **FOUR (4)** questions and comprises **FIFTEEN (15)** pages.
2. Answer **ALL** the questions and all questions carry equal marks.
3. Write your answers for all the questions in the Q & A Book.
4. Do not write your name on the Q & A Book.
5. Write your matriculation number on the front page of this Q & A Book.
6. Candidates are **NOT** allowed to remove any page from the Q & A Book.
7. This Q & A Book, used or unused, must not be removed from the Examination Hall. It **MUST BE HANDED IN** at the end of the examination.
8. This is a **CLOSED - BOOK** examination.

EXAMINER'S USE ONLY	
Questions	Marks
1	
2	
3a	
3b	
4	
Total	

MA2005

1(b) Figure 1(b) shows the intersection of the line 1-2 and the plane A-B-C in the Third Angle Projection. Draw and measure the true angle between the line and the plane. Hidden details are required. You may use the datums given. (13 marks)

/ 13



ANGLE = _____

Figure 1(b)

MA2005

2(a) Figure 2(a) shows the orthographic views of an object presented in First Angle Projection. Using the isometric paper provided, draw full size the isometric drawing of the object so that point A will be the highest point in the drawing. Hidden details are not required. Each grid unit represents 5 mm. (12 marks)

/ 12

Note: Each grid unit represents 5 mm

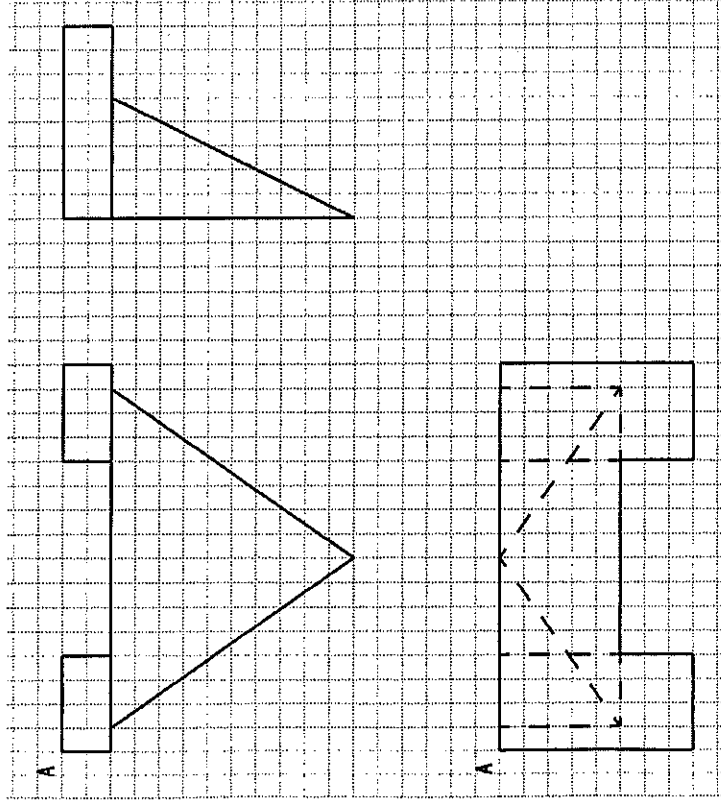


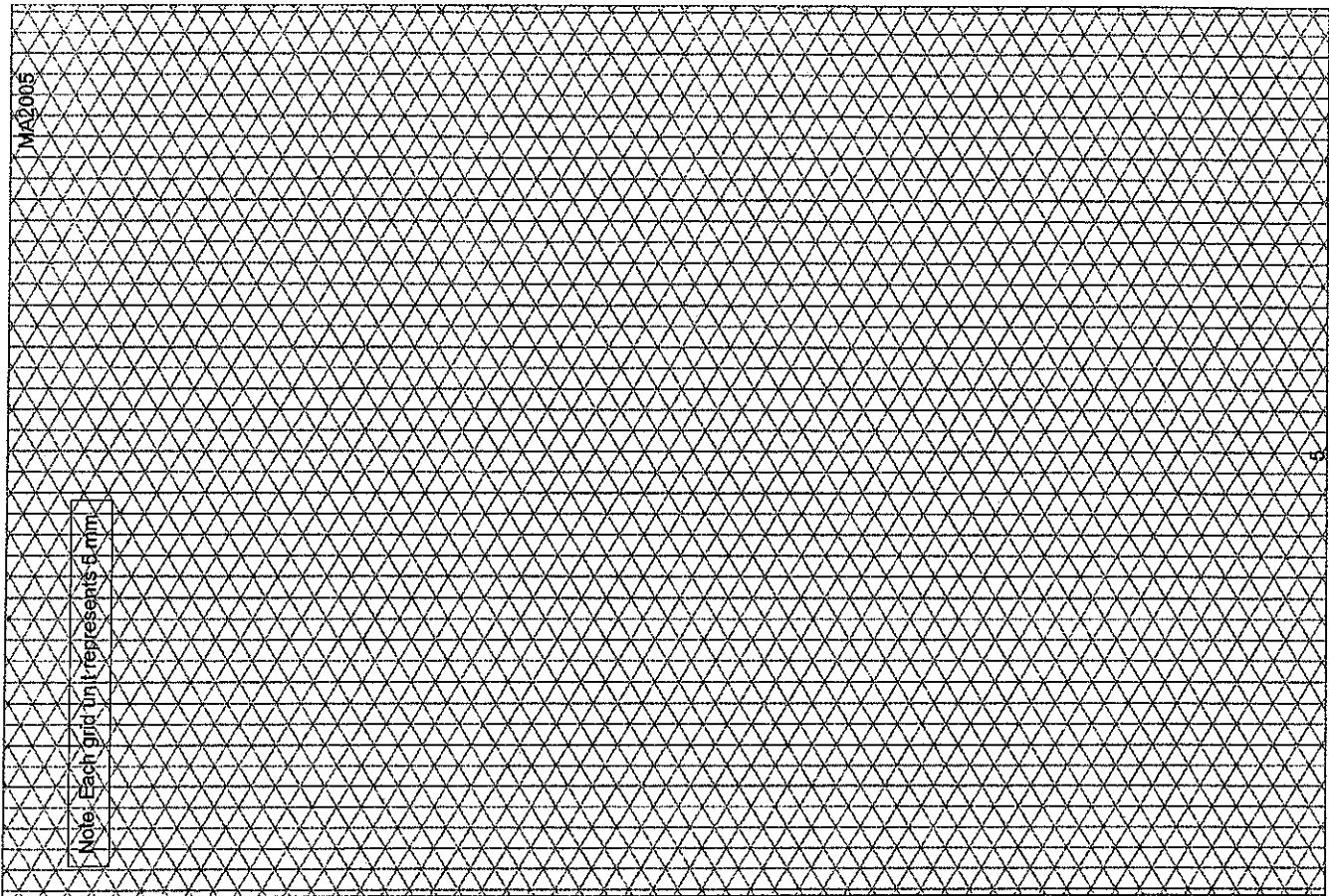
Figure 2(a)

MA2005

2(b) Figure 2(b) shows the front elevation and plan of a hollow truncated prism in First Angle Projection. Draw its development of the object. Begin the pattern with the seam at A-1 and seam allowance is not required.

(13 marks)

13 / 13



Note: Each grid unit represents 6 mm

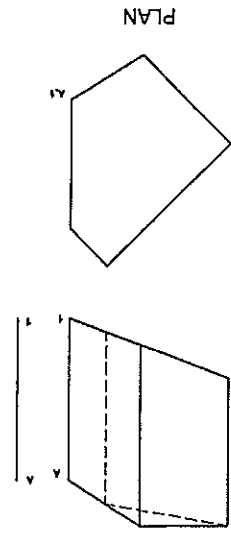


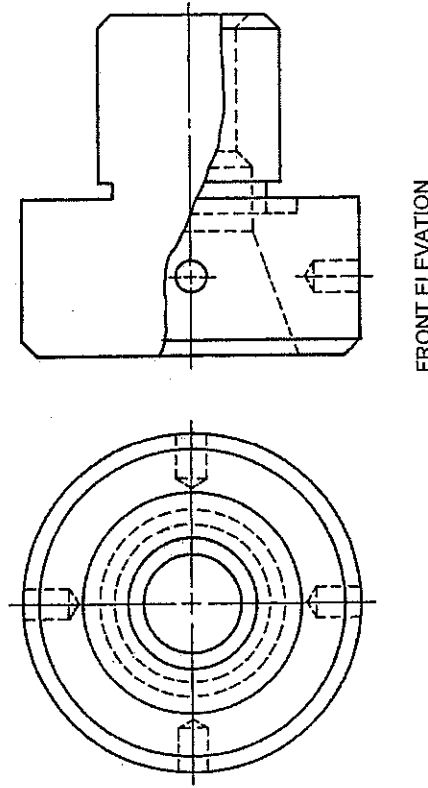
Figure 2(b)

MA2005

3(a) An object as shown in Figure 3(a) is presented in the Third Angle Projection. Draw a broken-out section in the front elevation showing all the construction lines and outlines clearly.

(13 marks)

/ 13



FRONT ELEVATION

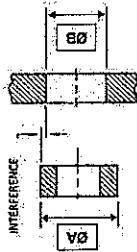
Figure 3(a)

MA2005

3(b) Determine and enter the missing dimensions into each of the tables as shown in Figure 3(b). (12 marks)

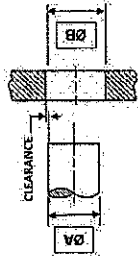
/ 12

Basic dimension	ϕA	ϕB
	Upper limit	-
	Lower limit	86.624



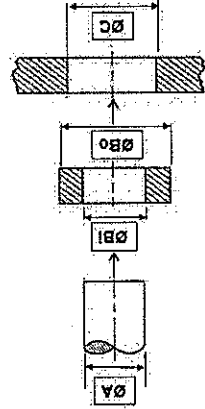
Bore B to have a tolerance of 0.102, bushing A to have a tolerance of 0.089 and a maximum interference of 0.213.

Basic dimension	ϕA	ϕB
	Upper limit	-
	Lower limit	54.355



Hole B to have a tolerance of 0.132, shaft A to have a tolerance of 0.118 and a maximum clearance of 1.015

Fitting between B & C		
Type of Fit	ϕB_0	ϕC
Basic dimension	-	112.750
Upper limit	-	-
Lower limit	-	-



Shaft A Bushing B Housing C

Fitting between A & B		
Type of Fit	ϕA	ϕB
Basic dimension	-	74.350
Upper limit	-	-
Lower limit	-	-

Fitting conditions:
Medium Drive Fit between bushing B and housing C; Sliding Fit between shaft A and bushing B.
(Refer to tables in the Appendix. Use ISO code for type of fit)

Figure 3(b)

MA2005

4(a) Determine and enter the missing data into the table as shown in Figure 4(a). (5 marks)

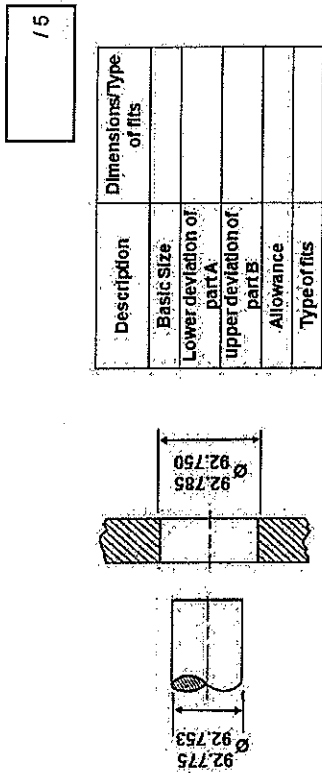


Figure 4(a)

4(b) Determine and enter the missing data as shown in Figure 4(b). (4 marks)

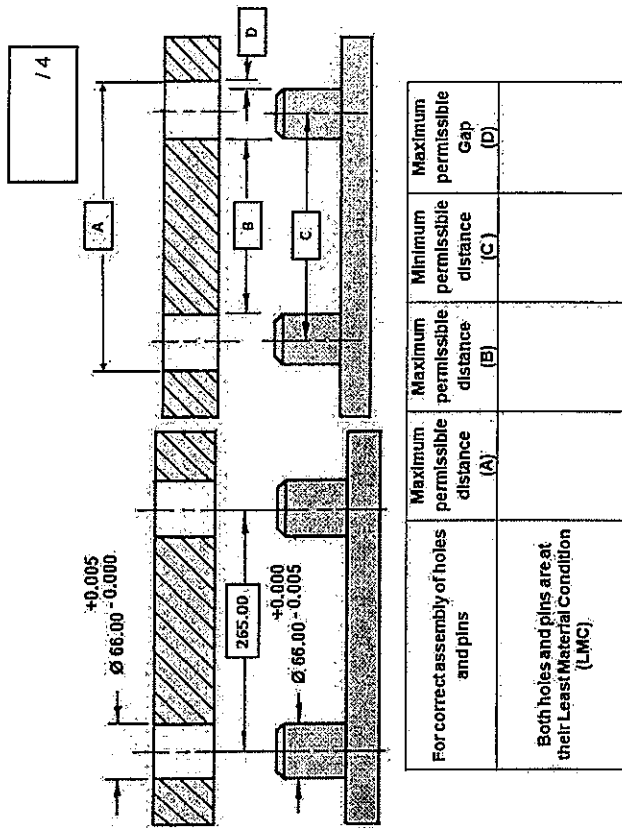


Figure 4(b)

10

MA2005

4(c) A Pin rests freely inside a hole located on the top right corner of a boss. The upper and lower limits of the centers of the hole and boss are shown in Figure 4(c). Use the maximum permissible tolerances as the position tolerances required in Figure 4(d). The position tolerances must be rounded up to two decimal places and are applied as indicated in the Feature Control Frame (FCF) in Figure 4(d). Enter suitable tolerance symbols, tolerances and dimensions, where appropriate, in the sketch provided in Figure 4(d). In addition, determine and enter the minimum and maximum distances as shown in the table within Figure 4(d). Round up your results to three decimal places.

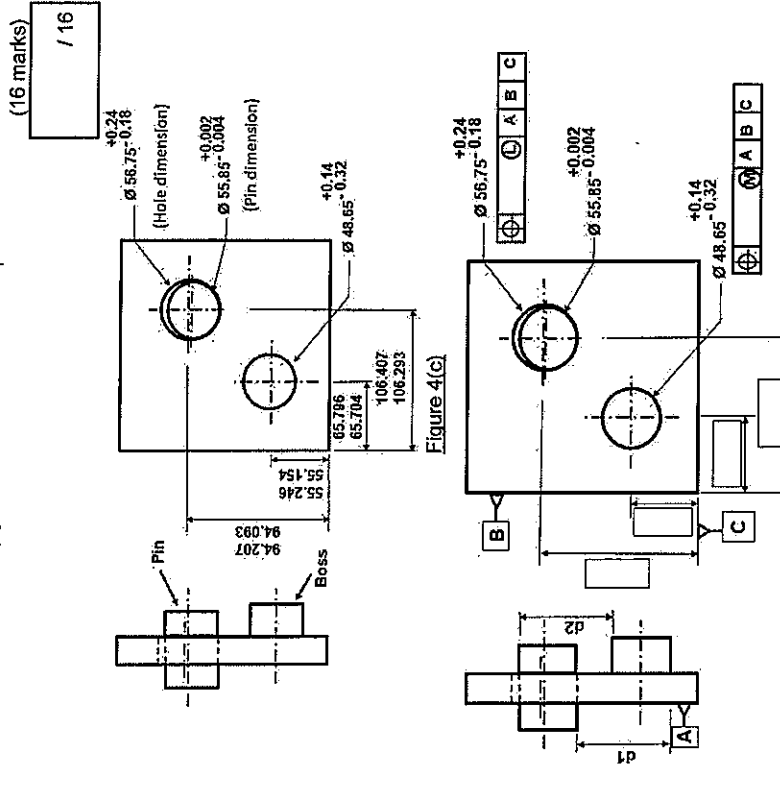


Figure 4(d)

End of Paper

11

1(a) Figure 1(a) shows a solid triangular prism intersect with a solid rectangular prism is presented in **Third Angle Projection**. Draw the incomplete front elevation of the object showing all the construction lines and outlines with hidden details clearly.

(12 marks)

/ 12

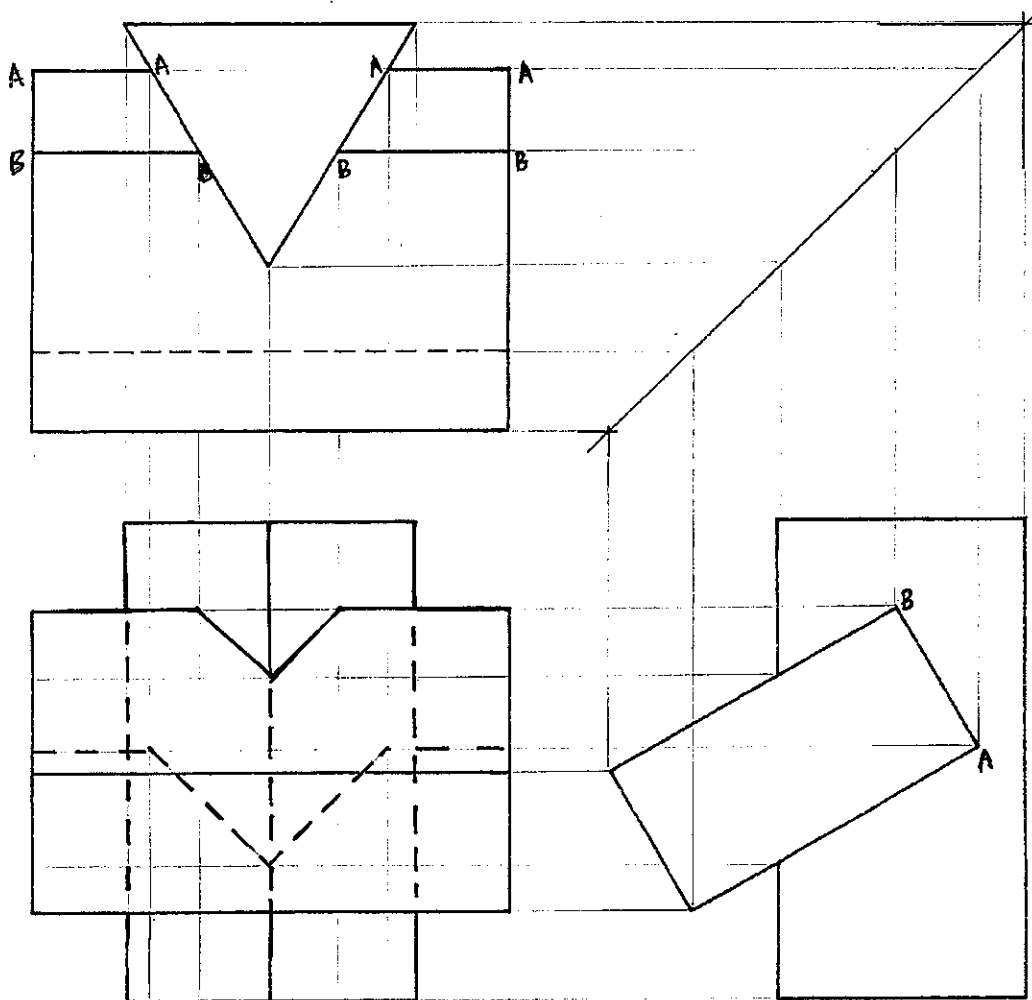
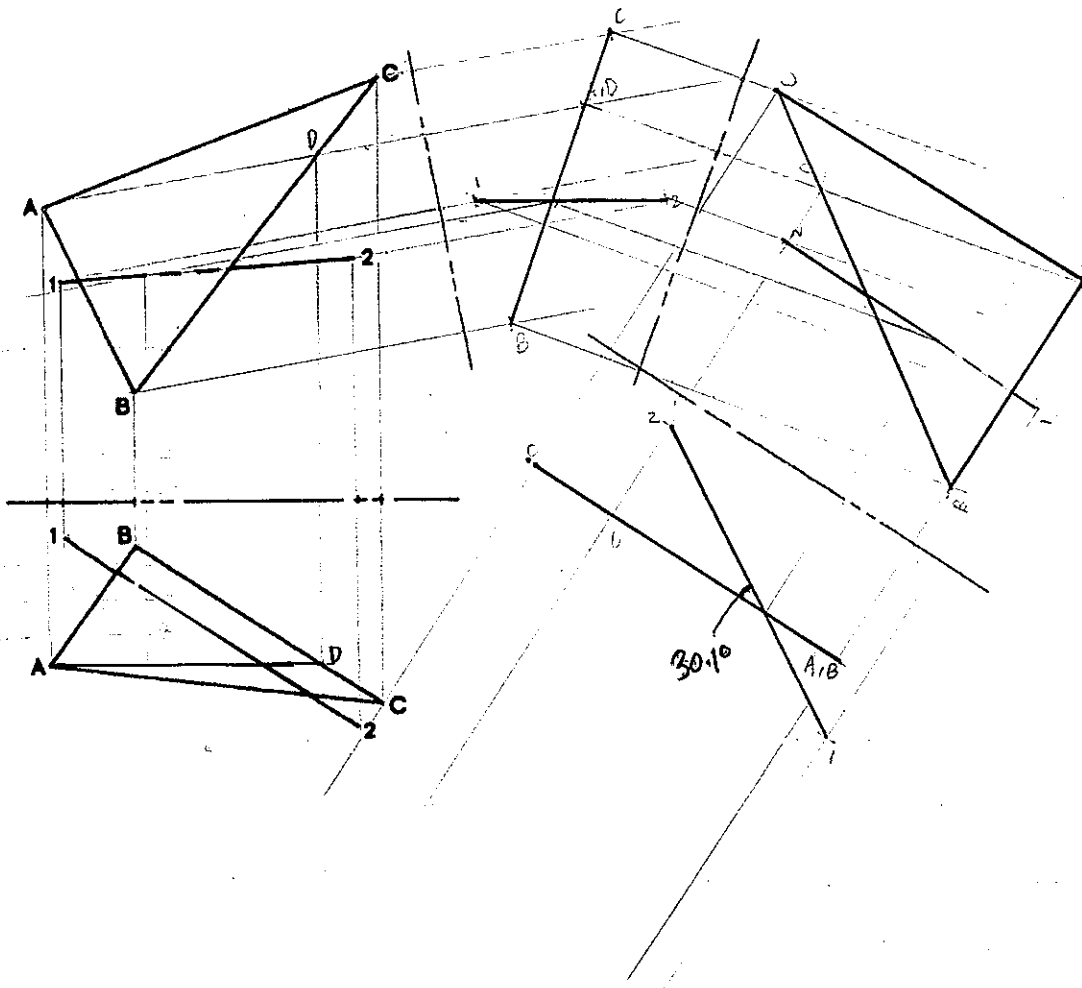


Figure 1(a)

- 1(b) Figure 1(b) shows the intersection of the line 1-2 and the plane A-B-C in the **Third Angle Projection**. Draw and measure the true angle between the line and the plane. Hidden details are required. You may use the datums given. (13 marks)

/ 13



ANGLE = 30.1°

Figure 1(b)

2(a) Figure 2(a) shows the orthographic views of an object presented in **First Angle Projection**. Using the isometric paper provided, draw full size the isometric drawing of the object so that point **A** will be the highest point in the drawing. Hidden details are not required. Each grid unit represents 5 mm.

(12 marks)

/ 12

Note: Each grid unit represents 5 mm

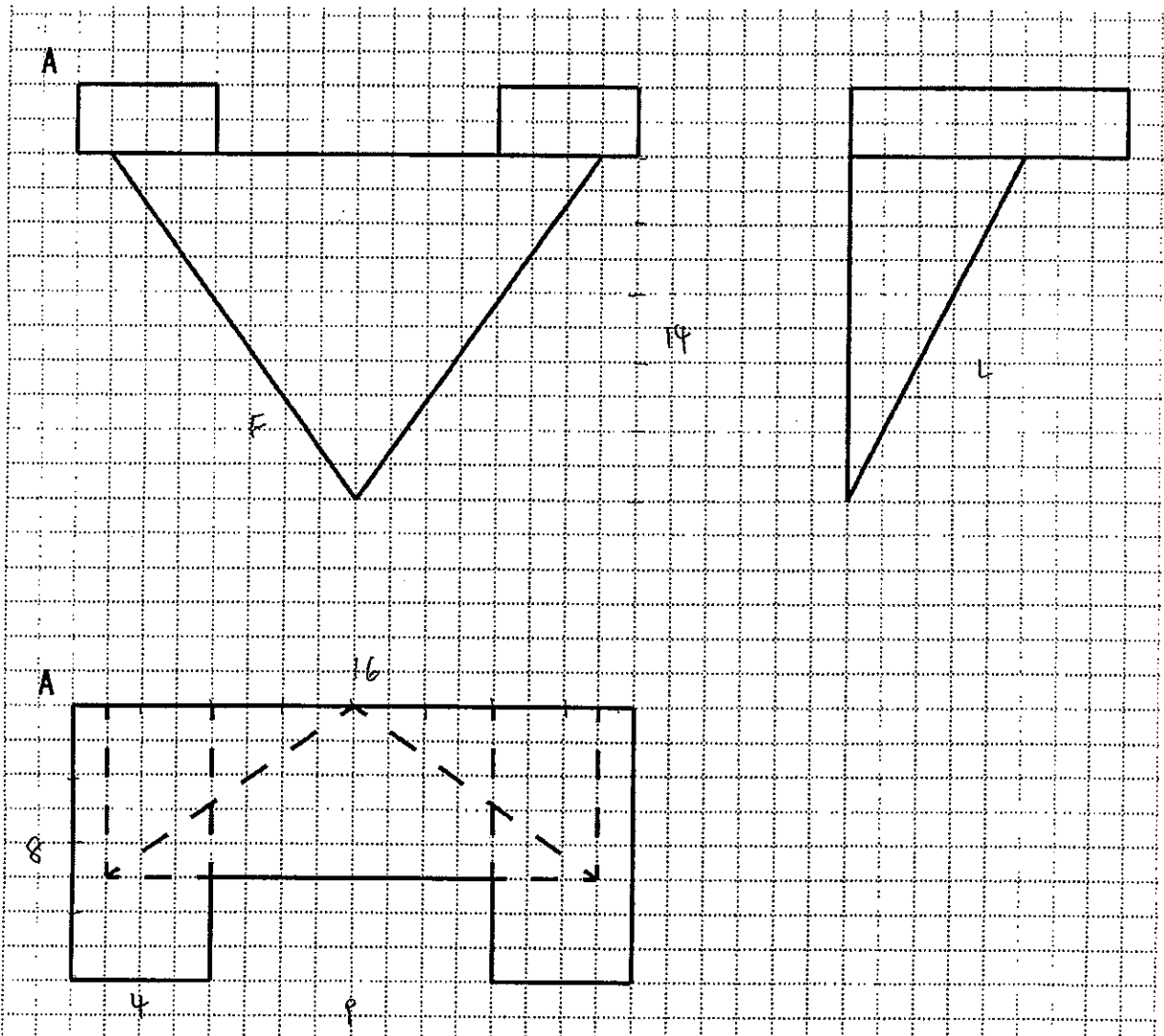
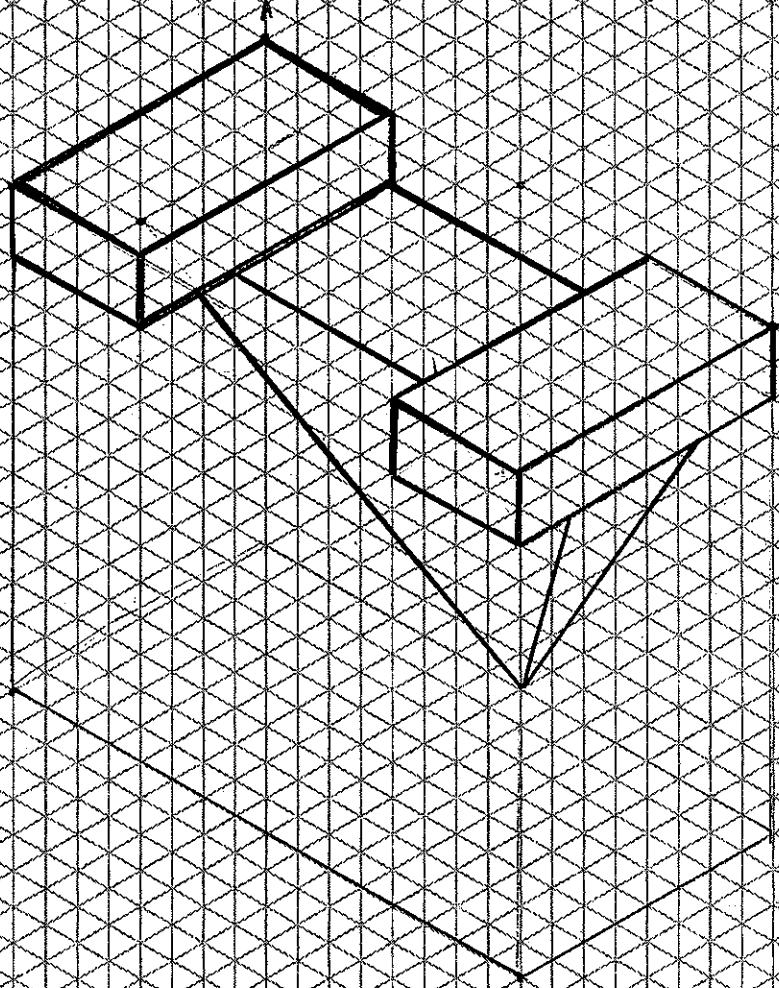


Figure 2(a)

Note: Each grid unit represents 5 mm.



2(b) Figure 2(b) shows the front elevation and plan of a hollow truncated prism in **First Angle Projection**. Draw its development of the object. Begin the pattern with the seam at A-1 and seam allowance is not required.

(13 marks)

/ 13

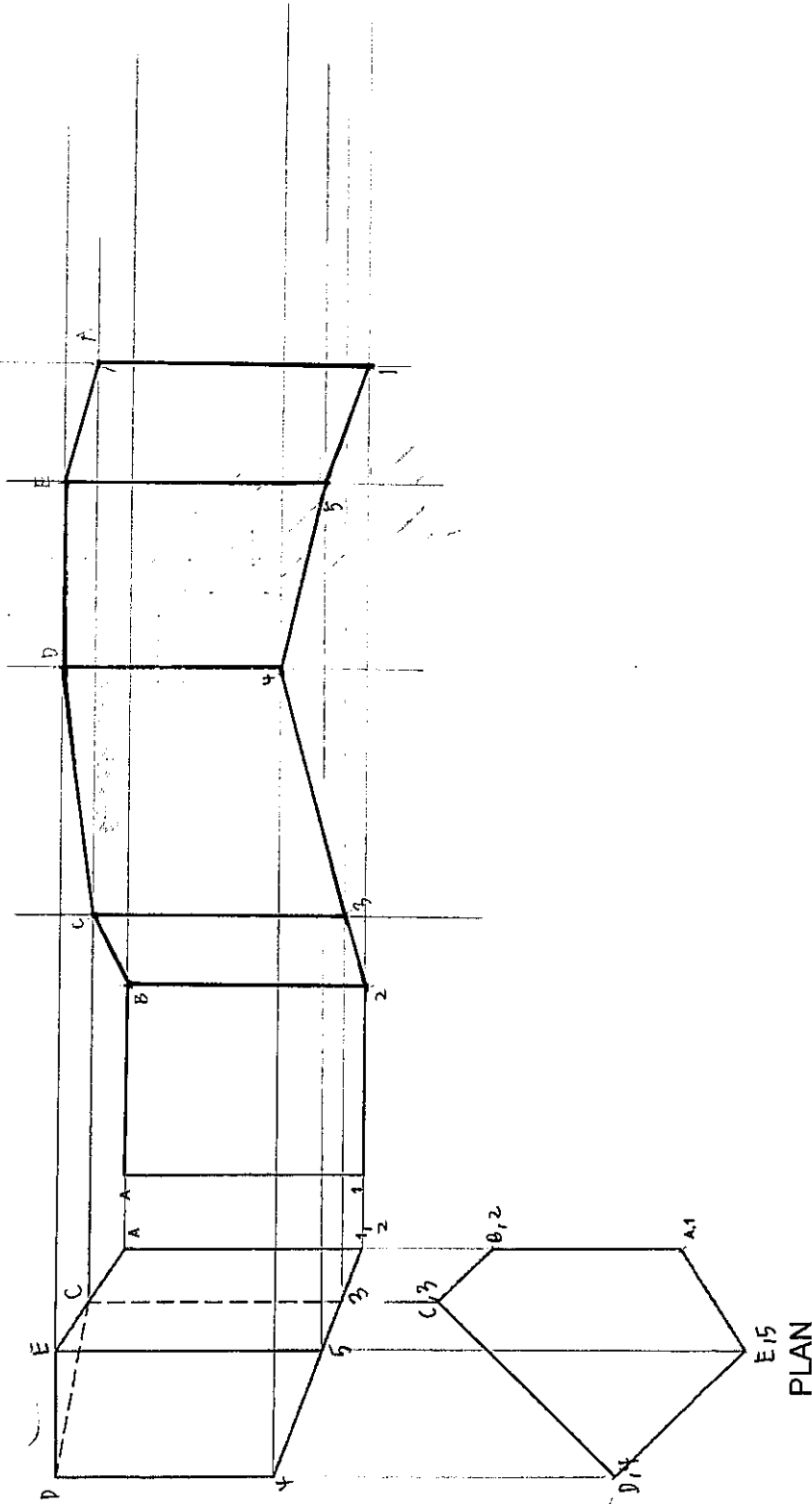


Figure 2(b)

- 3(a) An object as shown in Figure 3(a) is presented in the **Third Angle Projection**. Draw a broken-out section in the front elevation showing all the construction lines and outlines clearly.

(13 marks)

/ 13

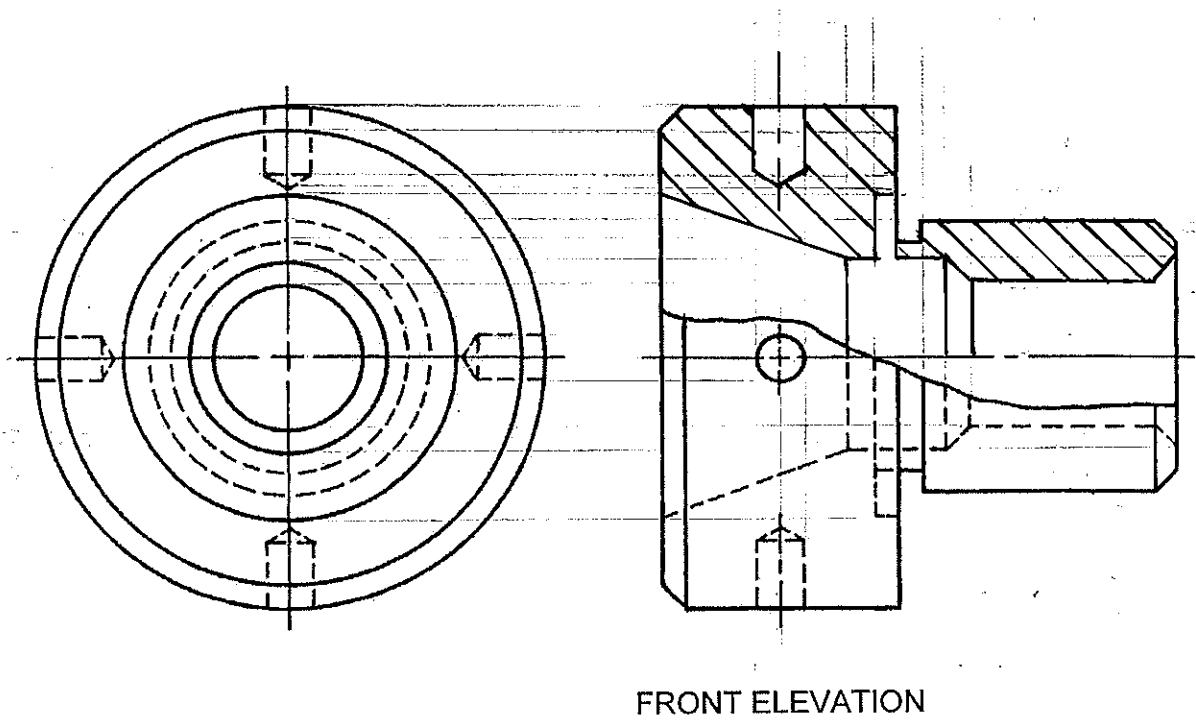
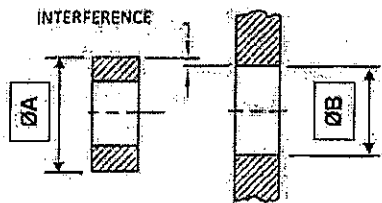


Figure 3(a)

3(b) Determine and enter the missing dimensions into each of the tables as shown in Figure 3(b).
(12 marks)

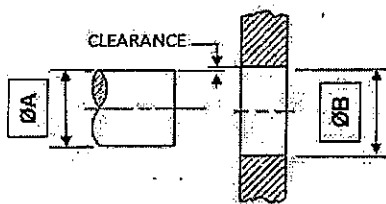
/ 12



		ØA	ØB
Basic dimension		--	86.500
--	Upper limit	86.713	86.602
	Lower limit	86.624	86.500

Bore B to have a tolerance of 0.102, bushing A to have a tolerance of 0.089 and a maximum interference of 0.213.

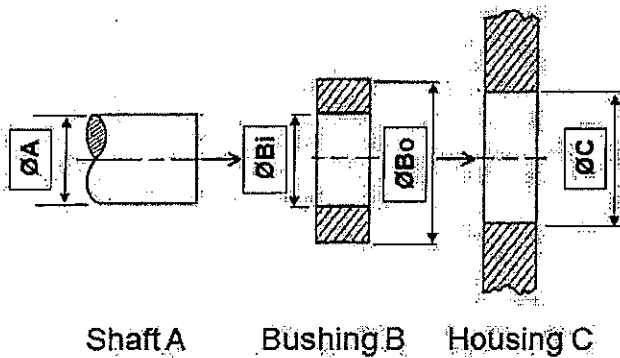
MMC shaft - MMC hole = 0.213



		ØA	ØB
Basic dimension		53.590	--
--	Upper limit	53.590	54.487
	Lower limit	53.472	54.355

Hole B to have a tolerance of 0.132, shaft A to have a tolerance of 0.118 and a maximum clearance of 1.015

LMC hole - LMC shaft = 1.015



		hole	
Fitting between B & C		ØBO	ØC
Type of Fit	Basic dimension	--	112.750
H7/s6	Upper limit	112.851	112.785
	Lower limit	112.829	112.750

		shaft	
Fitting between A & B		ØBI	ØA
Type of Fit	Basic dimension	--	74.350
G7/h6	Upper limit	74.390	74.350
	Lower limit	74.360	74.331

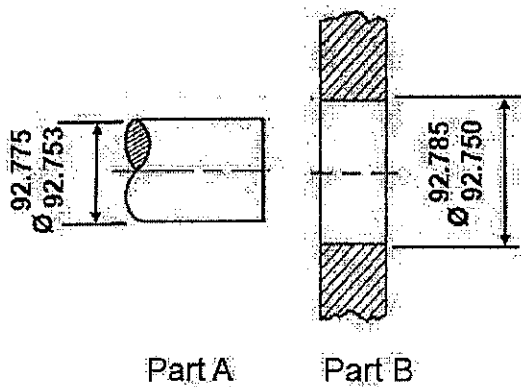
Fitting conditions:

Medium Drive Fit between bushing B and housing C; Sliding Fit between shaft A and bushing B. (Refer to tables in the Appendix. Use ISO code for type of fit)

Figure 3(b)

4(a) Determine and enter the missing data into the table as shown in Figure 4(a). (5 marks)

/ 5



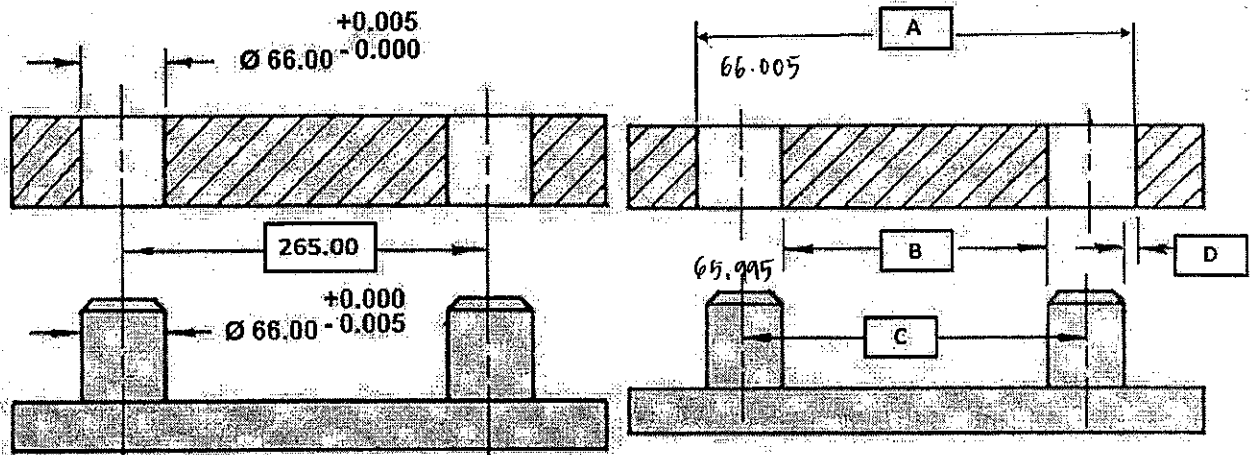
Description	Dimensions/Type of fits
Basic Size	92.750
Lower deviation of part A	0.003
upper deviation of part B	0.035
Allowance	-0.025
Type of fits	transition

from MMC, choose nicest no.
lower limit - basic
upper limit - basic
MMC hole - MMC shaft

Figure 4(a)

4(b) Determine and enter the missing data as shown in Figure 4(b). (4 marks)

/ 4



For correct assembly of holes and pins	Maximum permissible distance (A)	Maximum permissible distance (B)	Minimum permissible distance (C)	Maximum permissible Gap (D)
Both holes and pins are at their Least Material Condition (LMC)	331.005	265.005	264.990	0.010

Figure 4(b)

4(c) A Pin rests freely inside a hole located on the top right corner of a boss. The upper and lower limits of the centers of the hole and boss are shown in Figure 4(c). Use the maximum permissible tolerances as the position tolerances required in Figure 4(d). The position tolerances must be rounded up to two decimal places and are applied as indicated in the Feature Control Frame (FCF) in Figure 4(d). Enter suitable tolerance symbols, tolerances and dimensions, where appropriate, in the sketch provided in Figure 4(d). In addition, determine and enter the minimum and maximum distances as shown in the table within Figure 4(d). Round up your results to three decimal places.

(16 marks)

/ 16

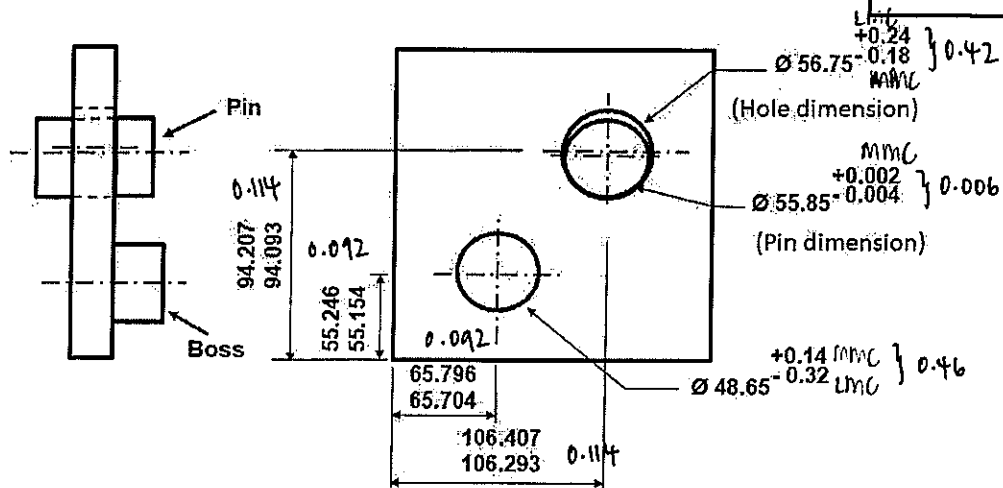
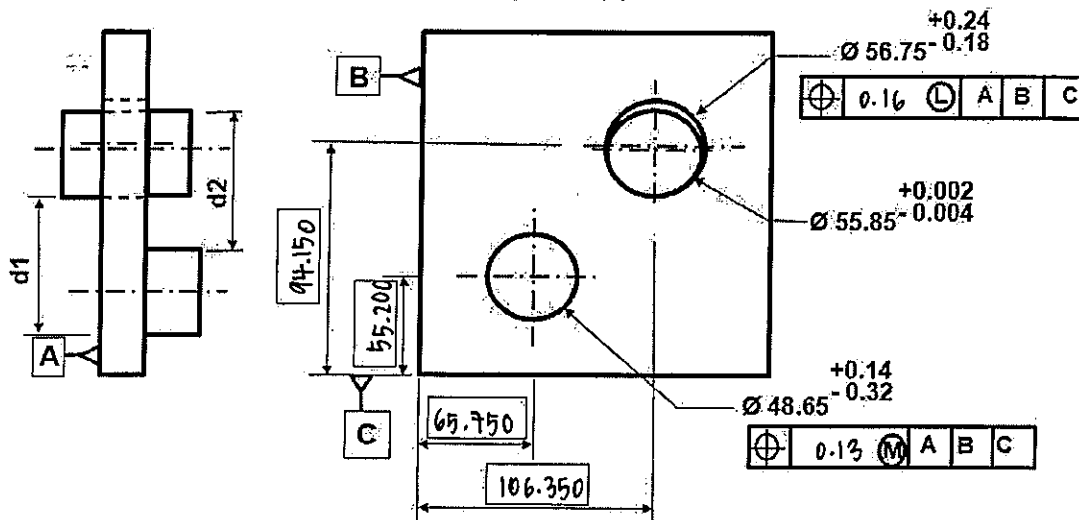


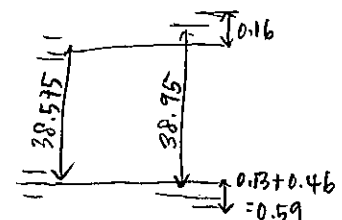
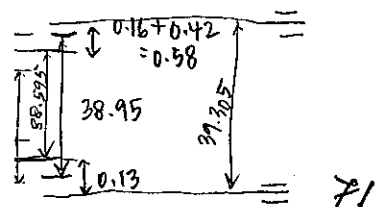
Figure 4(c)



Conditions	Minimum d1	Maximum d1	Minimum d2	Maximum d2
Hole and boss are at LMC. Pin is at MMC	—	—	41.537	42.287
Hole and boss are at MMC. Pin is at LMC	34.705	35.415	—	—

LMC.
hole: $\frac{56.99}{2}$
= 28.495
boss = 24.395

Figure 4(d)
End of Paper



NANYANG TECHNOLOGICAL UNIVERSITY
SEMESTER 1 EXAMINATION 2019-2020
MA2005 - ENGINEERING GRAPHICS

November/December 2019

Time Allowed: 2½ hours

Seat Number :

--	--	--	--	--

Matriculation Number:

--	--	--	--	--	--	--	--	--

INSTRUCTIONS TO CANDIDATES

1. This Question and Answer (Q & A) Book contains **FOUR (4)** questions and comprises **FIFTEEN (15)** pages.
2. Answer **ALL** the questions and all questions carry equal marks.
3. Write your answers for all the questions in the Q & A Book.
4. Do not write your name on the Q & A Book.
5. Write your matriculation number on the front page of this Q & A Book.
6. Candidates are **NOT** allowed to remove any page from the Q & A Book.
7. This Q & A Book, used or unused, must not be removed from the Examination Hall. It **MUST BE HANDED IN** at the end of the examination.
8. This is a **CLOSED - BOOK** examination.

EXAMINER'S USE ONLY	
Questions	Marks
①	
②	
③a	
③b	
④	
Total	

1(a) A support as shown in Figure 1(a) is presented in **First Angle Projection**. Draw all the incomplete views of the object showing all the construction lines and outlines with hidden details clearly.

(12 marks)

/ 12

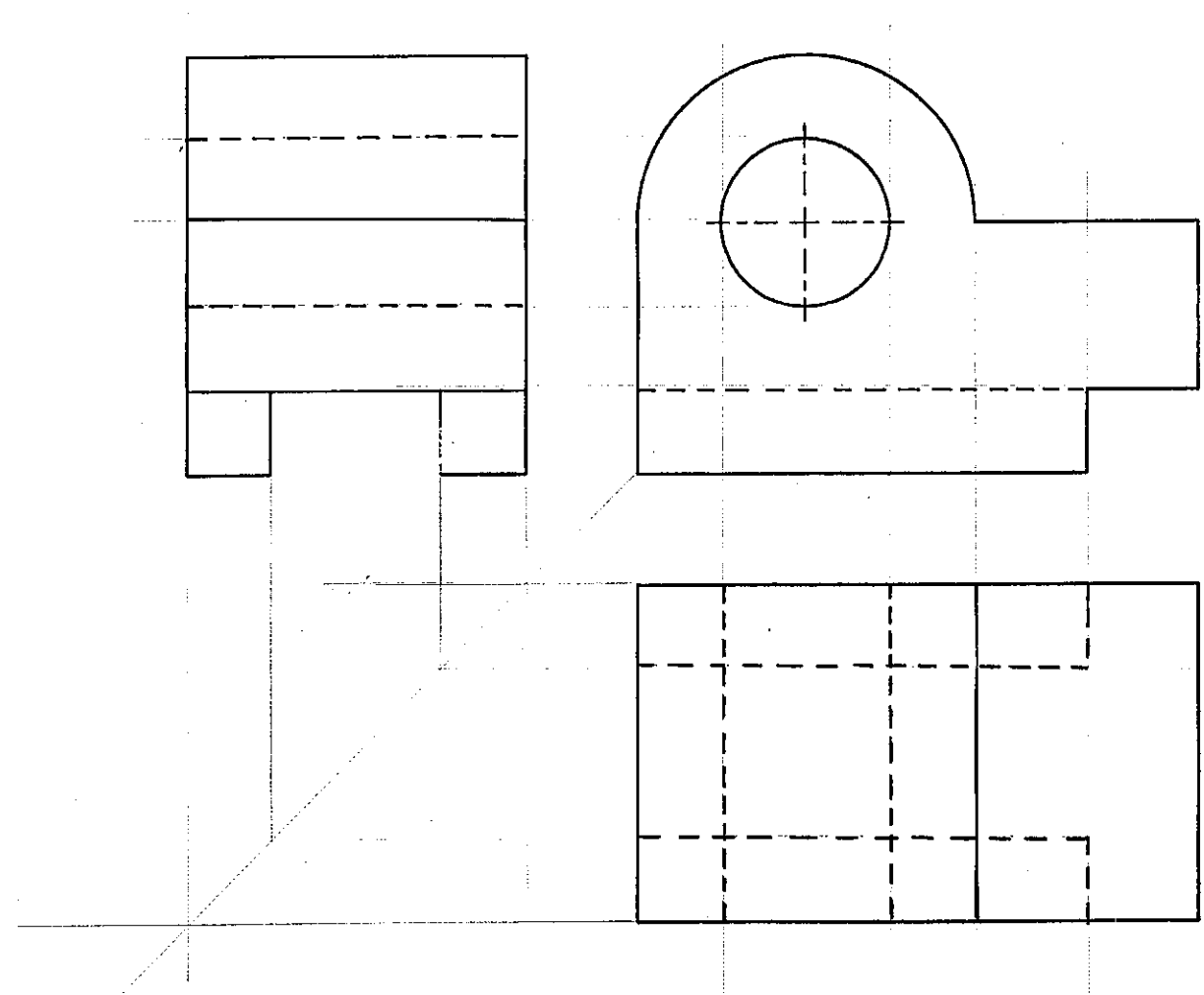


Figure 1(a)

1(b) A solid object as shown in Figure 1(b) is given in the **Third Angle Projection**. Draw the first auxiliary plan of the object in the direction of A. Hidden details are required.

(13 marks)

/ 13

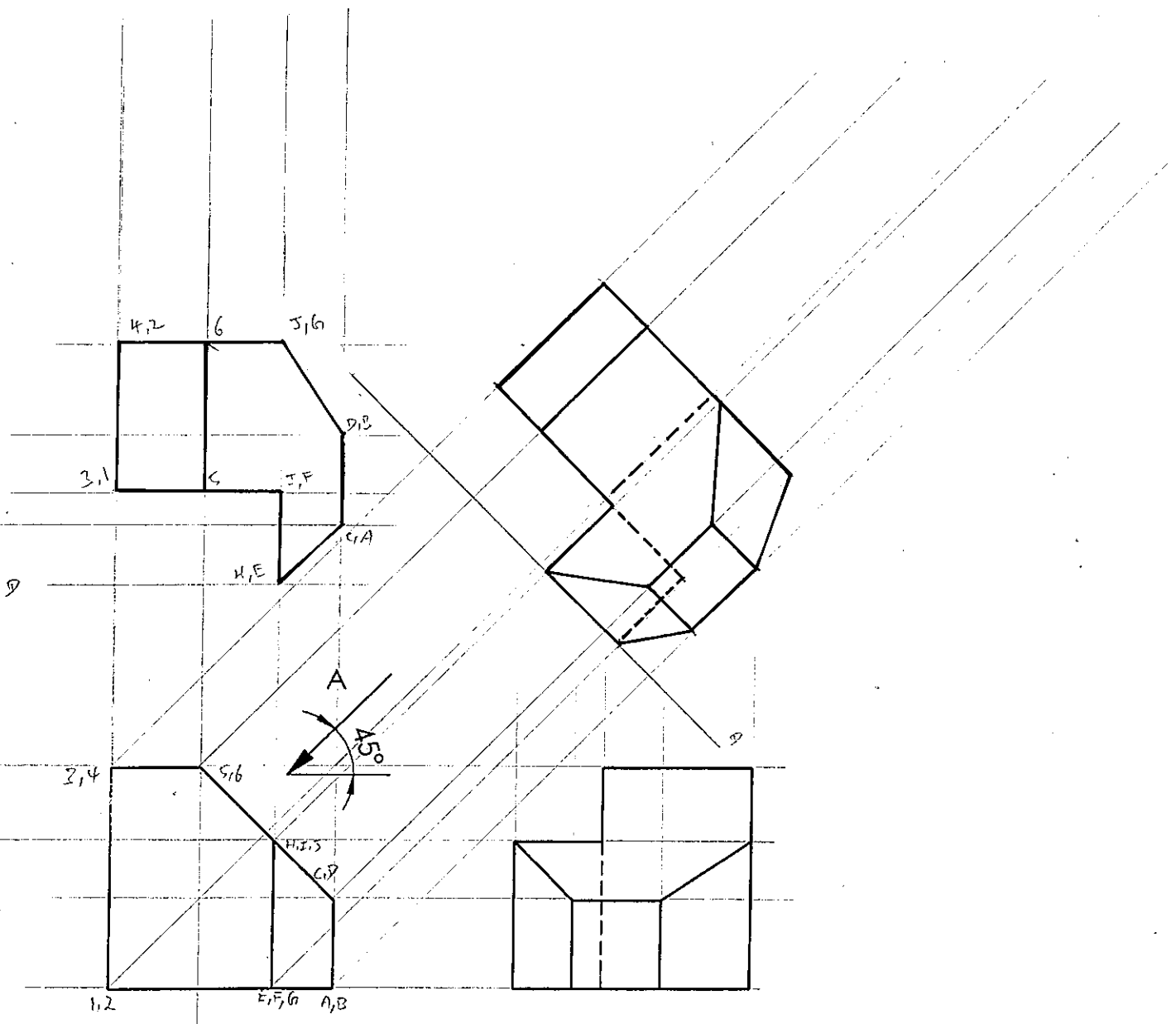


Figure 1(b)

2(a) Figure 2(a) shows the orthographic views of a support presented in **First Angle Projection**. Using the isometric paper provided, draw full size the isometric drawing of the object so that point **A** will be the lowest point in the drawing. Hidden details are not required. Each grid unit represents 5 mm.

(12 marks)

/ 12

Note: Each grid unit represents 5 mm

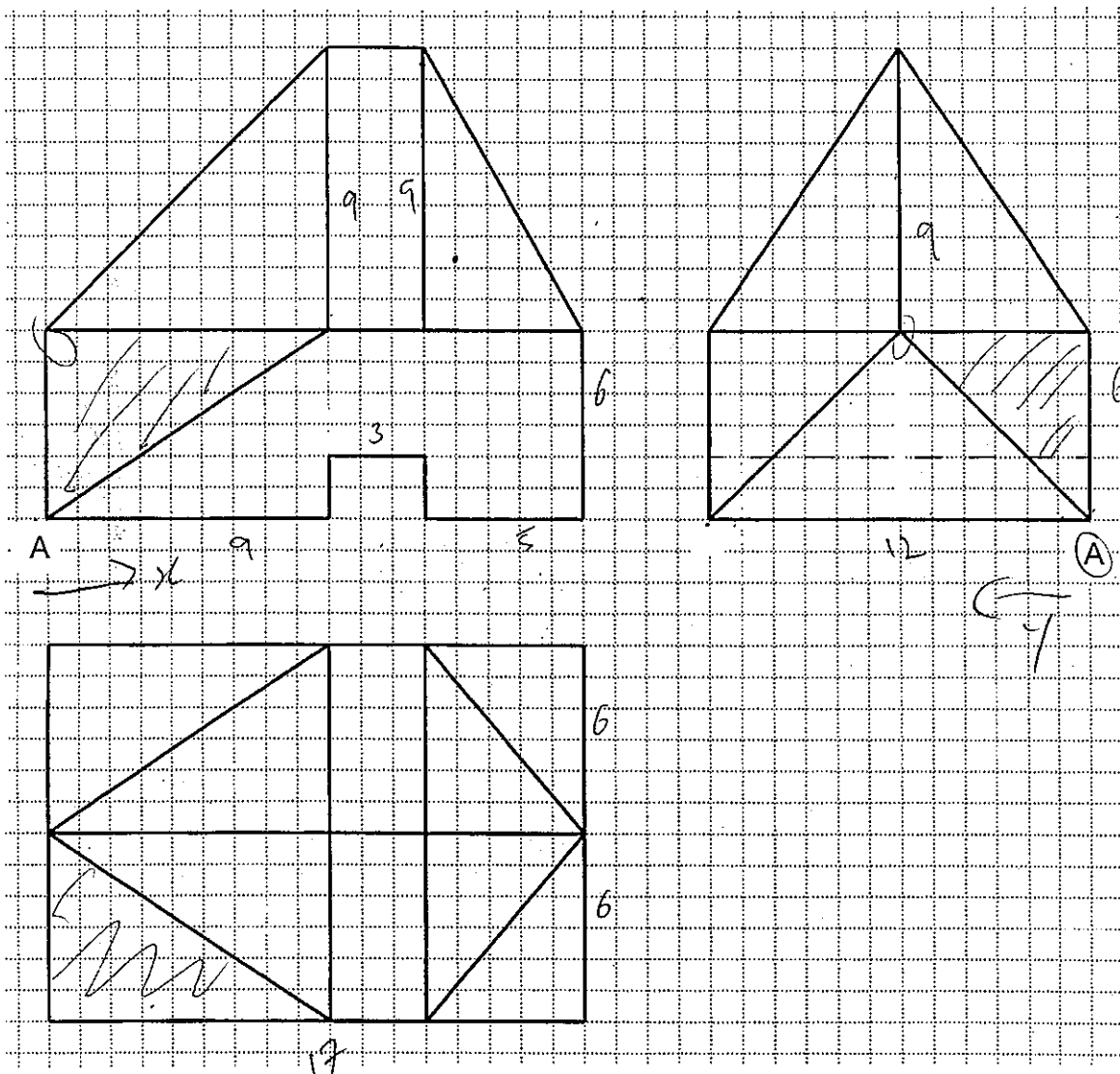
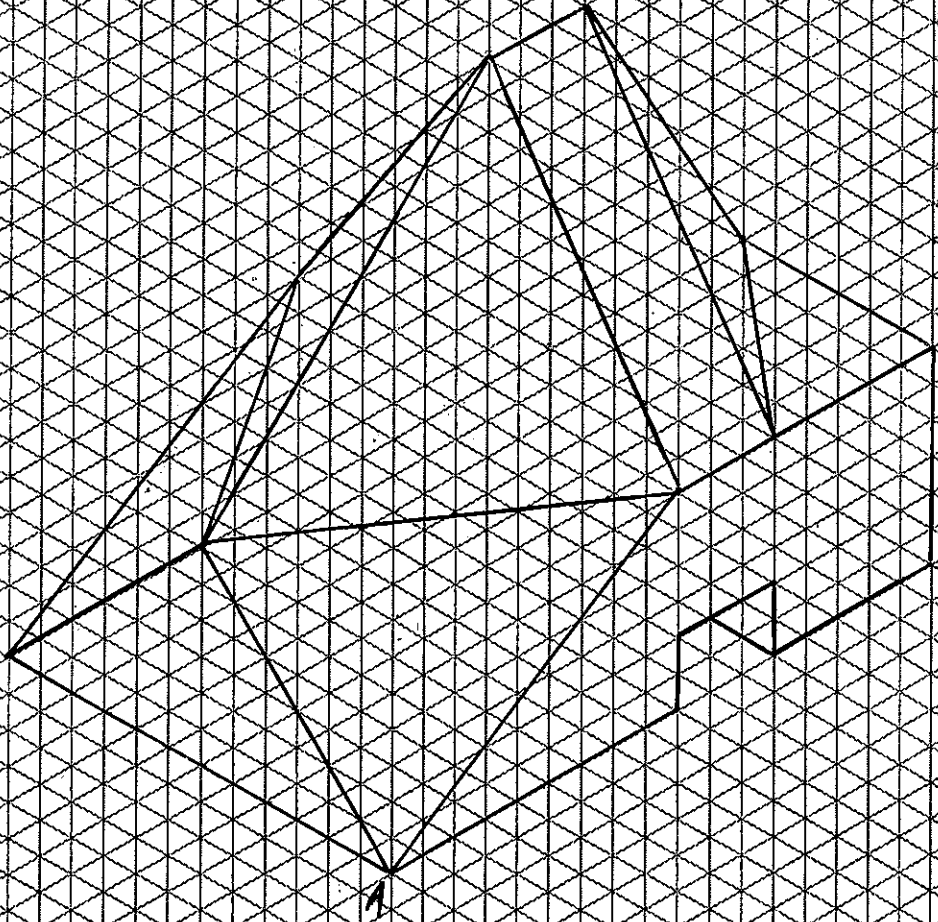


Figure 2(a)

Note: Each grid unit represents 5 mm



2(b) Figure 2(b) shows the plan and front elevation of a hollow truncated pyramid in **First Angle Projection**. Draw its development of the object. Begin the pattern with the seam at V-1 and seam allowance is not required.

(13 marks)

/ 13

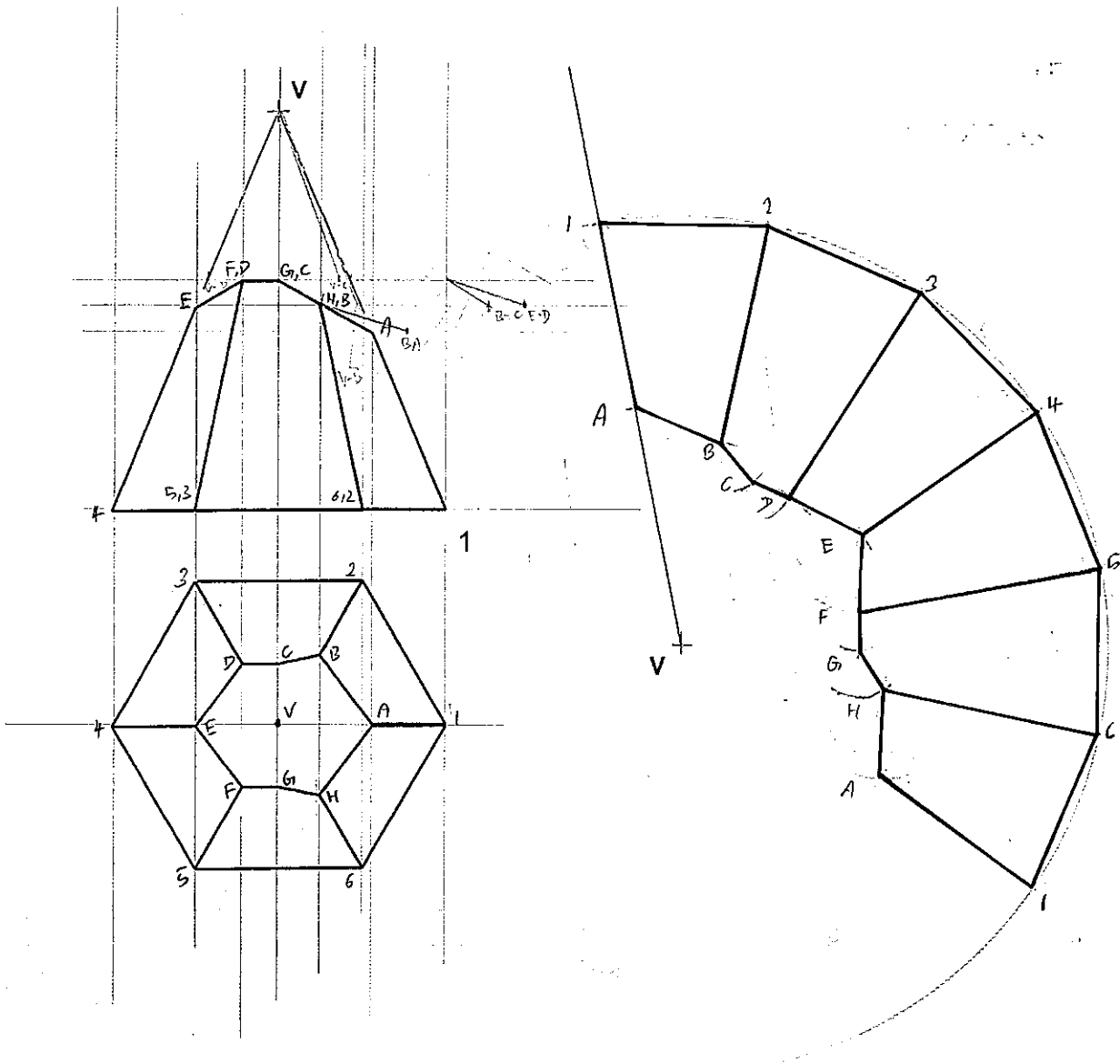


Figure 2(b)

3(a) An object as shown in Figure 3(a) is presented in the **Third Angle Projection**. Draw an off-set sectional view on **A-A** of the object showing all the construction lines and outlines clearly. Hidden lines are not required. (13 marks)

/ 13

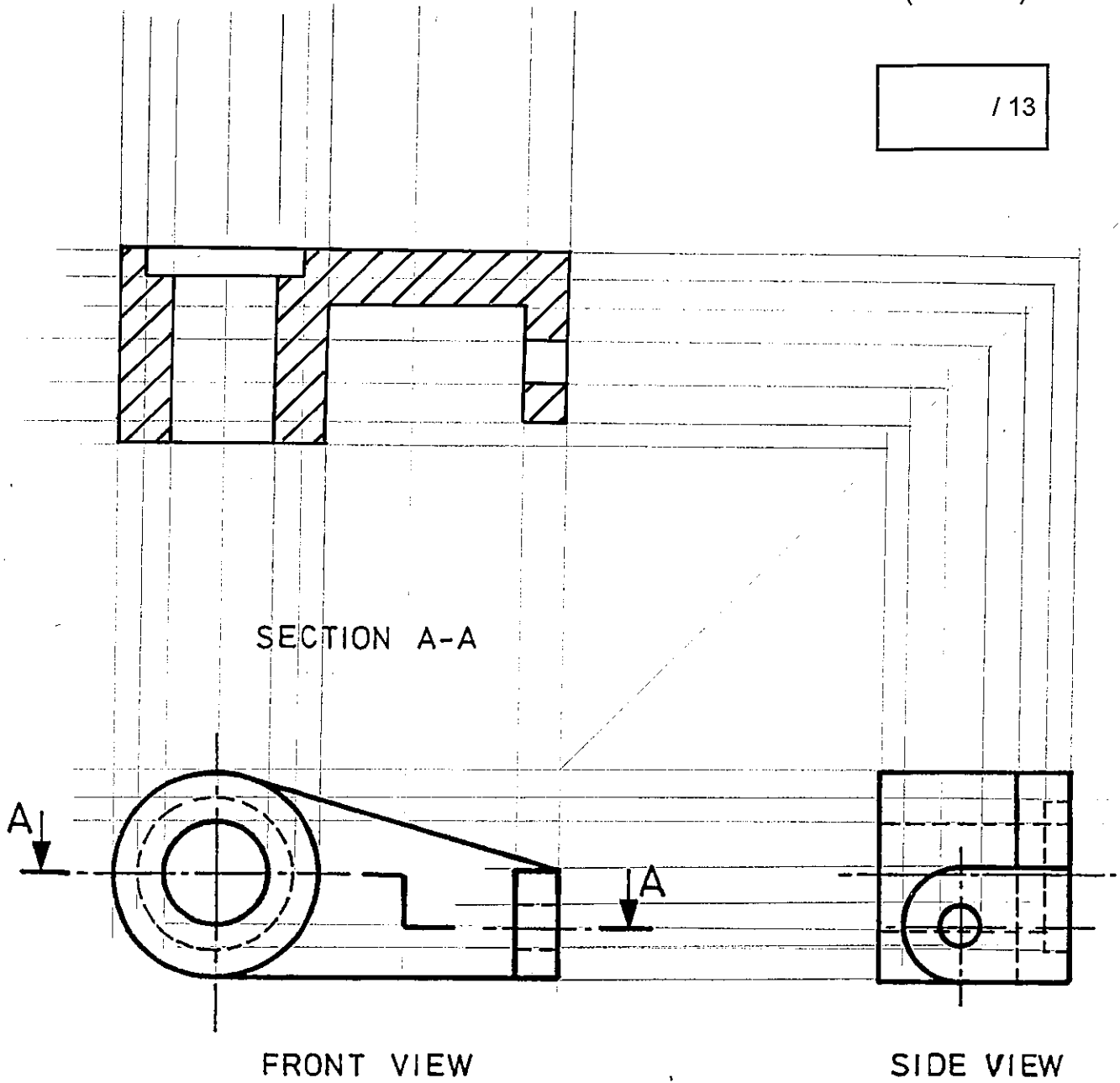
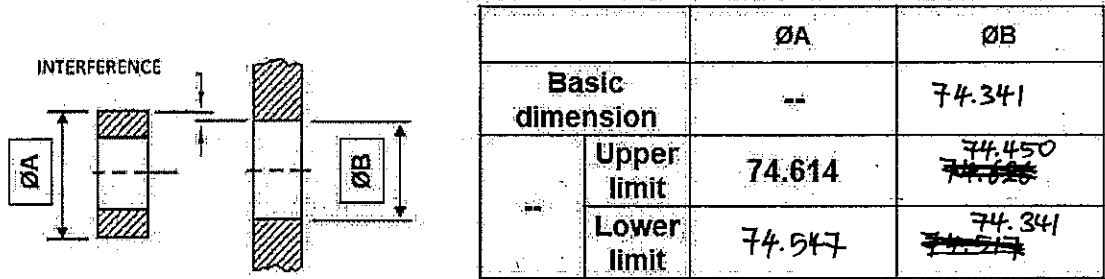


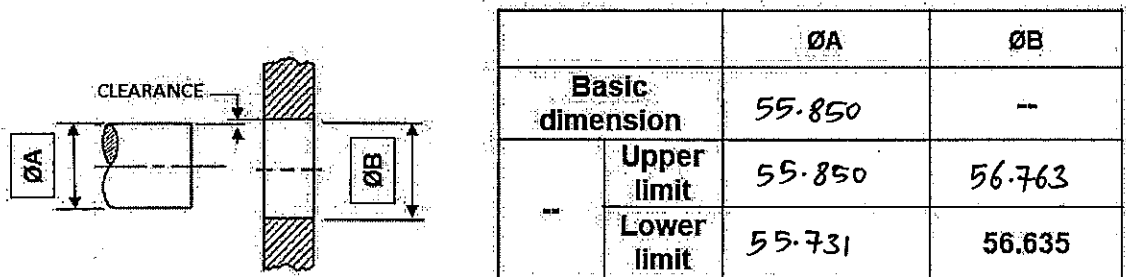
Figure 3(a)

3(b) Determine and enter the missing dimensions into each of the tables as shown in Figure 3(b). (12 marks)

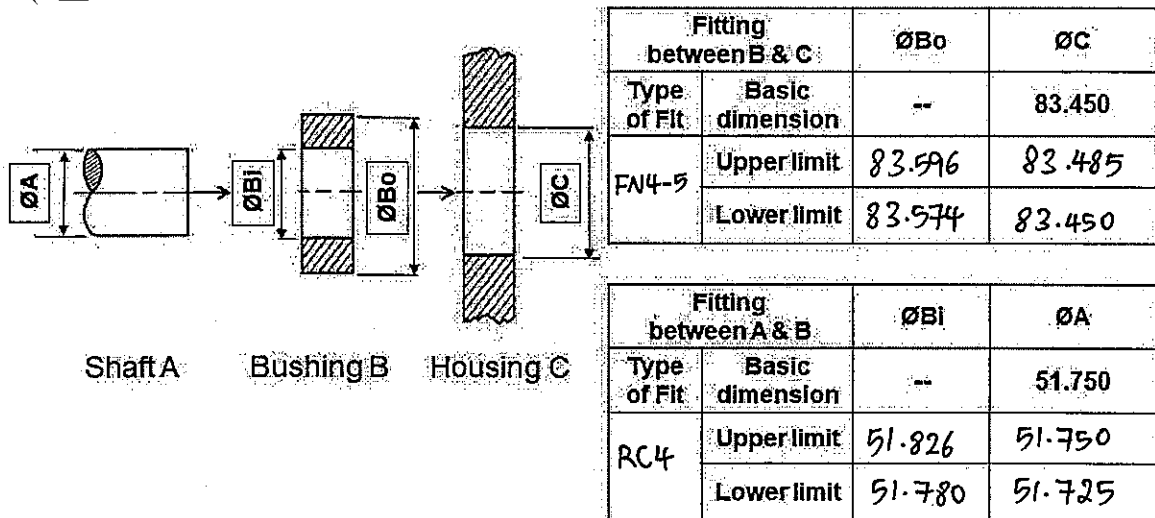
/ 12



Bore B to have a tolerance of 0.109, bushing A to have a tolerance of 0.067 and a minimum interference of 0.097. $\Rightarrow LMC_S - LMC_H = 0.097$



Hole B to have a tolerance of 0.128, shaft A to have a tolerance of 0.119 and a maximum clearance of 1.032 $\Rightarrow LMC_H - LMC_S = 1.032$



Fitting conditions:
 Force Fit between bushing B and housing C; Close Running Fit between shaft A and bushing B.
 (Refer to tables in the Appendix. Use ISO code for type of fit)

Figure 3(b)

4(a) Determine and enter the missing data into the table as shown in Figure 4(a). (5 marks)

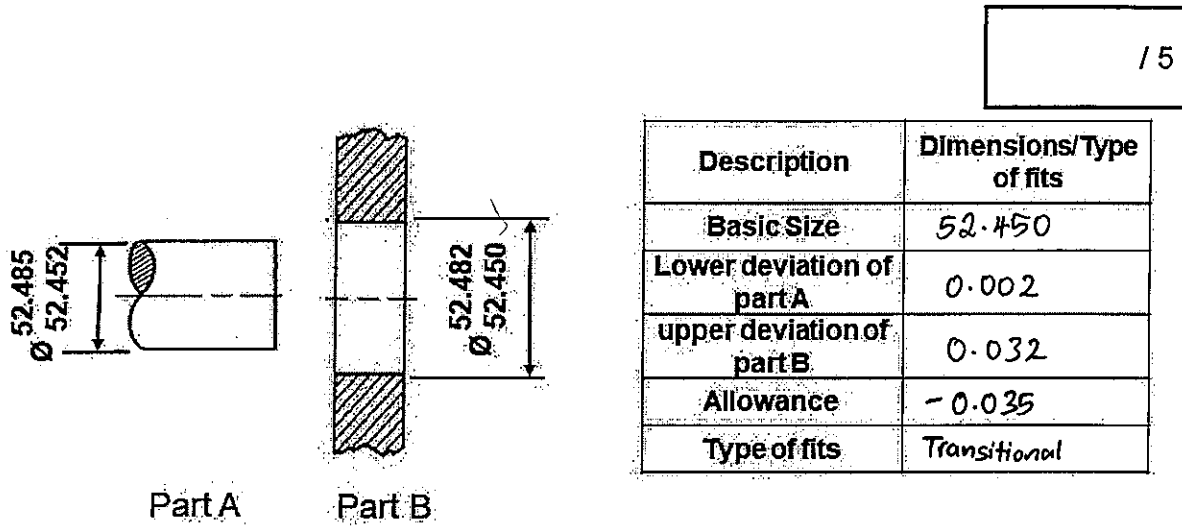
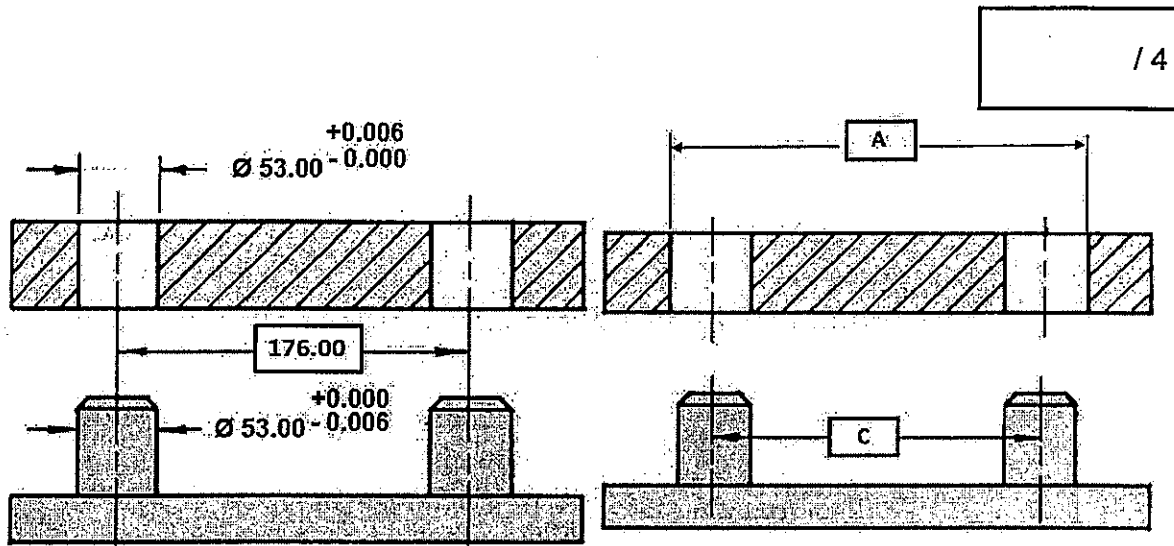


Figure 4(a)

4(b) Determine and enter the missing data as shown in Figure 4(b). (4 marks)



For correct assembly of holes and pins	Maximum permissible value of A When C=176.000	Minimum permissible value of A When C=176.000	Maximum permissible value of C When A=229.006	Minimum permissible value of C When A=229.006
Both holes and pins are at their Least Material Condition (LMC)	229.018	228.994	176.012	175.988

Figure 4(b)

4(c) A Pin rests freely inside a hole located on the top right corner of a boss. The upper and lower limits of the centers of the hole and boss are shown in Figure 4(c). Use the maximum permissible tolerances as the position tolerances required in Figure 4(d). The position tolerances must be rounded up to two decimal places and are applied as indicated in the Feature Control Frame (FCF) in Figure 4(d). Enter suitable tolerance symbols, tolerances and dimensions, where appropriate, in the sketch provided in Figure 4(d). In addition, determine and enter the minimum and maximum distances as shown in the table within Figure 4(d). Round up your results to three decimal places.

(16 marks)

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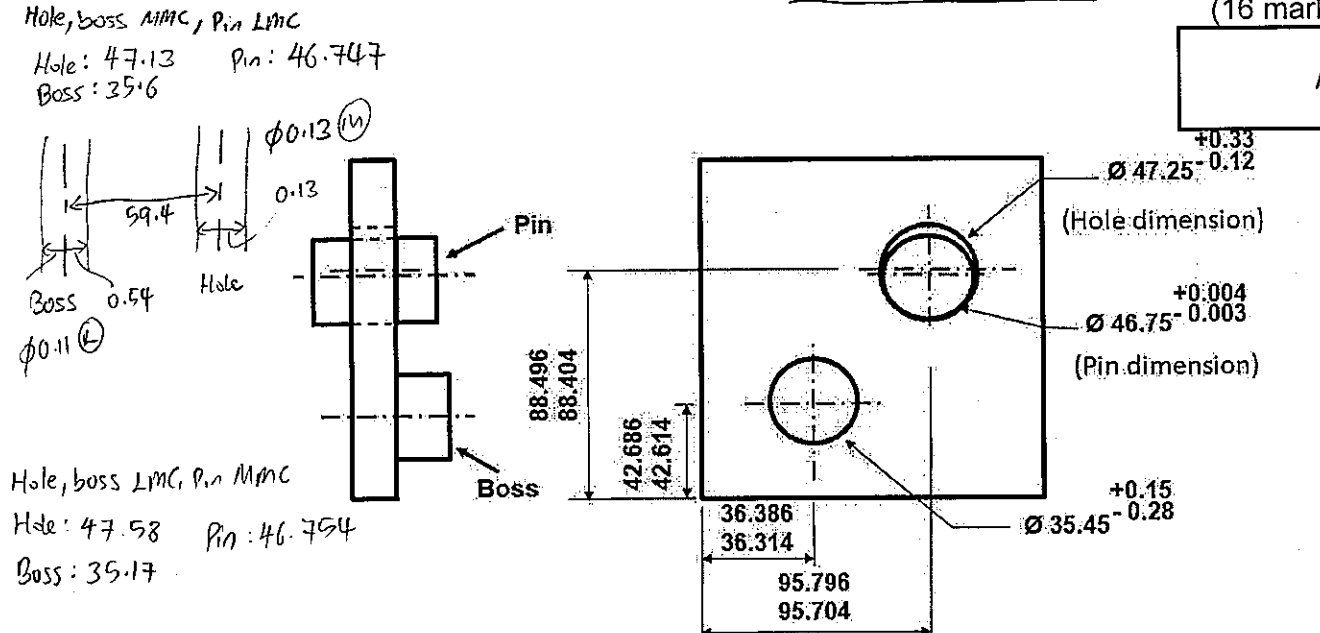
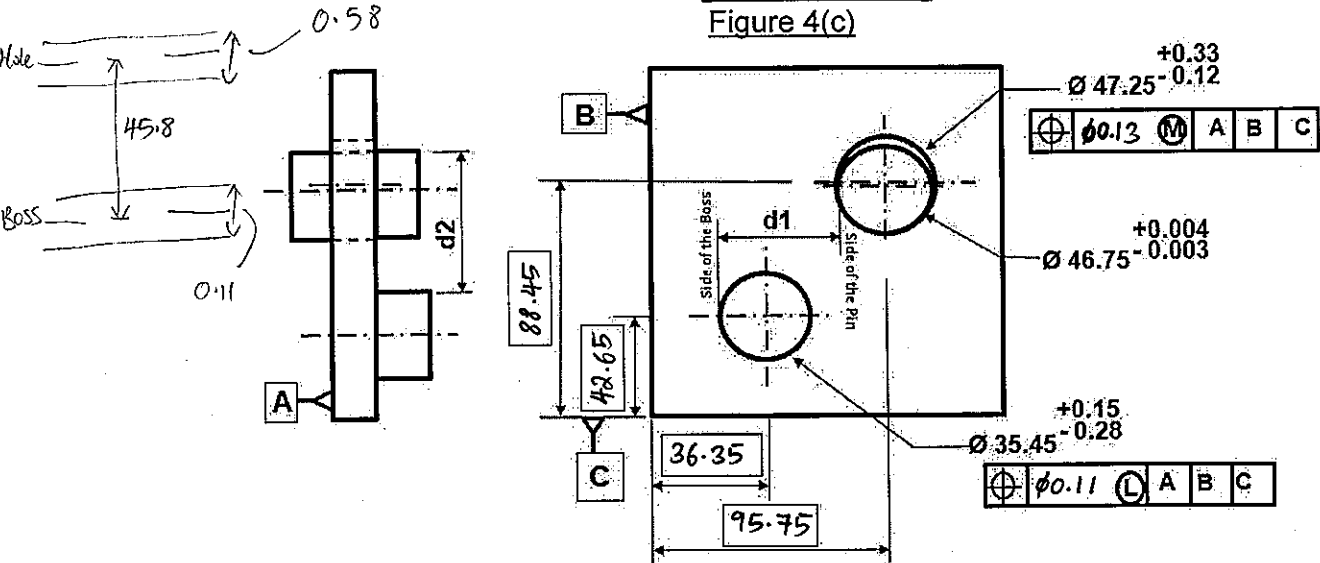


Figure 4(c)



Conditions	Minimum d1	Maximum d1	Minimum d2	Maximum d2
Hole and boss are at LMC. Pin is at MMC	—	—	50.834	51.524
Hole and boss are at MMC. Pin is at LMC	53.492	54.165 54.162	—	—

Figure 4(d)