



WINTER-15 EXAMINATION
Model Answer

Important Instructions to examiners:

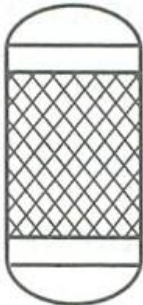
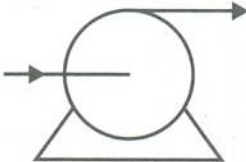


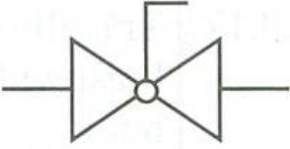
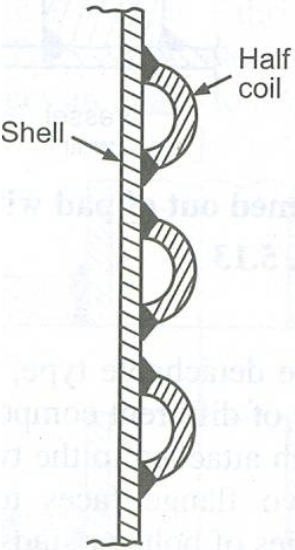
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.



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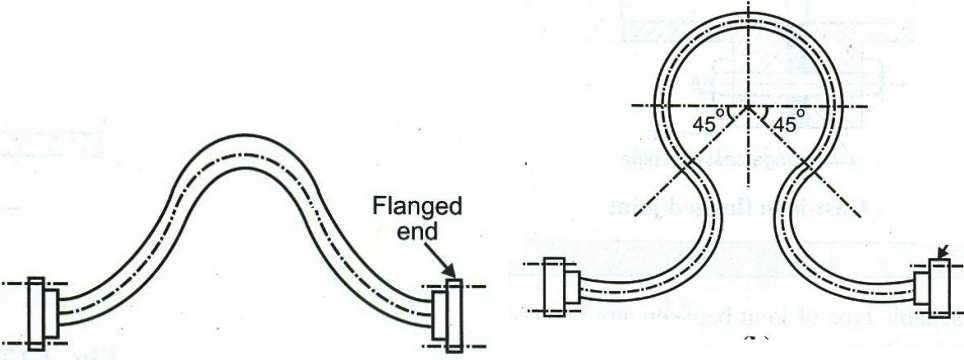
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Q No.	Answer	Marks	Total marks
1	Attempt any three		12
1 A i)	Symbol of packed bed reactor and centrifugal pump  	2+2	4
ii)	Gate valve and ball valve  or  	2+2	4
iii)	Reactor jacket with half coil 	4	4



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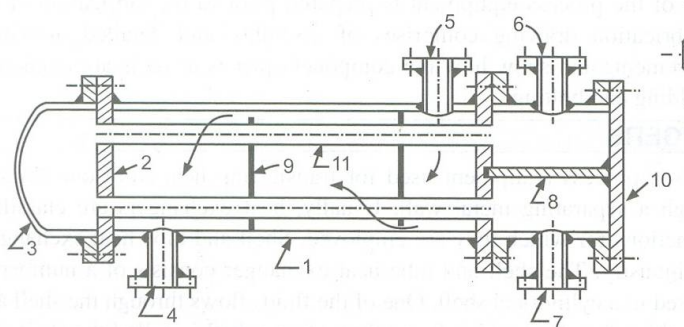
<p>iv)</p>	<p>Loop Joint (any one)</p> 	<p>4</p>	<p>4</p>																																								
<p>1b</p>	<p>Attempt any one</p>		<p>8</p>																																								
<p>1 B i)</p>	<p>Specification sheet of batch reactor</p> <table border="1" data-bbox="186 997 1193 1722"> <thead> <tr> <th colspan="2">3 SPECIFICATION SHEET FOR BATCH REACTOR (JACKETED)</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Specification No. Date</td> </tr> <tr> <td>2.</td> <td>Number required Location</td> </tr> <tr> <td>3.</td> <td>Capacity (volumetric)</td> </tr> <tr> <td>4.</td> <td>Operating conditions</td> </tr> <tr> <td>5.</td> <td>Process materials handled</td> </tr> <tr> <td>6.</td> <td>Feed composition density viscosity</td> </tr> <tr> <td>7.</td> <td>Product mix. composition density viscosity</td> </tr> <tr> <td>8.</td> <td>Temperature Pressure</td> </tr> <tr> <td>9.</td> <td>Construction details</td> </tr> <tr> <td>10.</td> <td>Reactor shell : dia. height thickness</td> </tr> <tr> <td>11.</td> <td>Heads type</td> </tr> <tr> <td>12.</td> <td>Jacket heating surface Pressure on Jacket side</td> </tr> <tr> <td>13.</td> <td>Jacket : type</td> </tr> <tr> <td>14.</td> <td>Jacket : length dia. thickness</td> </tr> <tr> <td>15.</td> <td>Vessel connections :</td> </tr> <tr> <td>16.</td> <td>Inlet : No. size Outlet : No. size</td> </tr> <tr> <td>17.</td> <td>Manhole size Stuffing box opening</td> </tr> <tr> <td>18.</td> <td>Pressure gauge connection Thermowell pocket</td> </tr> <tr> <td>19.</td> <td>Jacket connections :</td> </tr> </tbody> </table>	3 SPECIFICATION SHEET FOR BATCH REACTOR (JACKETED)		1.	Specification No. Date	2.	Number required Location	3.	Capacity (volumetric)	4.	Operating conditions	5.	Process materials handled	6.	Feed composition density viscosity	7.	Product mix. composition density viscosity	8.	Temperature Pressure	9.	Construction details	10.	Reactor shell : dia. height thickness	11.	Heads type	12.	Jacket heating surface Pressure on Jacket side	13.	Jacket : type	14.	Jacket : length dia. thickness	15.	Vessel connections :	16.	Inlet : No. size Outlet : No. size	17.	Manhole size Stuffing box opening	18.	Pressure gauge connection Thermowell pocket	19.	Jacket connections :	<p>8</p>	<p>8</p>
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20.	Steam inlet condensate size		
21.	Water inletwater outlet jacket drain		
22.	Agitator type Agitator/impeller dia.		
23.	Speed		
24.	Shaft : dia. length		
25.	Blades : No. width breadth thickness		
26.	Baffles : No. length width		
27.	Stuffing box : Make type gaskets		
28.	Special fittings : Relief valve		
29.	Materials of construction		
30.	Vessel Jacket Agitator		
31.	Vessel nozzles Jacket nozzles		
32.	Drive details		
33.	Drive : type gear ratio arrangement (V/H)		
34.	Motor : type HP phase cycles rpm class		
35.	Design code Design pressure		
36.	Hydrostatic test pressure		
37.	Weight : dry unit full of water		
38.	Services required :		
39.	Steam : pressure flow		
40.	Cooling water : Maximum temperature flow		
41.	Support : typeNo. Bracket size		
42.	Column support for bracket : size		
43.	Remarks		
	Prepared by Checked by Approved by		
	Name and Address		

ii) **Shell and tube heat exchanger**



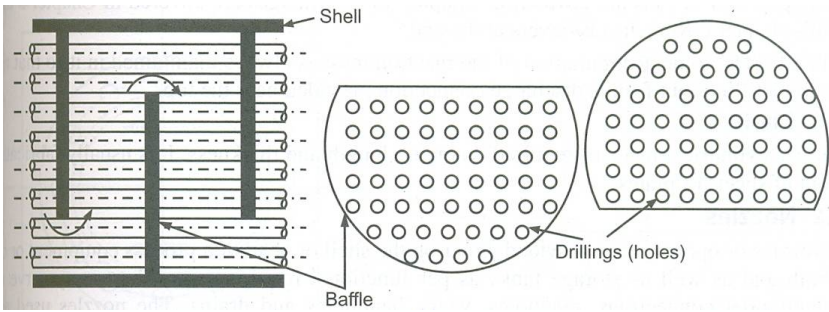
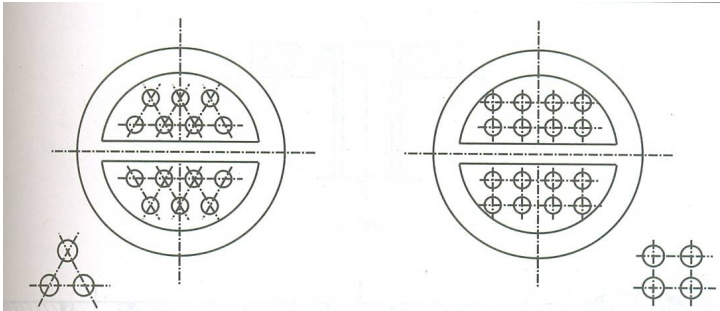
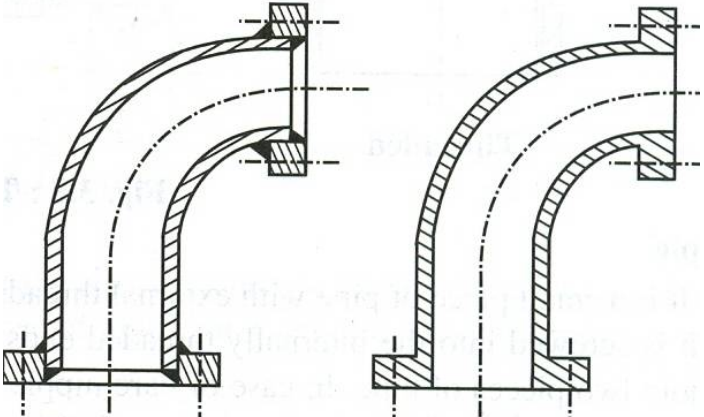
1 - shell, 2 - tube sheet, 3 - cover, 4, 5 - shell side nozzle inlet/outlet
6, 7 - tube nozzle-inlet/outlet, 8 - pass partition, 9 - baffle, 10 - channel cover, 11 - tube
Section lines are not shown for shell, cover and nozzles

8

8

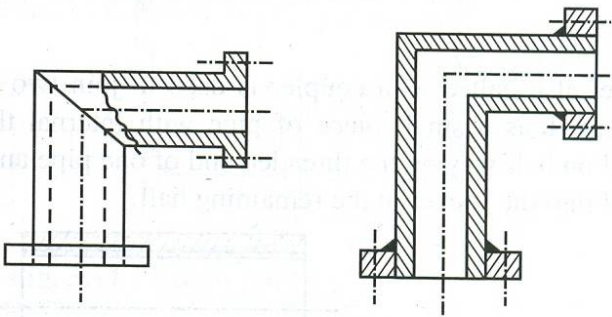
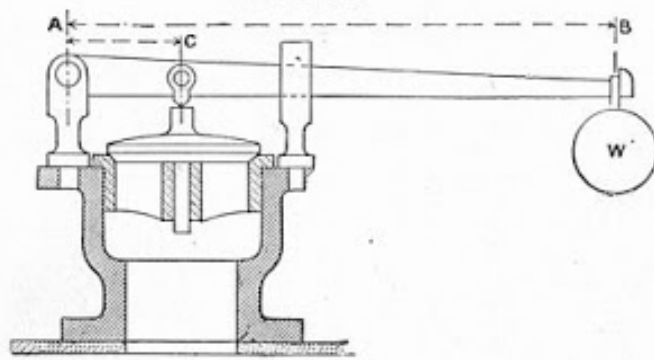


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2	Attempt any four		16
2 a)	<p>Segmental baffle</p>  <p>Tube sheet</p>  <p>(a) Triangular pitch of tubes (b) Square pitch of tubes</p>	2+2	4
b)	<p>Bend (any one)</p>  <p>Flanged bend (flange - welded) Flanged bend (flange - integral)</p>	2+2	4

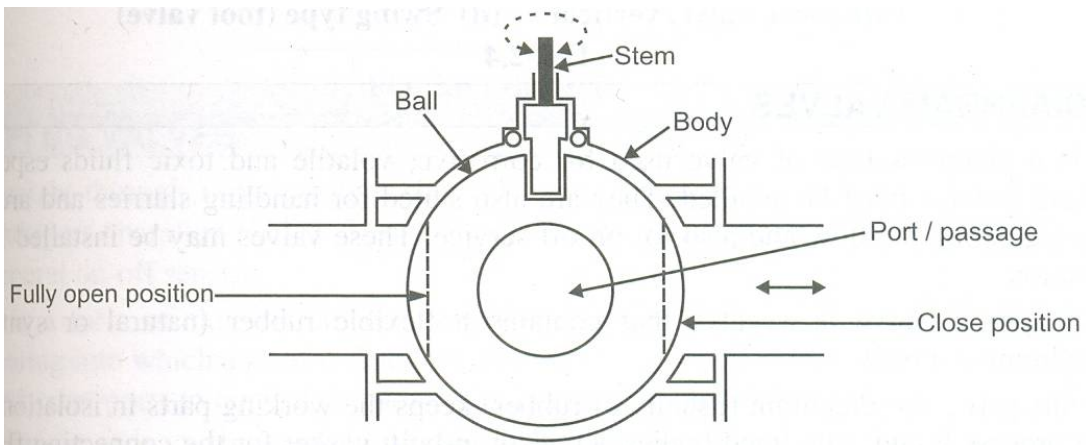
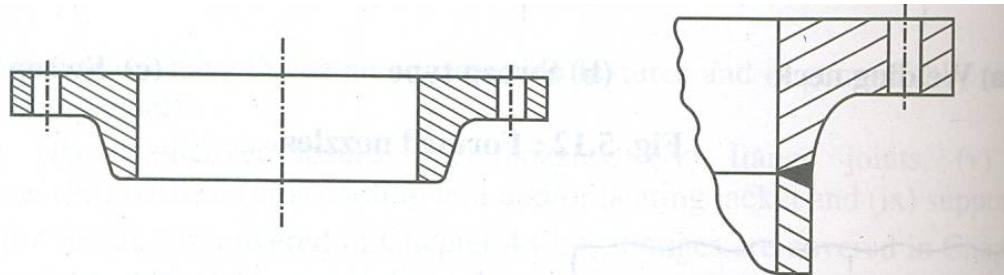
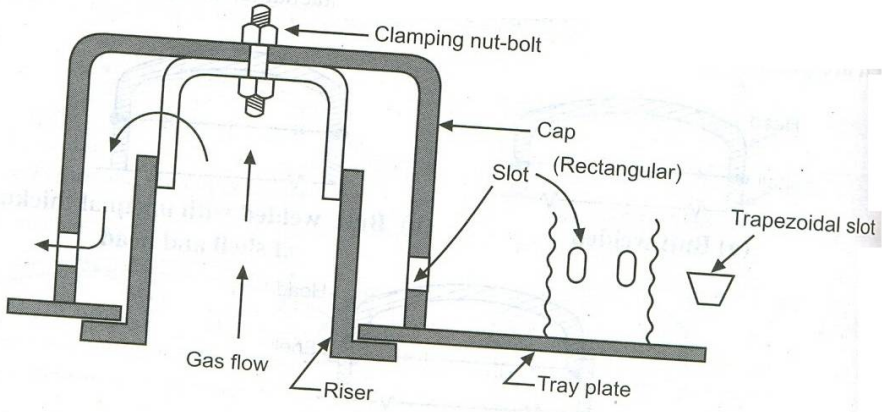


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	<p>Elbow (any one)</p>  <p>Flange - integral Flange - welded</p>		
c)	<p>Supports used for pipe line</p> <ol style="list-style-type: none">1. Hanger support2. Roller support3. Yard support <p>Yard support is used for a multiple group of pipeline which is placed between two plants or crossing road.</p>	3+1	4
d)	<p>Lever Safety valve</p> 	4	4



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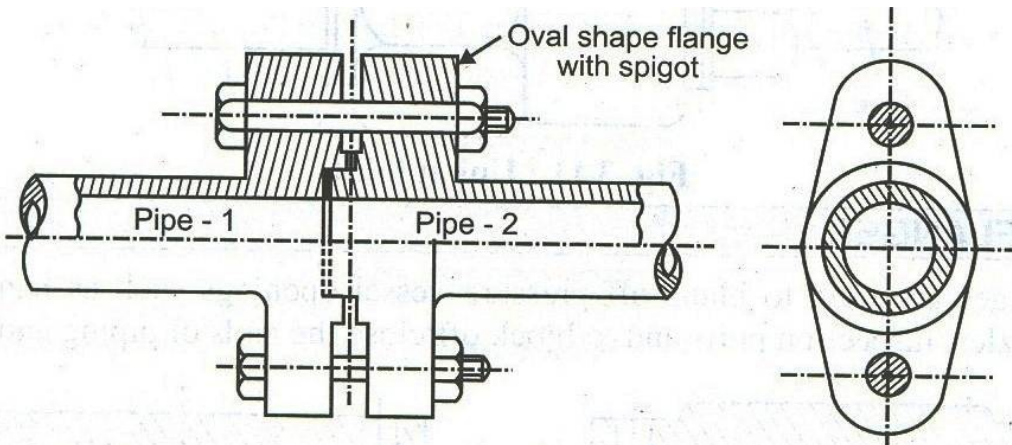
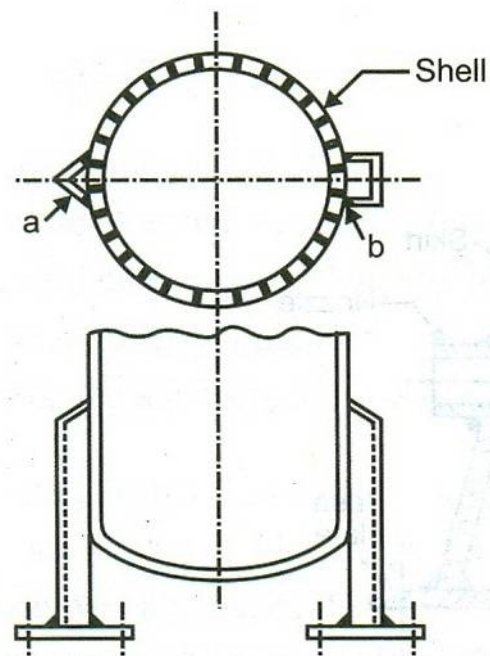
e)	<p>Ball valve</p> 	4	4
f)	<p>Welded neck flange</p> 	2+2	4
3	<p>Attempt any four</p>		16
3 a)	<p>Bubble cap tray</p> 	2+2	4



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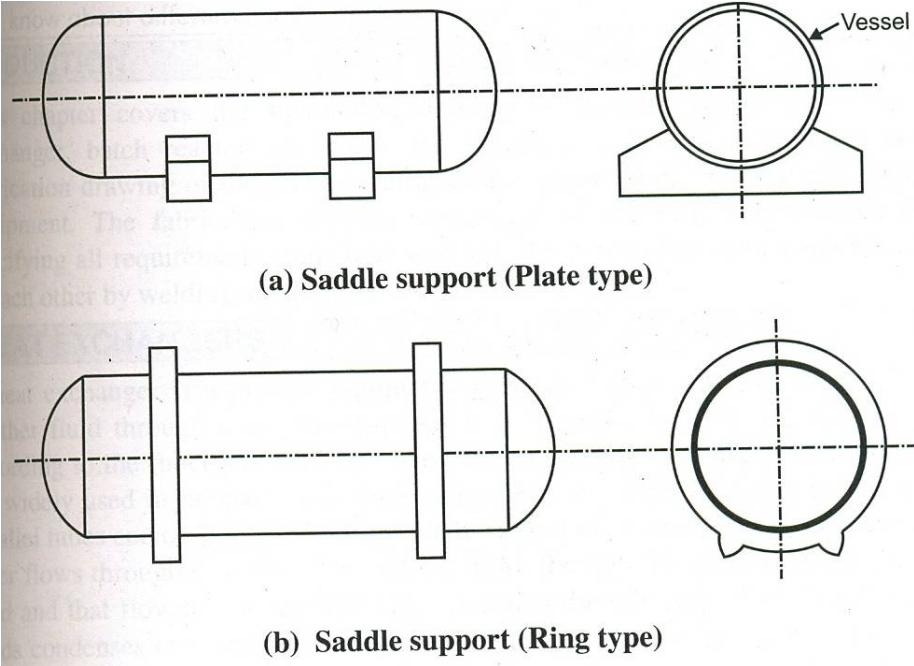
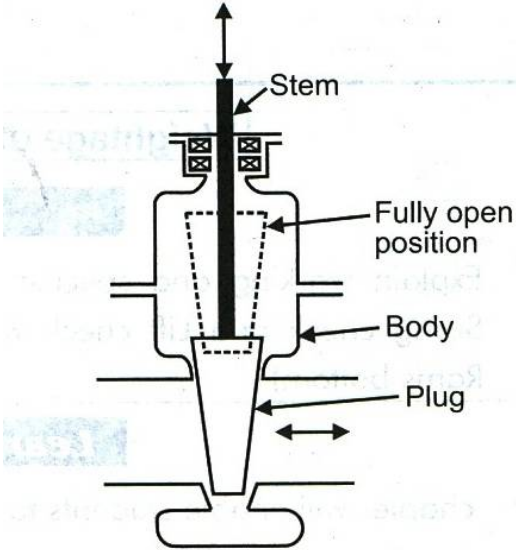
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b)	Hydraulic joint 	4	4
c)	Leg Support 	4	4

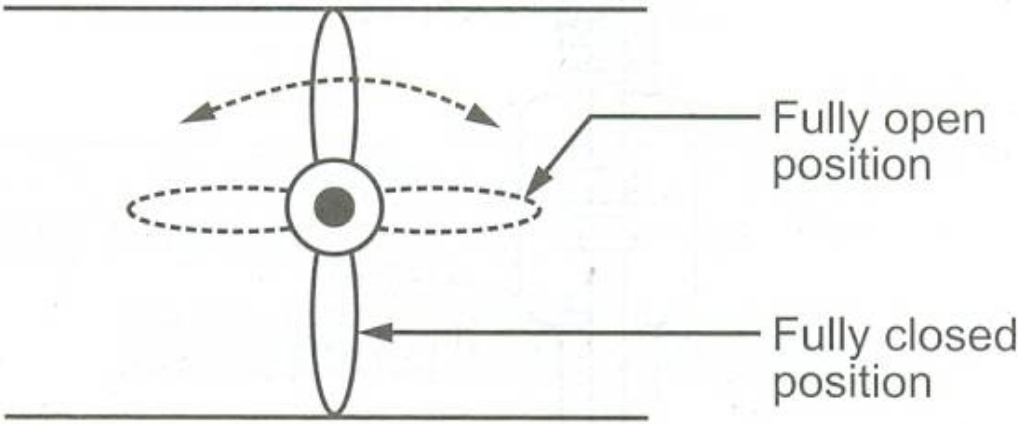


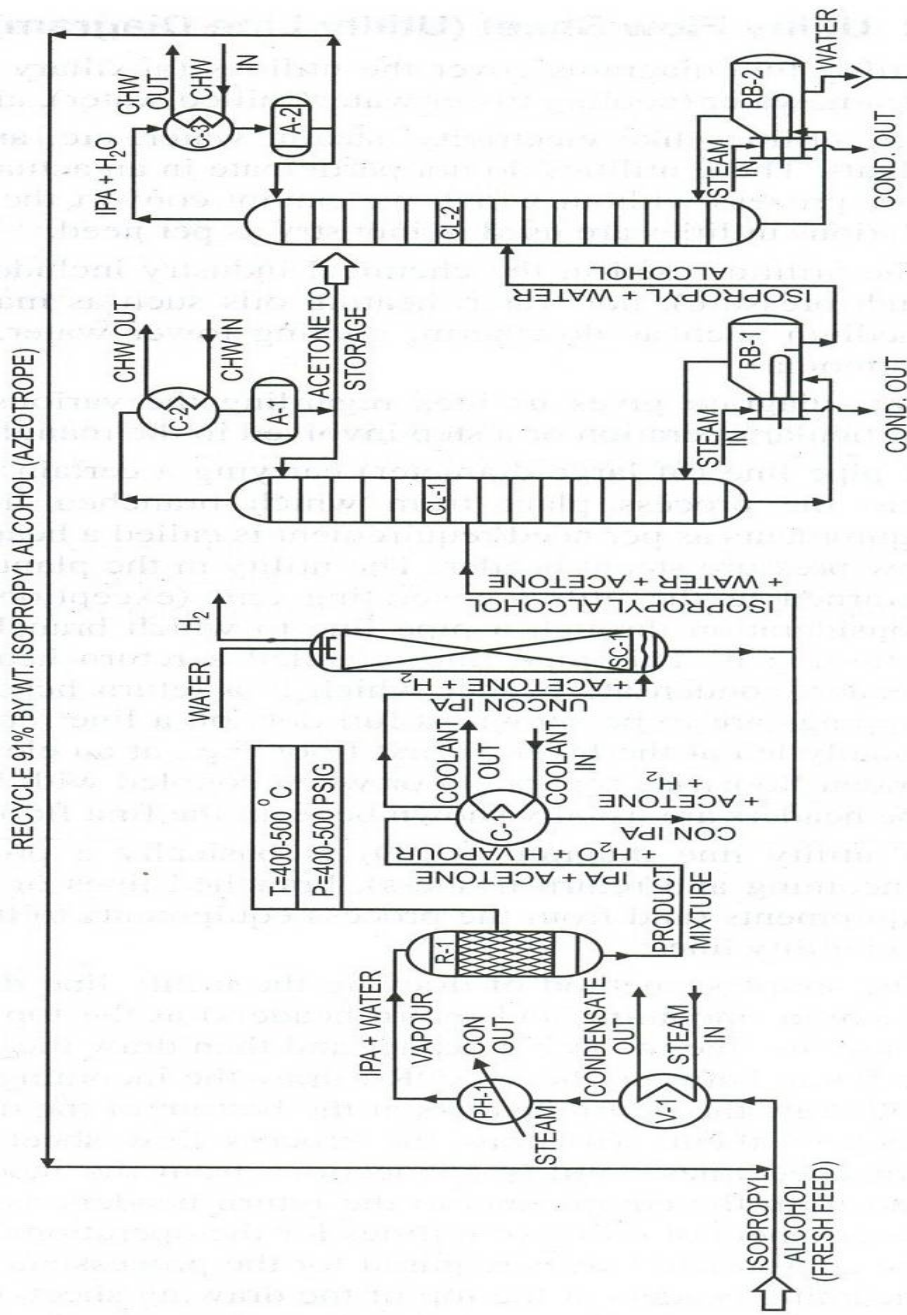
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<p>d)</p>	<p>Saddle support</p>  <p>(a) Saddle support (Plate type)</p> <p>(b) Saddle support (Ring type)</p>	<p>4</p>	<p>4</p>
<p>e)</p>	<p>Gate valve</p>  <p>Stem</p> <p>Fully open position</p> <p>Body</p> <p>Plug</p>	<p>4</p>	<p>4</p>



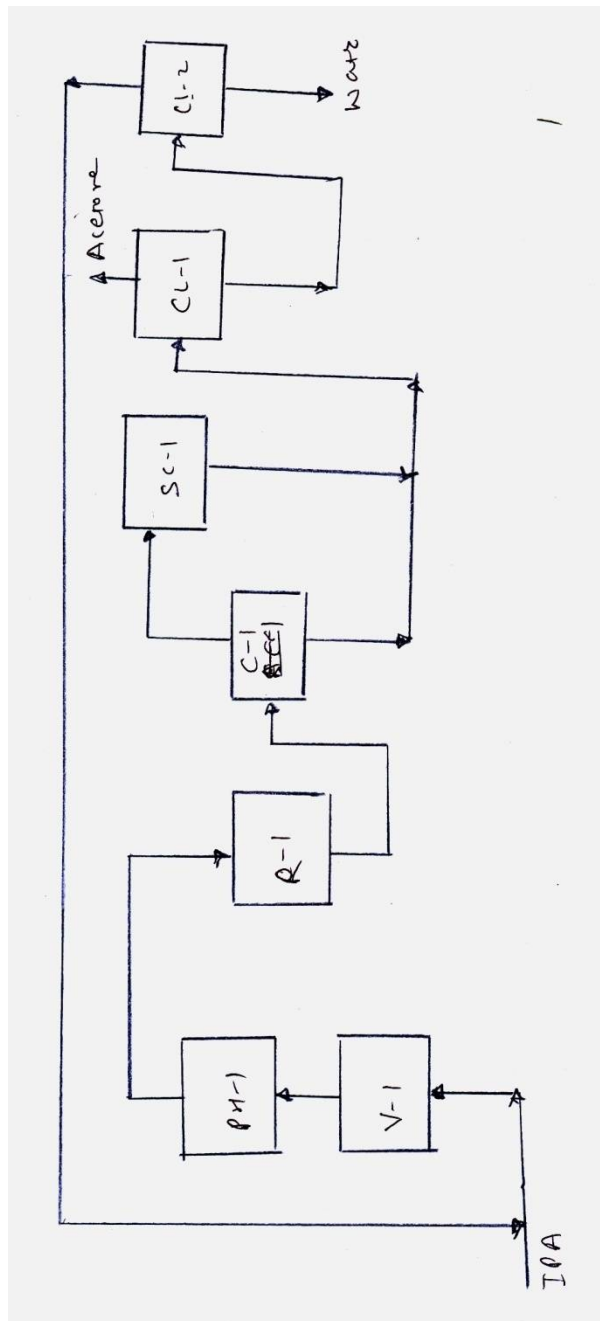
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<p>f)</p>	<p>Butterfly valve</p>  <p>Butterfly Valves are generally specified for most air, gas, steam, and liquid applications. They offer an excellent, economically priced, positive shut-off valve for handling materials (e.g. gases and liquids) that are easily displaced by the valve disc as it closes. When handling this type of material, butterfly valves provide a reliable, bubble-tight, bi-directional shut off.</p>	<p>3+1</p>	<p>4</p>																				
<p>4</p>	<p>Process Flow Diagram Legend for Q 4 , 5 and 6</p> <table border="1" data-bbox="186 1390 1075 1864"> <thead> <tr> <th>CODE</th> <th>DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>V-1</td> <td>VAPORISER</td> </tr> <tr> <td>PH-1</td> <td>PREHEATER</td> </tr> <tr> <td>R-1</td> <td>CATALYTIC REACTOR</td> </tr> <tr> <td>C-1,2,3</td> <td>CONDENSERS</td> </tr> <tr> <td>CL-1,2</td> <td>DISTILLATION COLUMNS</td> </tr> <tr> <td>RB-1,2</td> <td>REBOILERS</td> </tr> <tr> <td>SC-1</td> <td>SCRUBBER</td> </tr> <tr> <td>A-1,2</td> <td>ACCUMULATORS</td> </tr> <tr> <td>CHW</td> <td>CHILLED WATER</td> </tr> </tbody> </table>	CODE	DESCRIPTION	V-1	VAPORISER	PH-1	PREHEATER	R-1	CATALYTIC REACTOR	C-1,2,3	CONDENSERS	CL-1,2	DISTILLATION COLUMNS	RB-1,2	REBOILERS	SC-1	SCRUBBER	A-1,2	ACCUMULATORS	CHW	CHILLED WATER	<p>Block diagram 4 marks + Legends 2 marks + PFD 10marks</p>	<p>16</p>
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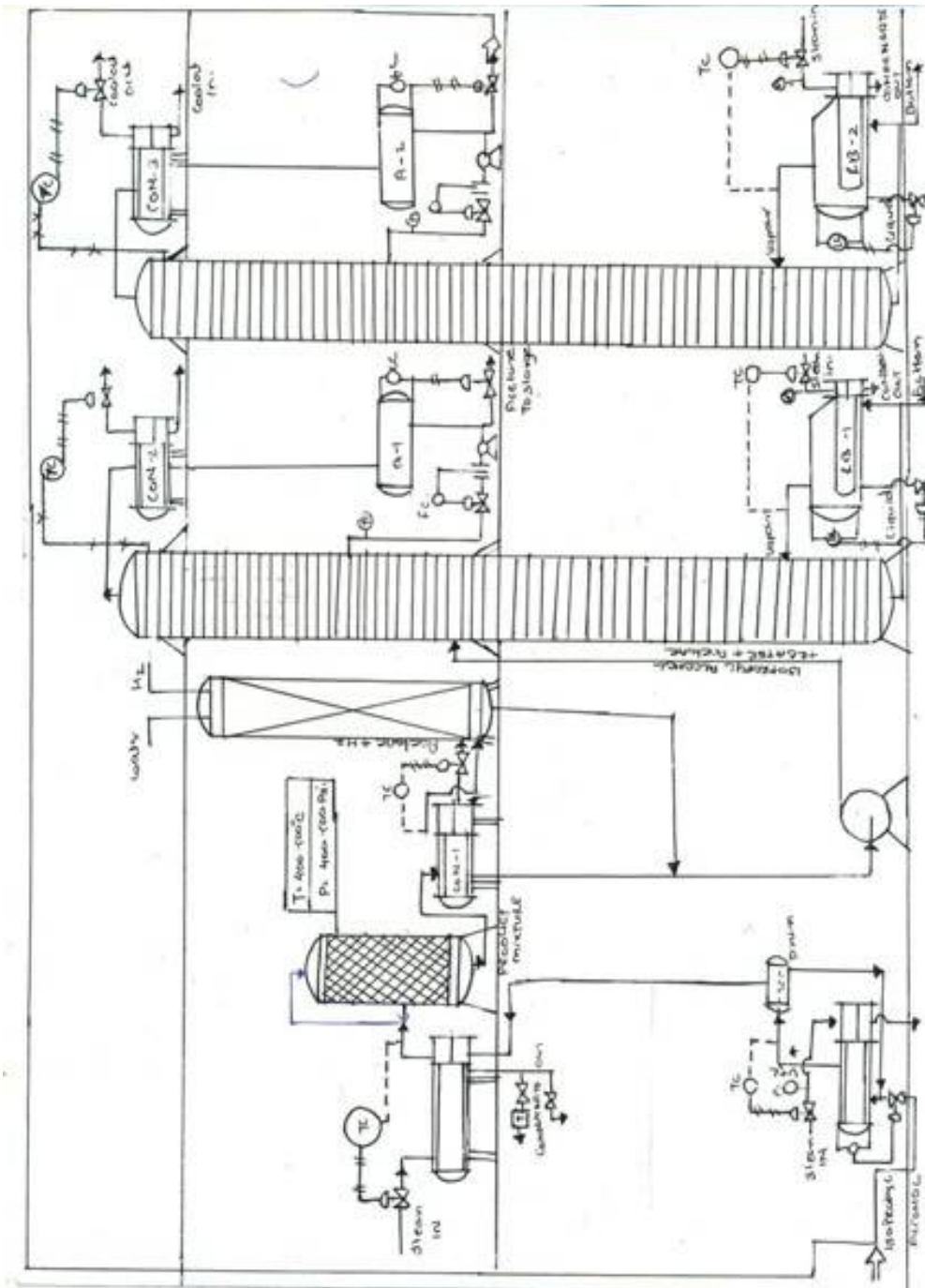
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5	Attempt any two		16
5 a)	<p>Utility Line Diagram</p> <p>The diagram illustrates the utility requirements for a process. It shows the following components and connections:</p> <ul style="list-style-type: none">Utility Headers: MPS (Medium Pressure Steam), CON (Condensate Return), CW (Cooling Water), and C/W (Cooling Water).Process Units: IPA, PH-1, V-1, R-1, SC-1, C-1, C-2, C-3, CL-1, CL-2, BS-1, BS-2, and I/A.Connections: IPA is connected to PH-1 and V-1. PH-1 and V-1 are connected to R-1. R-1 is connected to SC-1. SC-1 is connected to C-1. C-1 is connected to C-2 and C-3. C-2 and C-3 are connected to CL-1 and CL-2. CL-1 and CL-2 are connected to BS-1 and BS-2. BS-1 and BS-2 are connected to I/A. I/A is connected to H₂O and H₂.Flow Directions: Indicated by arrows showing the flow of utilities through the process units.	ULD 7 marks , Legends 1 marks	8



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b) **Piping and instrumentation Diagram**



Legends
1 marks
+ P&I
diagram
7 marks

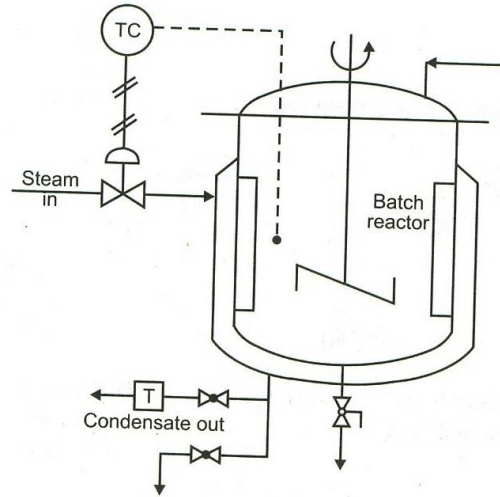


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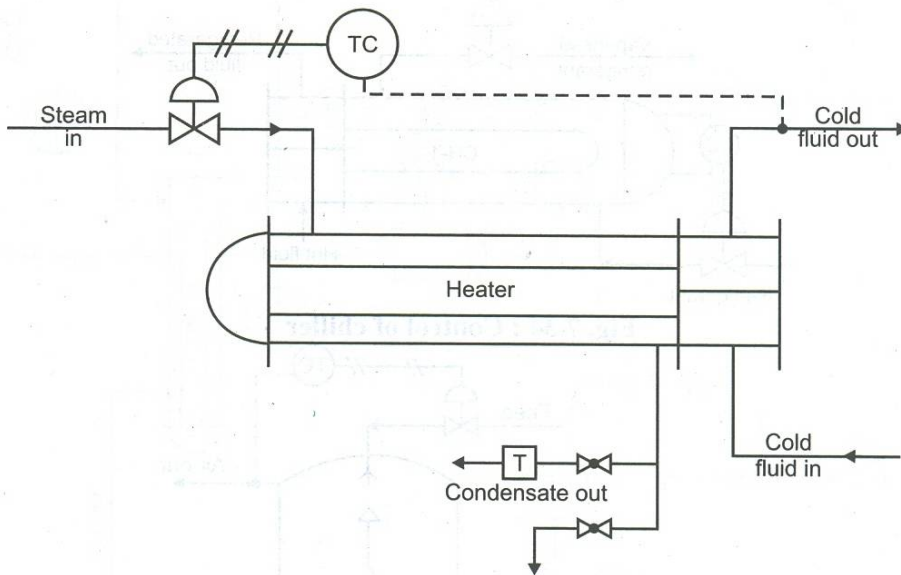
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5 c) **P & I for reactor**



4

P & I for heat exchanger

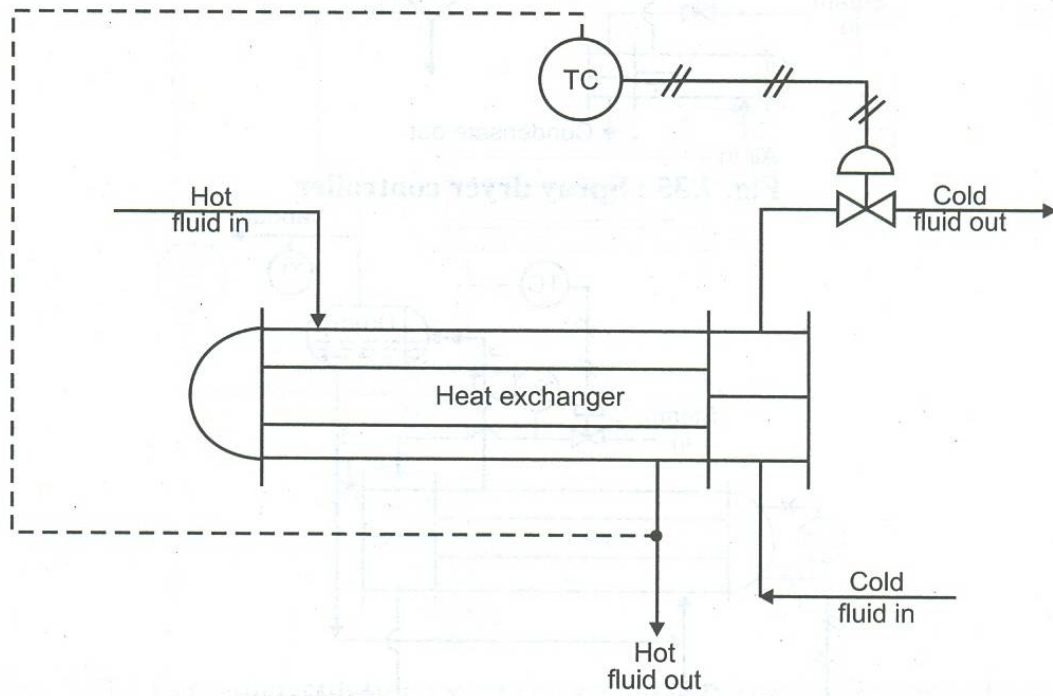


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6 a

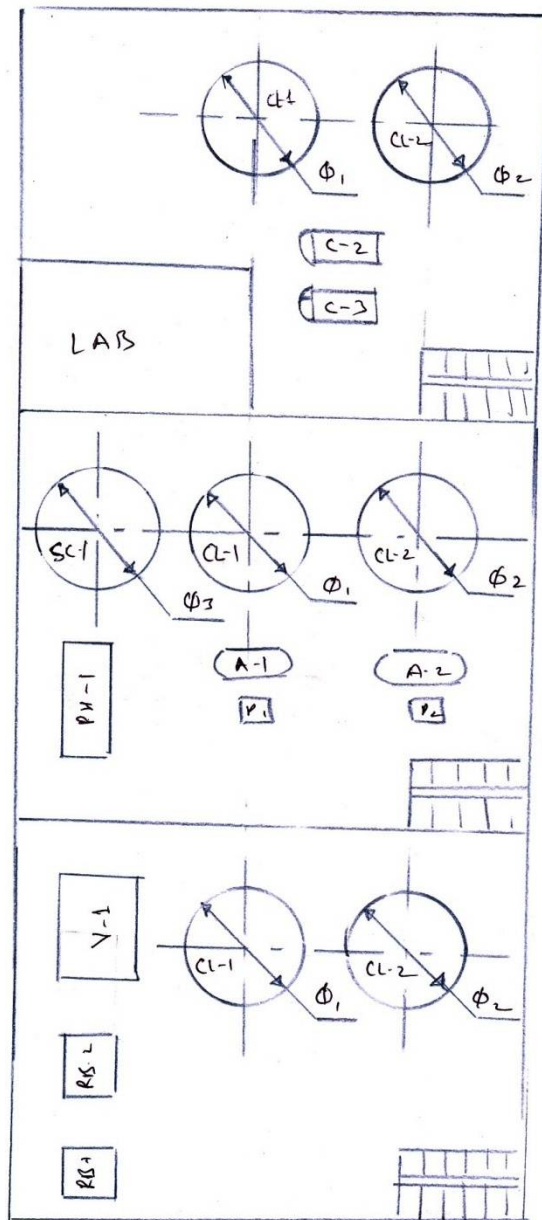
Equipment layout

Equipm
ent
layout 7
marks +
legends
1 mark

8



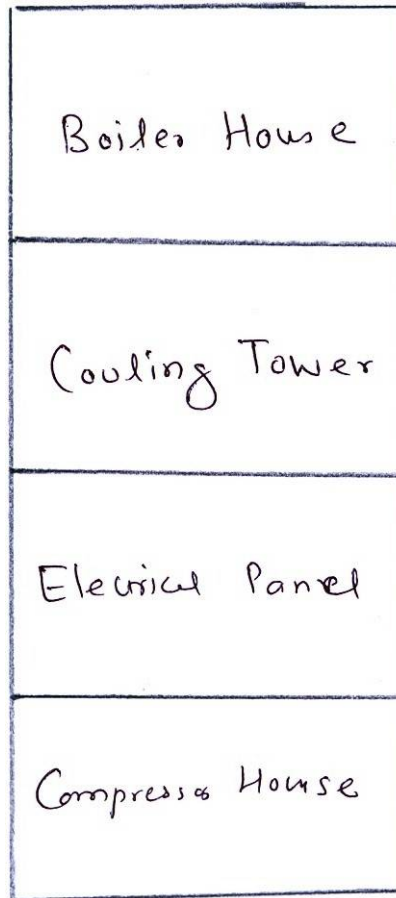
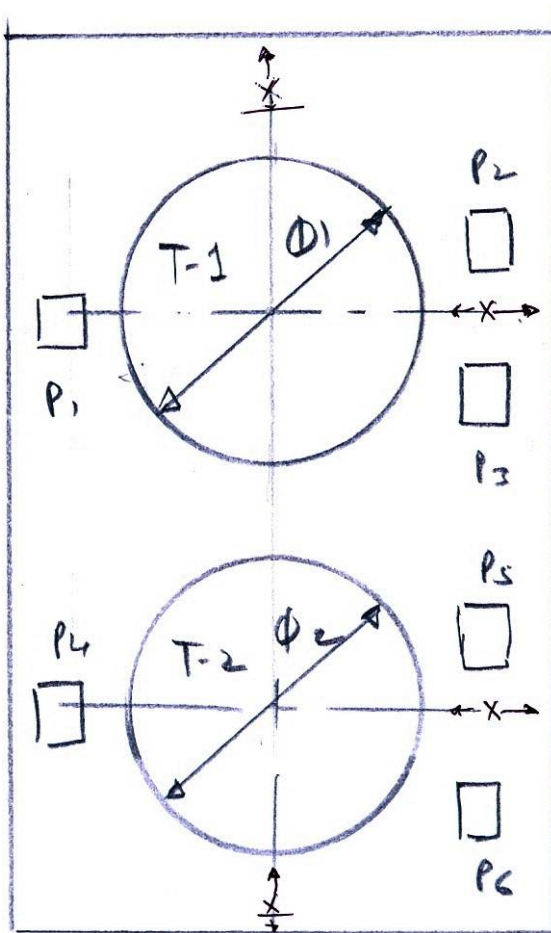
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b) Tank farm and utility block diagram



T-1 - IPA storage tank

T-2 Acetone storage tank

P-1,2,3- IPA transfer pumps

P-3,4,5 – Acetone transfer pumps

4+4

8