



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

(Autonomous)
(ISO/IEC - 27001 - 2005 Certified)

SUMMER-2016 EXAMINATION
Model Answer

Subject code :(17647)

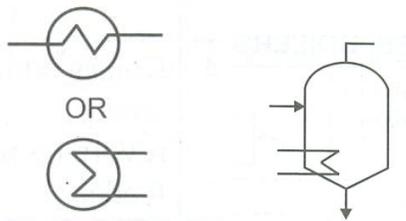
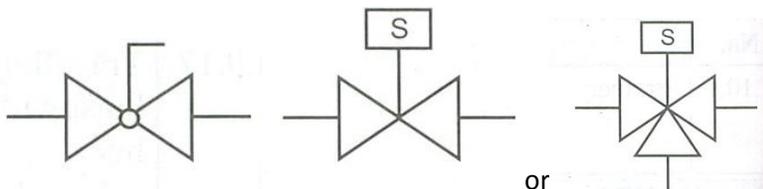
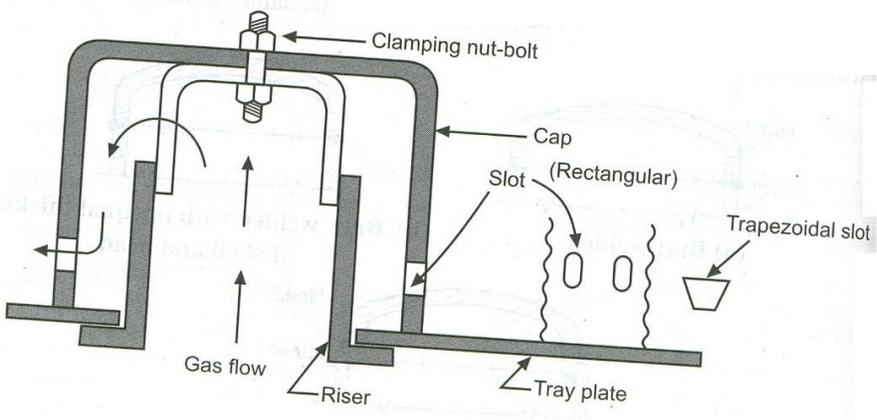
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Important Instructions to examiners:

- 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.

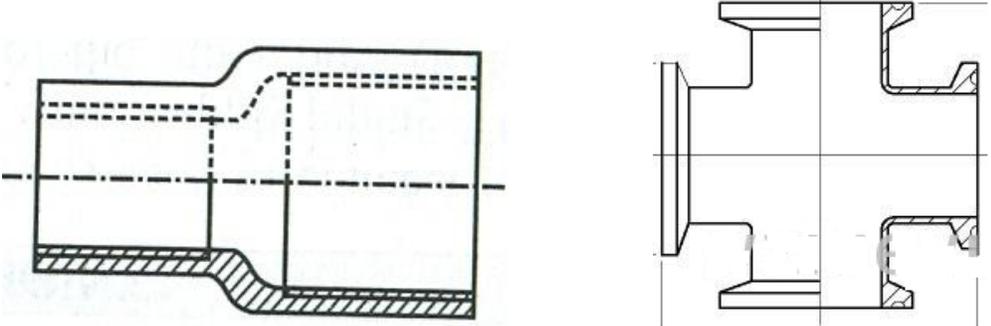


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Q No.	Answer	Marks	Total marks
1 (A)	Attempt any three		12
a)	Heat Exchange Equipments  Any other symbol which shows heat exchange should be considered.	2+2	4
b)	Ball Valve and Solenoid Valve 	2+2	4
c)	Bubble Cap Tray 	4	4
d)	Expander and Cross		

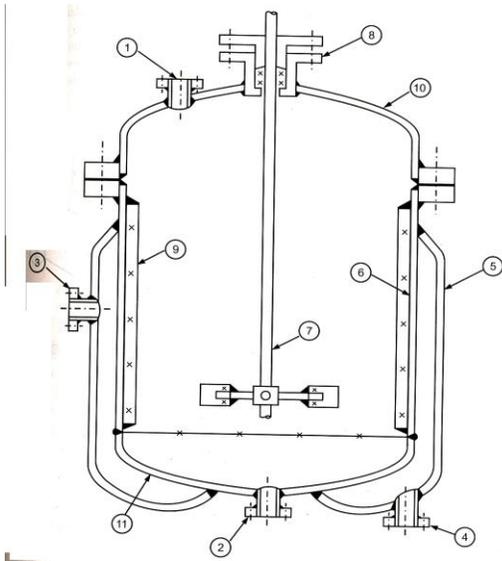


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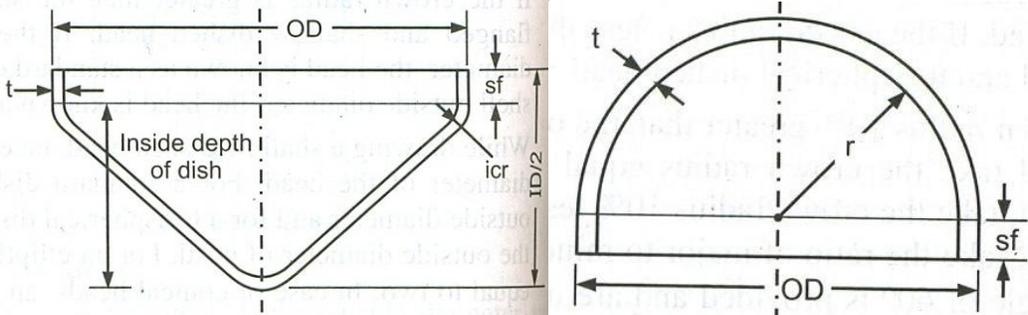
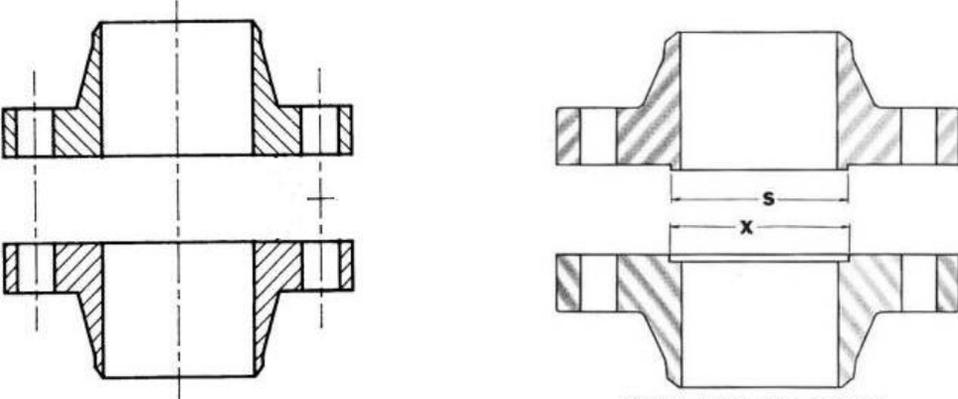
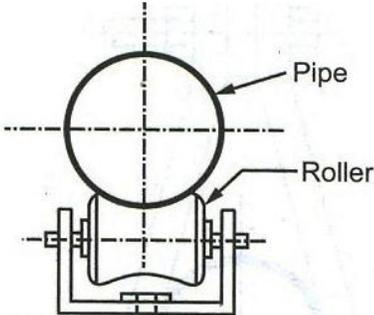
		2+2	4																																																												
(B)	Attempt any one		8																																																												
a)	<p>Specification sheet for heat exchanger</p> <table border="1" data-bbox="186 892 1274 1617"> <tr> <td>1.</td> <td>Specification NO.</td> <td>Date</td> </tr> <tr> <td>2.</td> <td>Number required</td> <td>Location</td> </tr> <tr> <td>3.</td> <td>Type</td> <td>Duty as</td> </tr> <tr> <td>4.</td> <td colspan="2">Operating data/conditions</td> </tr> <tr> <td>5.</td> <td>Fluid description</td> <td>Shell side</td> </tr> <tr> <td>6.</td> <td>Name</td> <td>In ... out ...</td> </tr> <tr> <td>7.</td> <td>Composition</td> <td>In ... out ...</td> </tr> <tr> <td>8.</td> <td>Flow rate, kg/h</td> <td>In ... out ...</td> </tr> <tr> <td>9.</td> <td>Density, kg/m³</td> <td>In ... out ...</td> </tr> <tr> <td>10.</td> <td>Viscosity, cP</td> <td>In ... out ...</td> </tr> <tr> <td>11.</td> <td>Specific heat,</td> <td>.....</td> </tr> <tr> <td>12.</td> <td>Latent heat, kcal/kg</td> <td>.....</td> </tr> <tr> <td>13.</td> <td>Thermal conductivity</td> <td>.....</td> </tr> <tr> <td>14.</td> <td>Temperature, °C</td> <td>In ... out ...</td> </tr> <tr> <td>15.</td> <td>Operating pressure, kgf/cm².g</td> <td>In ... out ...</td> </tr> <tr> <td>16.</td> <td>No. of passes</td> <td>.....</td> </tr> <tr> <td>17.</td> <td>Velocity, m/s</td> <td>.....</td> </tr> <tr> <td>18.</td> <td>Fouling resistance</td> <td>.....</td> </tr> <tr> <td>19.</td> <td colspan="2">Heat exchange duty kcal/kg LMTD °C</td> </tr> <tr> <td>20.</td> <td colspan="2">Overall heat transfer coefficient kcal/m².h.°C.</td> </tr> </table>	1.	Specification NO.	Date	2.	Number required	Location	3.	Type	Duty as	4.	Operating data/conditions		5.	Fluid description	Shell side	6.	Name	In ... out ...	7.	Composition	In ... out ...	8.	Flow rate, kg/h	In ... out ...	9.	Density, kg/m ³	In ... out ...	10.	Viscosity, cP	In ... out ...	11.	Specific heat,	12.	Latent heat, kcal/kg	13.	Thermal conductivity	14.	Temperature, °C	In ... out ...	15.	Operating pressure, kgf/cm ² .g	In ... out ...	16.	No. of passes	17.	Velocity, m/s	18.	Fouling resistance	19.	Heat exchange duty kcal/kg LMTD °C		20.	Overall heat transfer coefficient kcal/m ² .h.°C.		8	8
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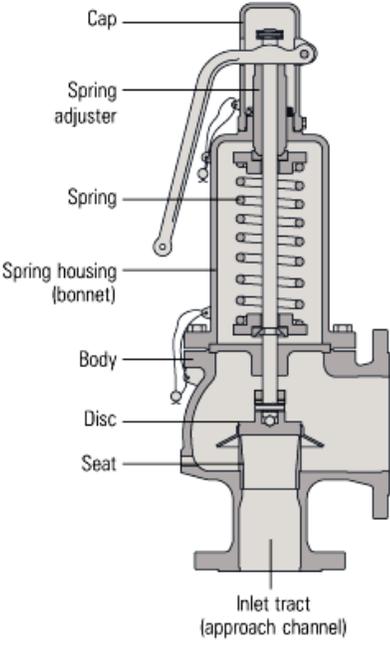
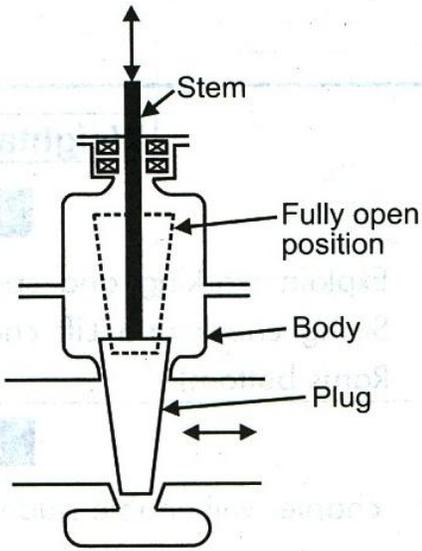
	<table border="1"> <tr> <td>21.</td> <td>Tube : OD mm, length m, wall thickness (BWG) pitch mm <input type="checkbox"/> Δ material</td> </tr> <tr> <td>22.</td> <td>Shell : Nom. OD length mm thickness</td> </tr> <tr> <td>23.</td> <td>Shell cover : Material</td> </tr> <tr> <td>24.</td> <td>Channel Channel cover</td> </tr> <tr> <td>25.</td> <td>Tube sheet type (stationary/floating)</td> </tr> <tr> <td>26.</td> <td>Baffles : type No. Thickness</td> </tr> <tr> <td>27.</td> <td>Shell side nozzles : Inlet outlet drain</td> </tr> <tr> <td>28.</td> <td>Tube side nozzles : Inlet outlet</td> </tr> <tr> <td>29.</td> <td>Corrosion allowance : shell side tube side</td> </tr> <tr> <td>30.</td> <td>Gaskets</td> </tr> <tr> <td>31.</td> <td>Design code</td> </tr> <tr> <td>32.</td> <td>Design pressure and temperature ... kgf/cm²-g, °C ... kgf/cm²-g, °C</td> </tr> <tr> <td>33.</td> <td>Test pressure and temperature,,,</td> </tr> <tr> <td>34.</td> <td>Weight : Dry, Tube bundle Unit full of water kg.</td> </tr> <tr> <td>35.</td> <td>Remarks</td> </tr> <tr> <td></td> <td>Prepared by Checked by Approved by</td> </tr> <tr> <td></td> <td>Name and Address</td> </tr> </table>	21.	Tube : OD mm, length m, wall thickness (BWG) pitch mm <input type="checkbox"/> Δ material	22.	Shell : Nom. OD length mm thickness	23.	Shell cover : Material	24.	Channel Channel cover	25.	Tube sheet type (stationary/floating)	26.	Baffles : type No. Thickness	27.	Shell side nozzles : Inlet outlet drain	28.	Tube side nozzles : Inlet outlet	29.	Corrosion allowance : shell side tube side	30.	Gaskets	31.	Design code	32.	Design pressure and temperature ... kgf/cm ² -g, °C ... kgf/cm ² -g, °C	33.	Test pressure and temperature,,,	34.	Weight : Dry, Tube bundle Unit full of water kg.	35.	Remarks		Prepared by Checked by Approved by		Name and Address		
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<p>b)</p>	<p>Batch Reactor</p>  <p>1. Inlet nozzle, 2. Outlet nozzle, 3. Steam nozzle, 4. Condensate nozzle, 5. Jacket, Shell, 7. Agitator, 8. Stuffing box, 9. Baffle, 10. Top dished head, 11. Bottom dish end</p> <p>Fig. 5.23 : Jacketed batch or semibatch reactor (Section lines are not shown)</p>	<p>8</p>	<p>8</p>																																		



2	Attempt any four		16
a)	Conical Head and Hemispherical Head 	2+2	4
b)	Plain and Male-Female Flange 	2+2	4
c)	Roller Support 	4	4



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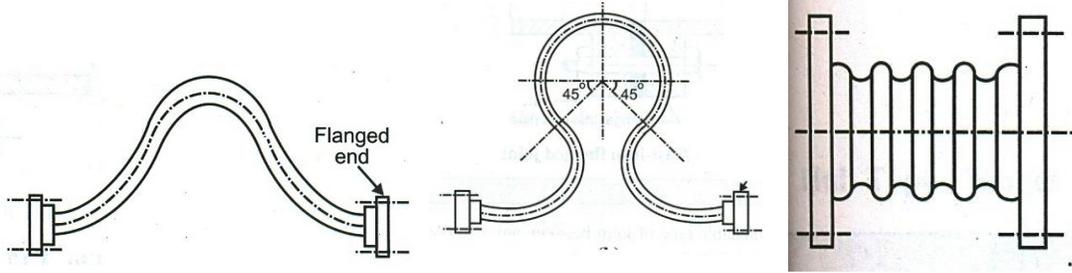
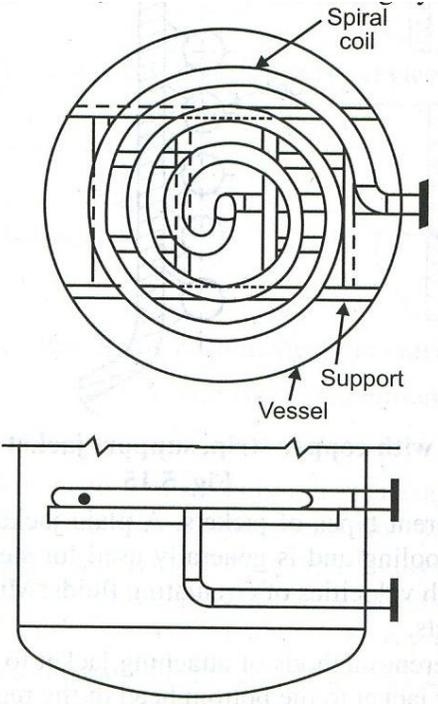
d)	<p>Spring Loaded Safety Valve</p>  <p>The diagram shows a cross-section of a spring-loaded safety valve. At the top is a cap, followed by a spring adjuster and a coiled spring. Below the spring is the spring housing (bonnet). The main body of the valve contains a disc that sits on a seat. The inlet tract (approach channel) is at the bottom. Arrows indicate the upward movement of the disc when pressure exceeds the spring force.</p>	4	4
e)	<p>Gate valve</p>  <p>The diagram shows a cross-section of a gate valve. A vertical stem is connected to a plug at the bottom. The plug is shown in a fully open position, allowing flow. The body of the valve is shown with a plug that can move horizontally to seal the valve. Arrows indicate the vertical movement of the stem and the horizontal movement of the plug.</p>	4	4



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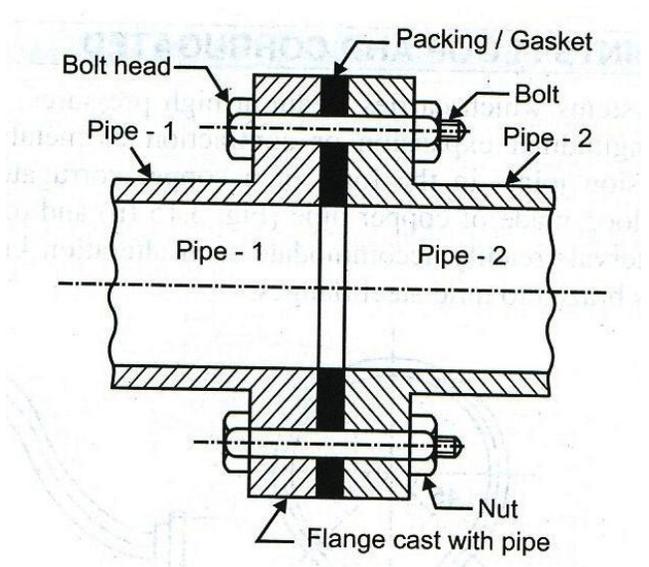
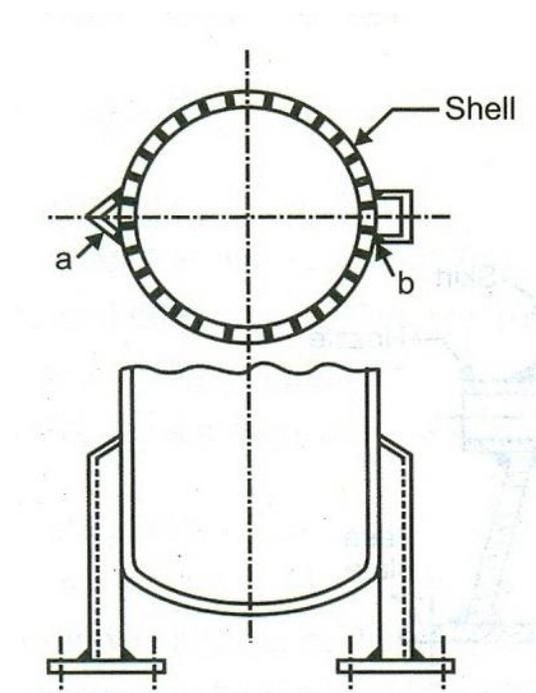
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f)	Expansion Joint (any one) 	4	4
3	Attempt any four		16
a)	Spiral Coil 	4	4



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<p>b)</p>	<p>CI Joint</p>  <p>The diagram illustrates a cross-section of a cast iron (CI) joint between two pipes, Pipe-1 and Pipe-2. The pipes are joined by a flange cast with pipe. The joint is secured with a packing or gasket, bolt heads, and nuts. Labels include: Bolt head, Packing / Gasket, Bolt, Pipe - 1, Pipe - 2, and Nut. The flange is labeled as 'Flange cast with pipe'.</p>	<p>4</p>	<p>4</p>
<p>c)</p>	<p>Leg support</p>  <p>The diagram shows a leg support for a shell. The top part is a cross-section of the shell, labeled 'Shell', with a dashed vertical line indicating the centerline. Points 'a' and 'b' are marked on the shell. The bottom part is a side view of the support structure, showing two legs supporting the shell. The legs are attached to the shell at points 'a' and 'b'.</p>	<p>4</p>	<p>4</p>



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d)	<p>Skirt and Angular Support</p> <p>The left diagram illustrates a vessel supported by a skirt. The vessel is shown in cross-section, resting on a skirt that is attached to a base plate. A nozzle or opening for the vessel outlet is shown extending from the skirt. The right diagram shows a vessel supported by an angular support. The vessel is shown in cross-section, resting on a skirt that is attached to a base plate. A nozzle is shown extending from the skirt.</p>	2+2	4
e)	<p>Diaphragm Valve</p> <p>The diagram shows a diaphragm valve in the fully open position. A vertical stem is shown moving upwards, indicated by a double-headed arrow. The stem is connected to a diaphragm, which is shown in a curved position, also indicated by a double-headed arrow. The body of the valve is shown in cross-section, with two ports on either side. The diaphragm is positioned between the two ports, and the stem is connected to the diaphragm.</p>	4	4



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4 Process Flow Diagram and Process Instrumentation Diagram

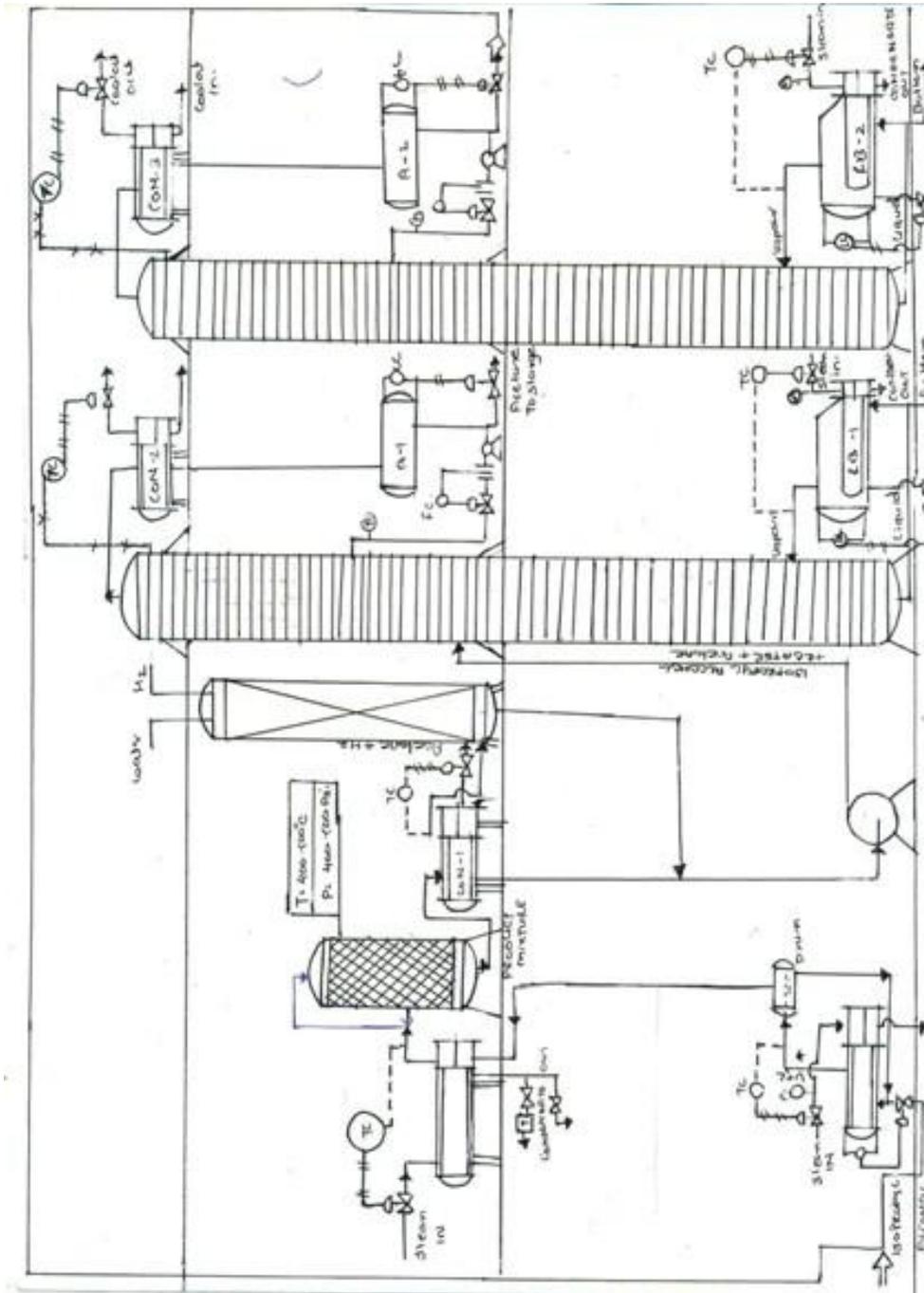
16

Legend for Q 4 , 5 and 6

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



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PID 7
marks +
legends
1 mark



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5	For Process in Q.4		16
a)	<p>Utility Line Diagram</p>	ULD 7 marks + legends 1 mark	

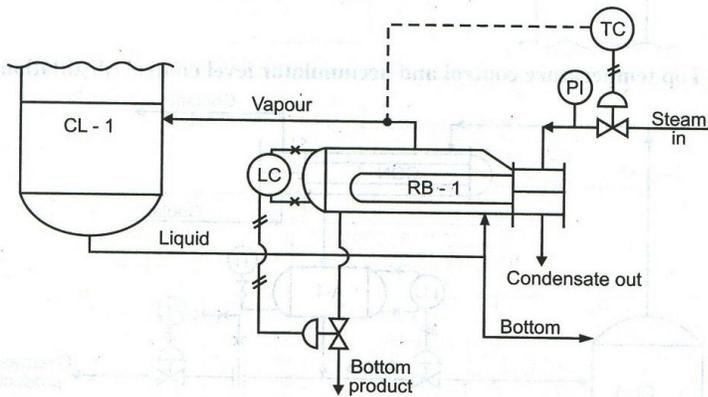
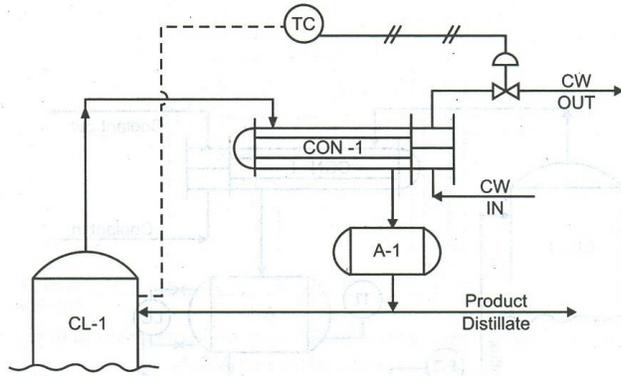


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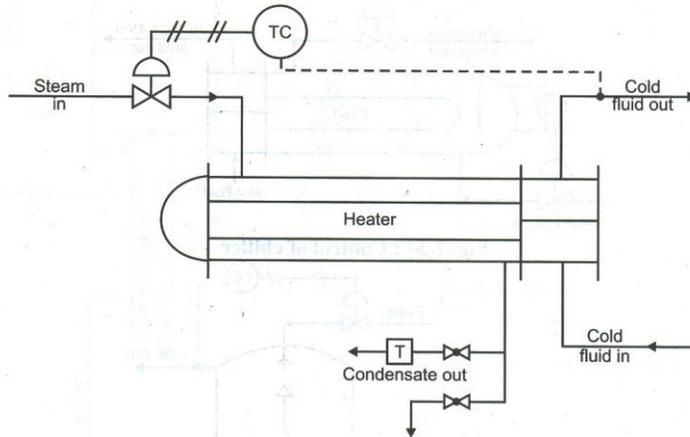
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b) **Distillation column Control (TOP and BOTTOM)**



Heat Exchanger Control (Preheater)



8 mark
for any
one

8



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6	For Process in Q.4		16
a)	<p>Equipment layout</p> <p>LAB</p>	Equipm ent layout 7 marks + legends 1 mark	8

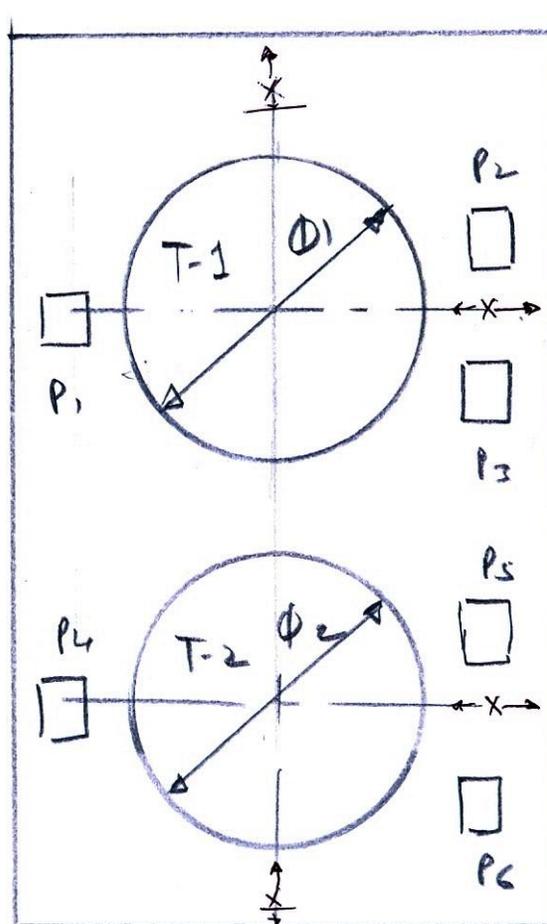


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b) Tank farm and utility block diagram



6

8

2

T-1 - IPA storage tank

T-2 Acetone storage tank

P-1,2,3- IPA transfer pumps

P-3,4,5 – Acetone transfer pumps