



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

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

SUMMER-2016 EXAMINATION

Model Answer

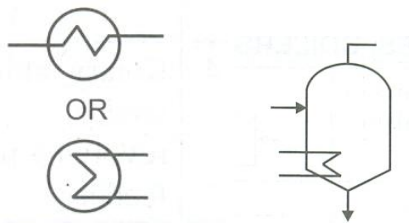
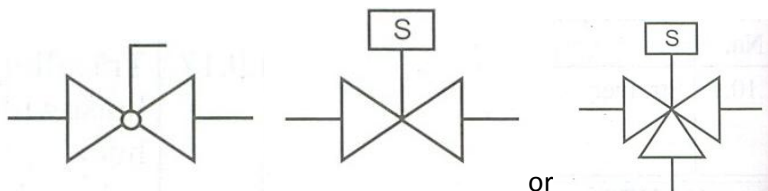
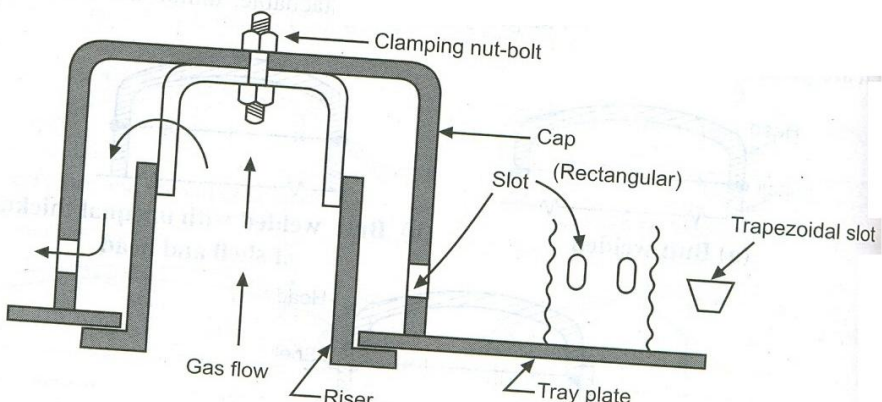
Subject code :(17647)

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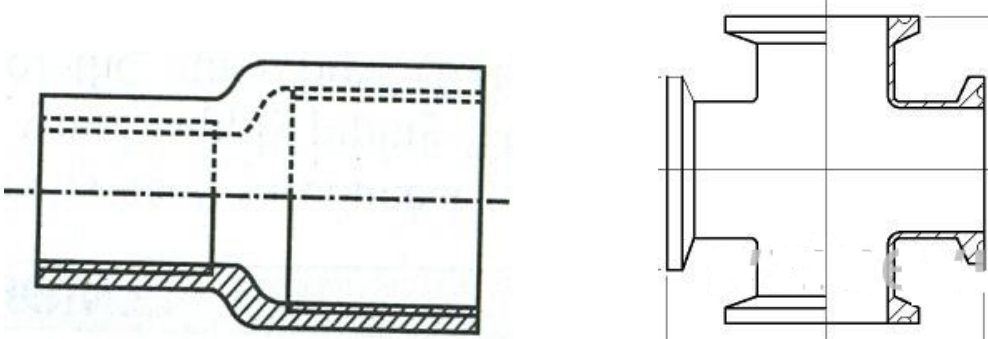
**Important Instructions to examiners:**

- 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.



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



		2+2	4																																																																												
(B)	Attempt any one		8																																																																												
a)	<p><b>Specification sheet for heat exchanger</b></p> <table><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><td>Tube side</td></tr><tr><td>6.</td><td>Name</td><td>In ... out ...</td><td>In ... out ...</td></tr><tr><td>7.</td><td>Composition</td><td>In ... out ...</td><td>In ... out ...</td></tr><tr><td>8.</td><td>Flow rate, kg/h</td><td>In ... out ...</td><td>In ... out ...</td></tr><tr><td>9.</td><td>Density, kg/m<sup>3</sup></td><td>In ... out ...</td><td>In ... out ...</td></tr><tr><td>10.</td><td>Viscosity, cP</td><td>In ... out ...</td><td>In ... out ...</td></tr><tr><td>11.</td><td>Specific heat,</td><td>.....</td><td>.....</td></tr><tr><td>12.</td><td>Latent heat, kcal/kg</td><td>.....</td><td>.....</td></tr><tr><td>13.</td><td>Thermal conductivity</td><td>.....</td><td>.....</td></tr><tr><td>14.</td><td>Temperature, °C</td><td>In ... out ...</td><td>In ... out ...</td></tr><tr><td>15.</td><td>Operating pressure, kgf/cm<sup>2</sup>.g</td><td>In ... out ...</td><td>In ... out ...</td></tr><tr><td>16.</td><td>No. of passes</td><td>.....</td><td>.....</td></tr><tr><td>17.</td><td>Velocity, m/s</td><td>.....</td><td>.....</td></tr><tr><td>18.</td><td>Fouling resistance</td><td>.....</td><td>.....</td></tr><tr><td>19.</td><td colspan="3">Heat exchange duty ..... kcal/kg LMTD ..... °C</td></tr><tr><td>20.</td><td colspan="3">Overall heat transfer coefficient ..... kcal/m<sup>2</sup>.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	Tube side	6.	Name	In ... out ...	In ... out ...	7.	Composition	In ... out ...	In ... out ...	8.	Flow rate, kg/h	In ... out ...	In ... out ...	9.	Density, kg/m <sup>3</sup>	In ... out ...	In ... out ...	10.	Viscosity, cP	In ... out ...	In ... out ...	11.	Specific heat,	.....	.....	12.	Latent heat, kcal/kg	.....	.....	13.	Thermal conductivity	.....	.....	14.	Temperature, °C	In ... out ...	In ... out ...	15.	Operating pressure, kgf/cm <sup>2</sup> .g	In ... out ...	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 <sup>2</sup> .h.°C.			8	8
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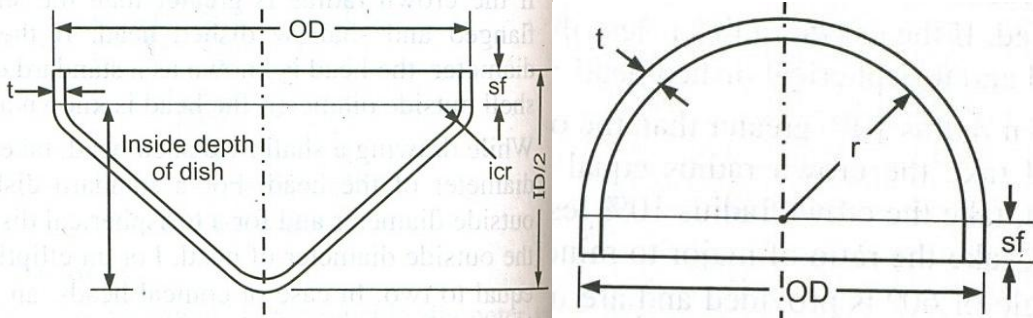
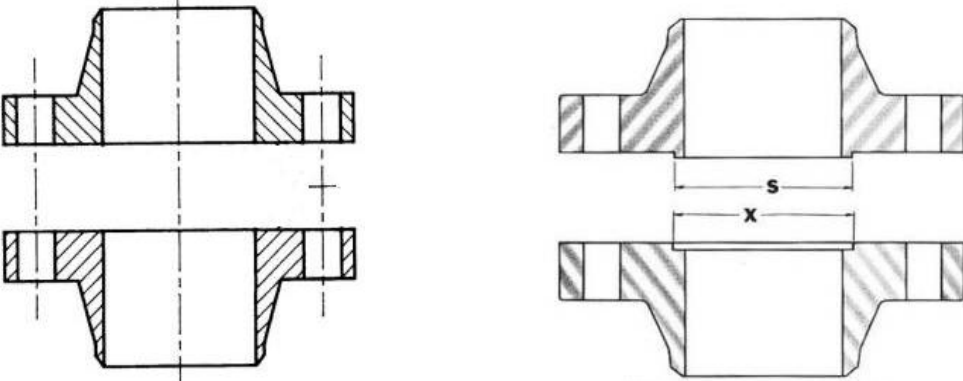
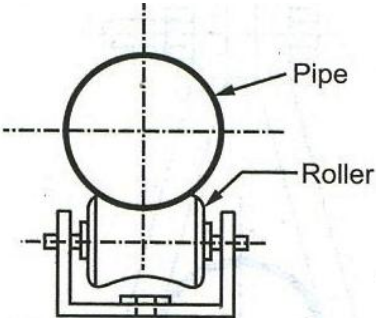
Model Answer

Subject code :(17647)

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	<table><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/cm<sup>2</sup>·g, ..... °C   ... kgf/cm<sup>2</sup>·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 ..... 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 <sup>2</sup> ·g, ..... °C   ... kgf/cm <sup>2</sup> ·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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b)	<div><div>Batch Reactor</div><div><p>1. Inlet nozzle, 2. Outlet nozzle, 3. Steam nozzle, 4. Condensate nozzle, 5. Jacket, 6. Shell, 7. Agitator, 8. Stuffing box, 9. Baffle, 10. Top dished head, 11. Bottom dish end Fig. 5.23 : Jacketed batch or semibatch reactor (Section lines are not shown)</p></div></div>	8	8																																



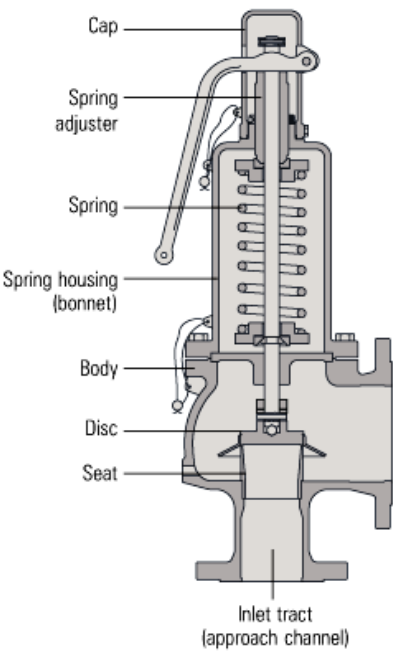
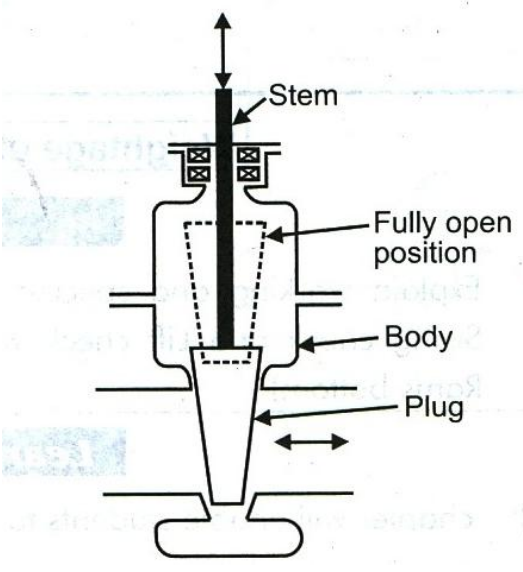
2	Attempt any four		16
a)	<b>Conical Head and Hemispherical Head</b> 	2+2	4
b)	<b>Plain and Male-Female Flange</b> 	2+2	4
c)	<b>Roller Support</b> 	4	4



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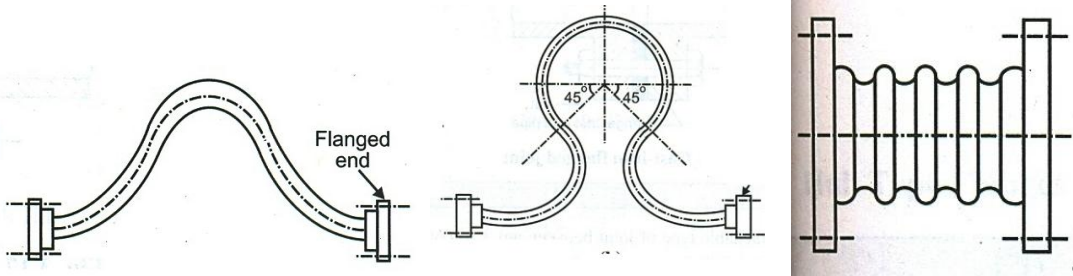
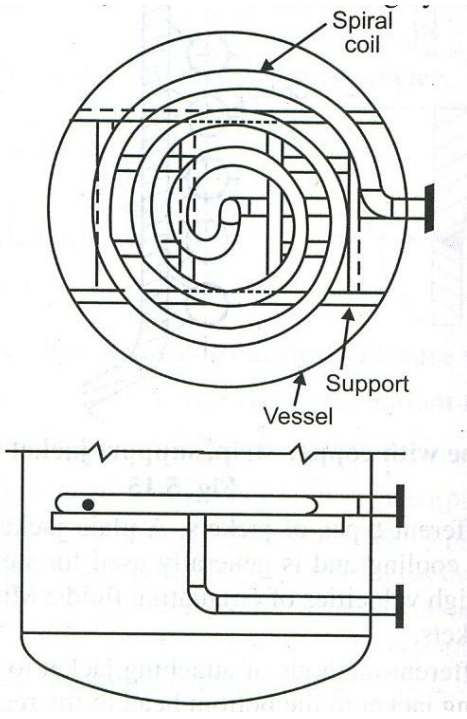
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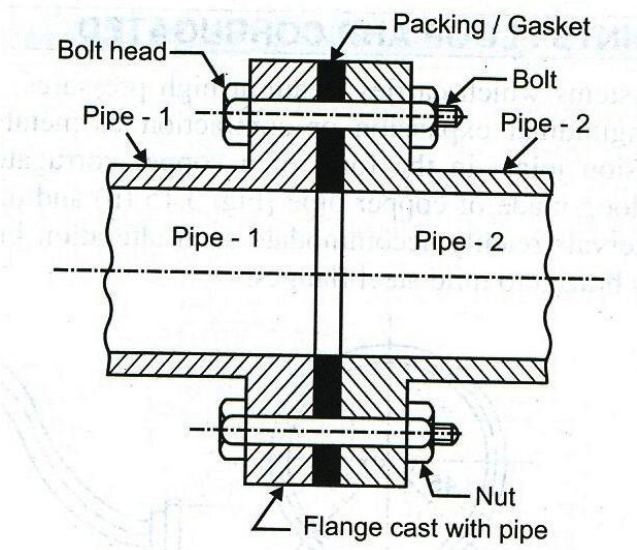
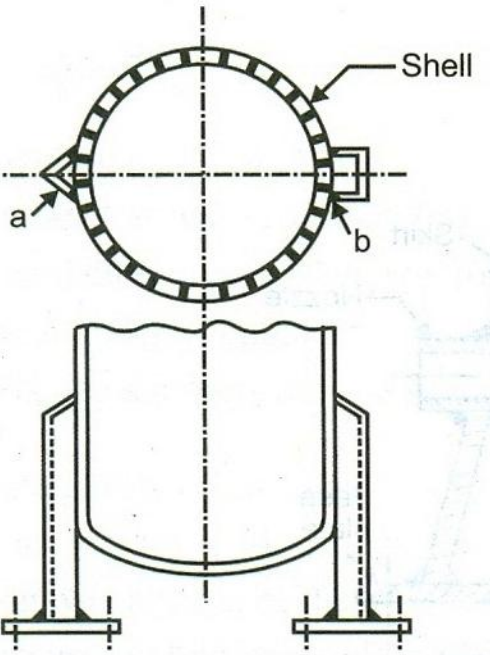
d)	<b>Spring Loaded Safety Valve</b> 	4	4
e)	<b>Gate valve</b> 	4	4





f)	<b>Expansion Joint (any one)</b> 	4	4
3	<b>Attempt any four</b>		16
a)	<b>Spiral Coil</b> 	4	4



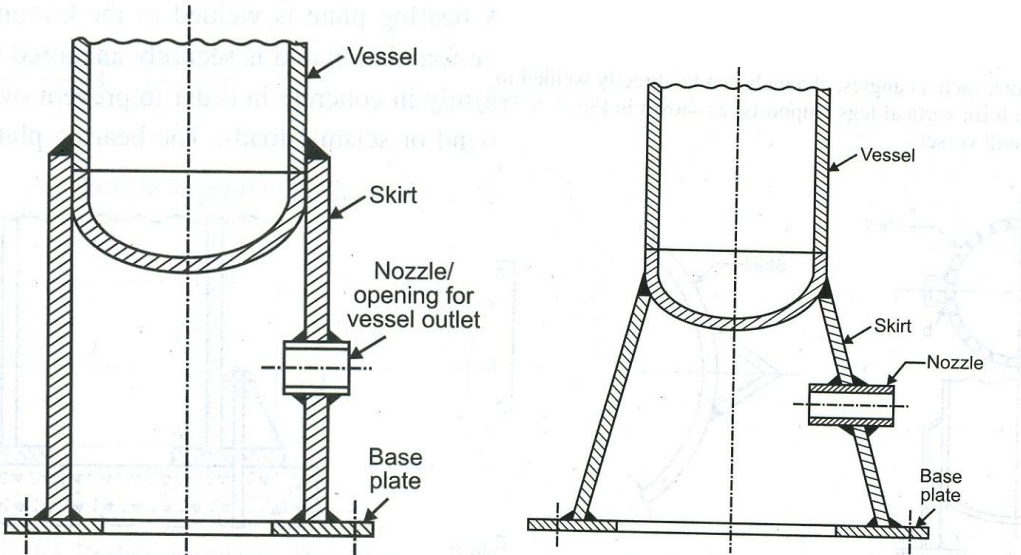
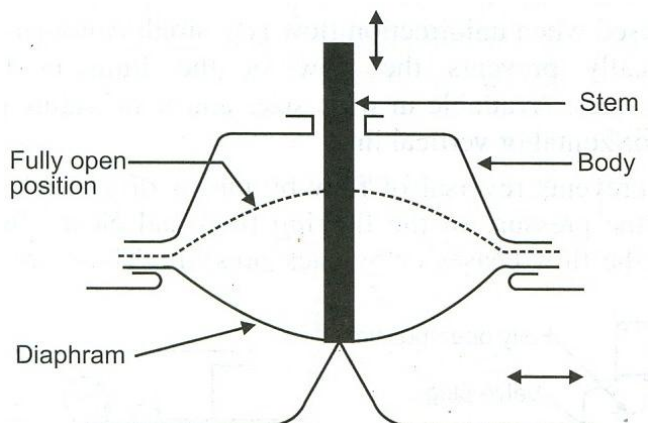
b)	<b>CI Joint</b> 	4	4
c)	<b>Leg support</b> 	4	4





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d)	<p><b>Skirt and Angular Support</b></p> 	2+2	4
e)	<p><b>Diaphragm Valve</b></p> 	4	4



**4 Process Flow Diagram and Process Instrumentation Diagram**

16

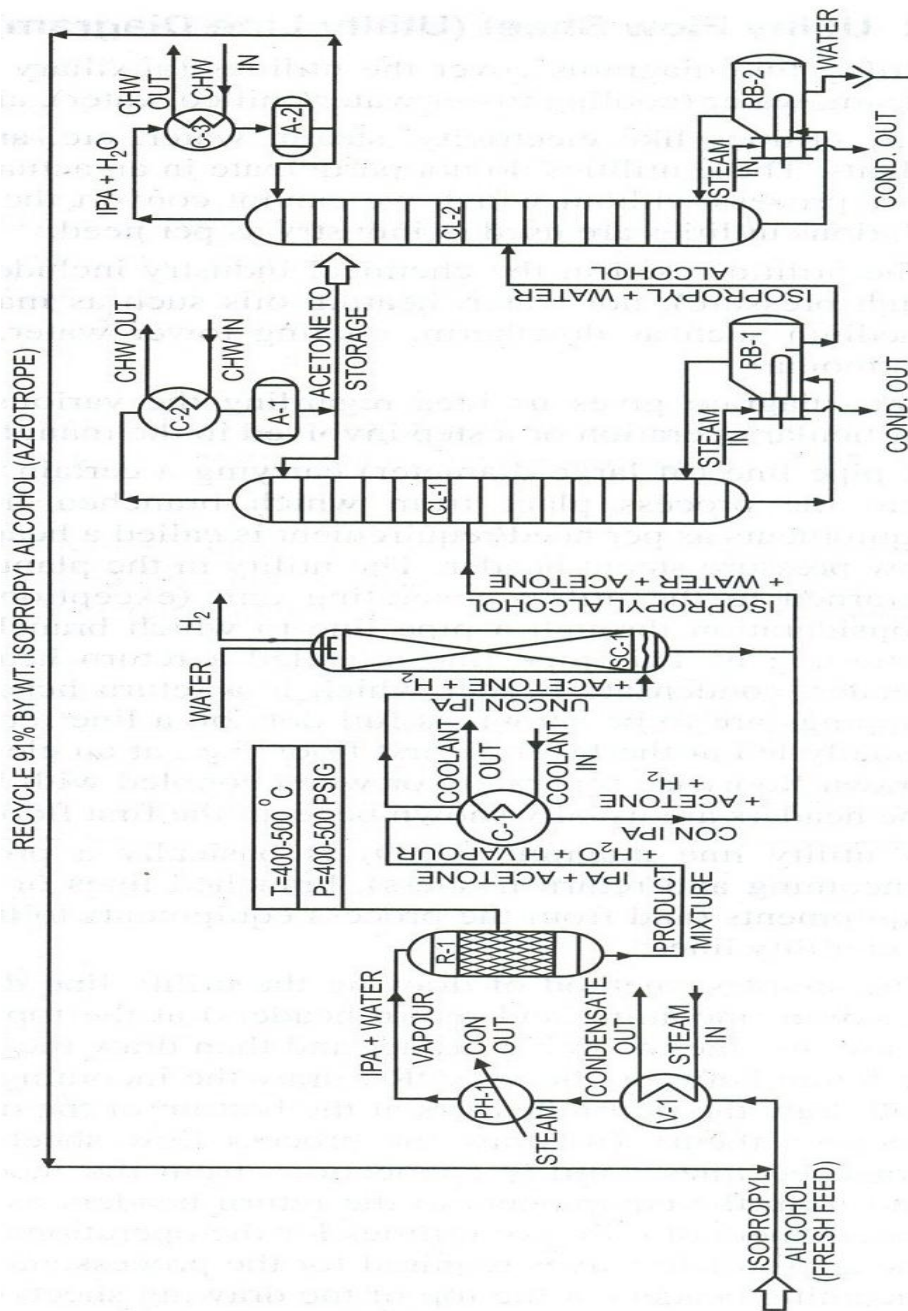
**Legend for Q 4 , 5 and 6**

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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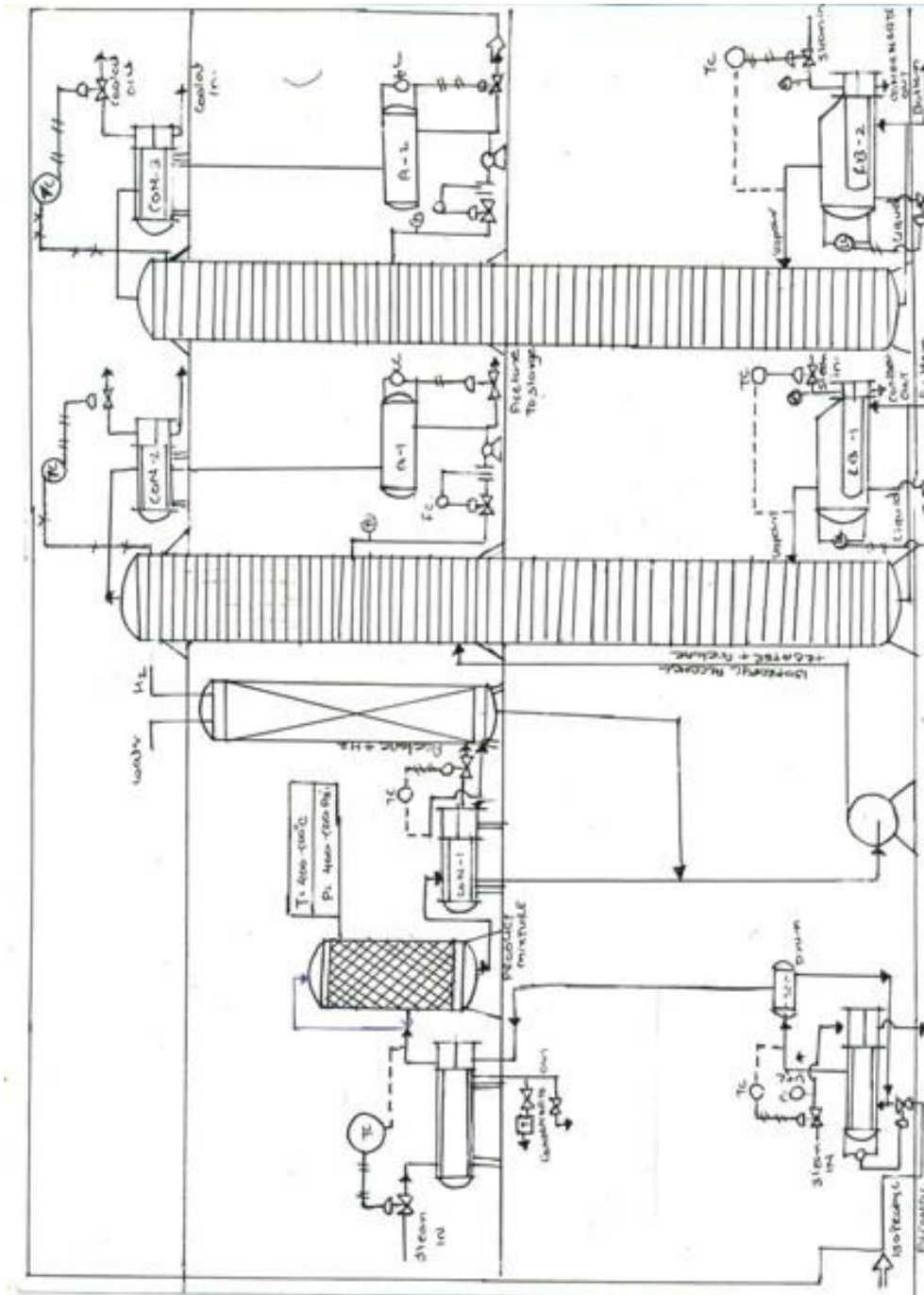
PFD 7  
marks +  
legends  
1 mark



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PID 7  
marks +  
legends  
1 mark



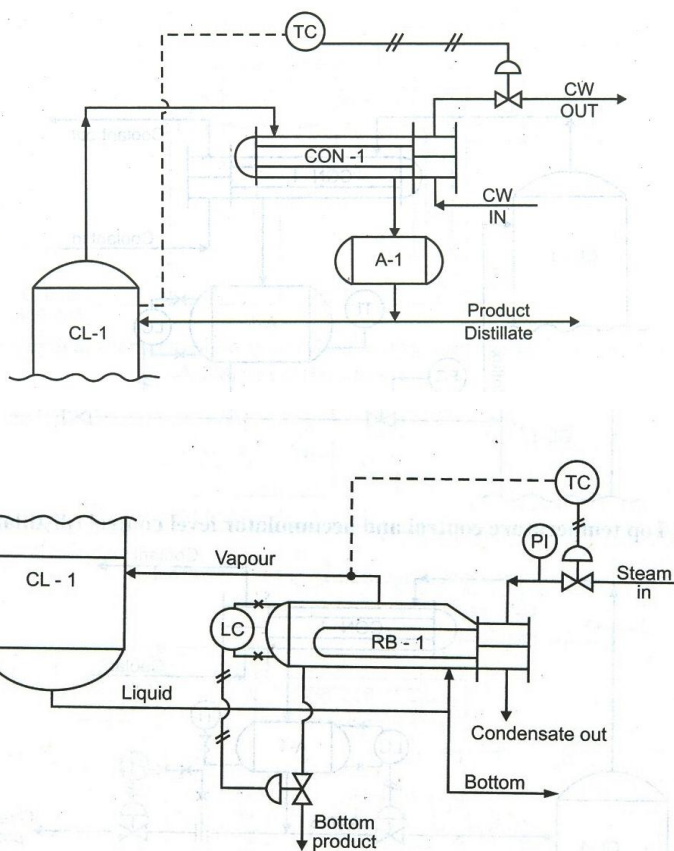
5	For Process in Q.4		16
a)	Utility Line Diagram	<p>ULD 7 marks + legends 1 mark</p>	



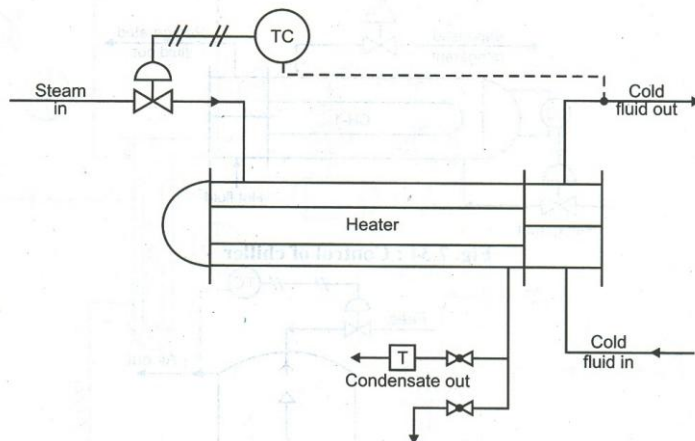


b)

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



**Heat Exchanger Control (Preheater)**



8 mark  
for any  
one

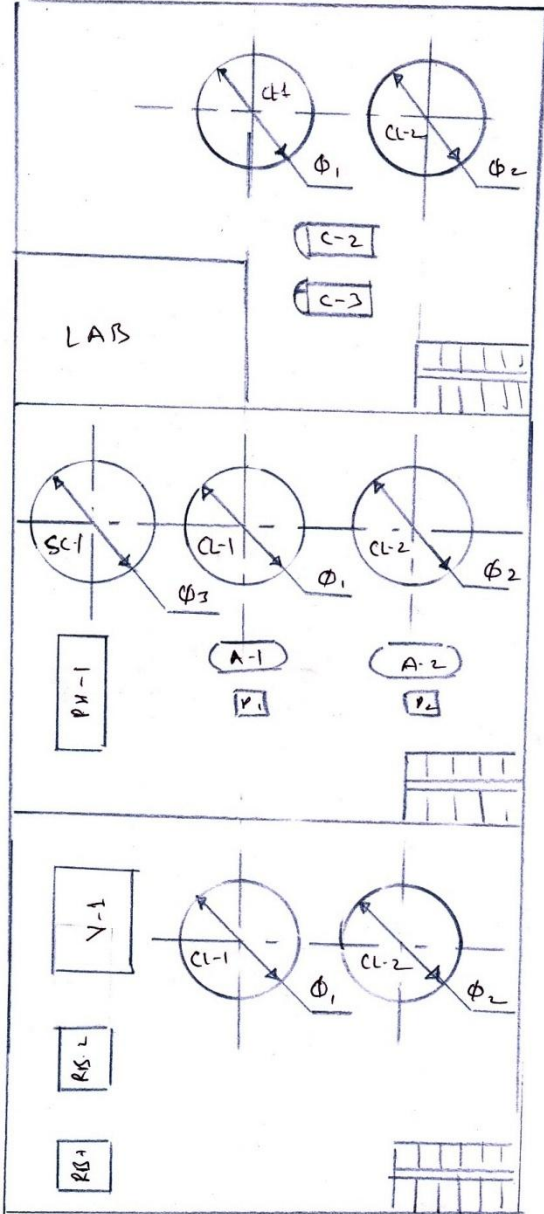
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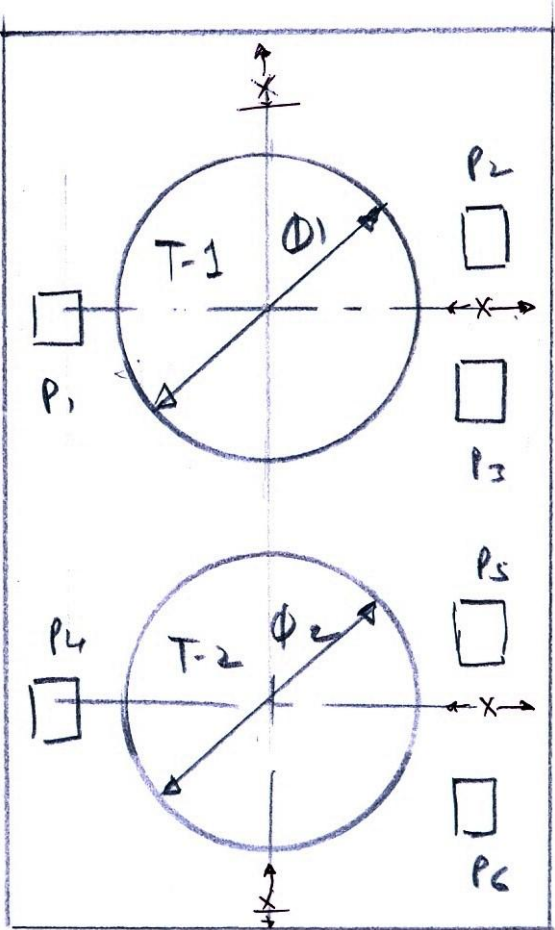


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6	For Process in Q.4		16
a)	Equipment layout		Equipm ent layout 7 marks + legends 1 mark



b)	<p><b>Tank farm and utility block diagram</b></p>  <p><b>T-1 - IPA storage tank</b> <b>T-2 Acetone storage tank</b> <b>P-1,2,3- IPA transfer pumps</b> <b>P-3,4,5 – Acetone transfer pumps</b></p>	6	8
		2	