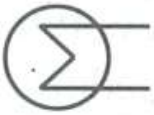
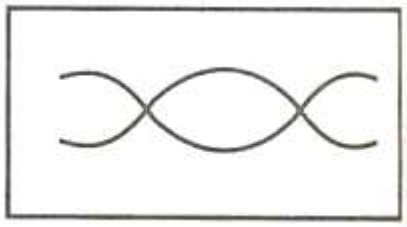
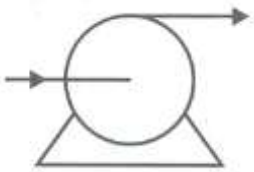
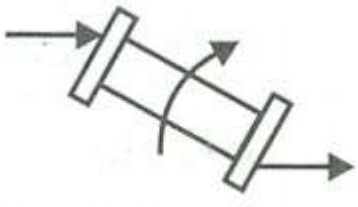
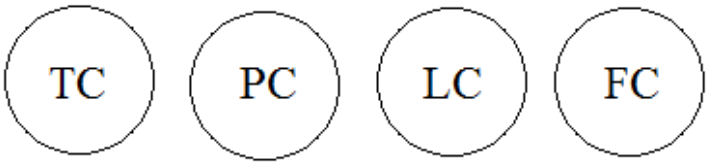
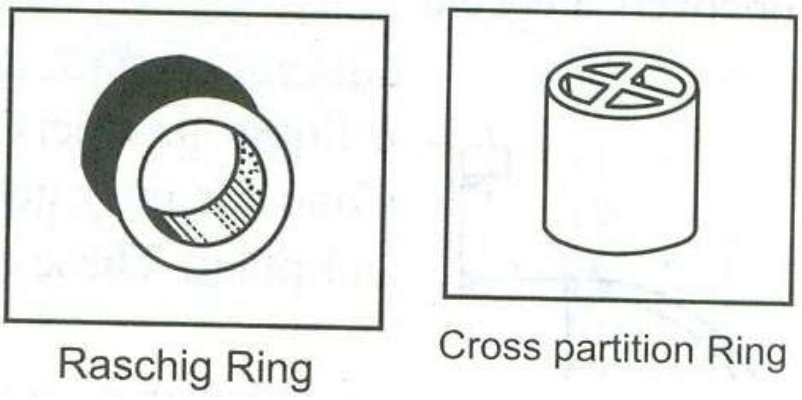
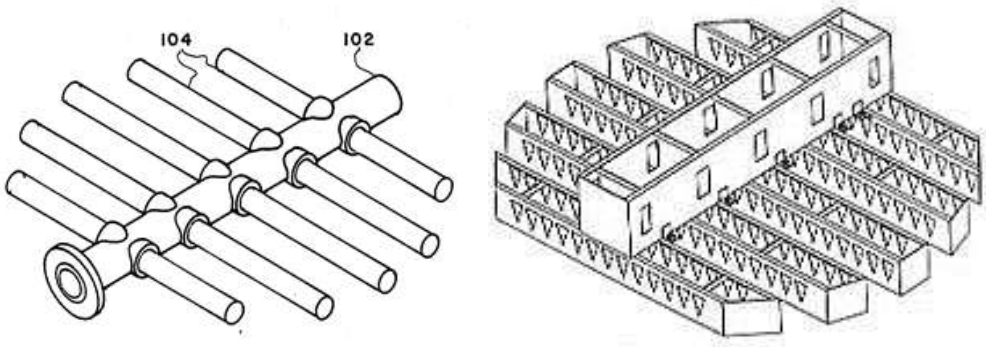
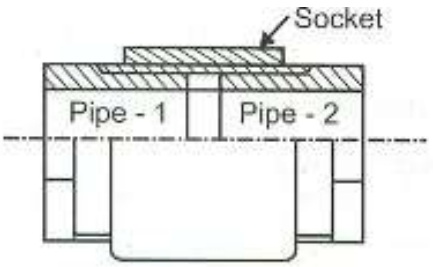
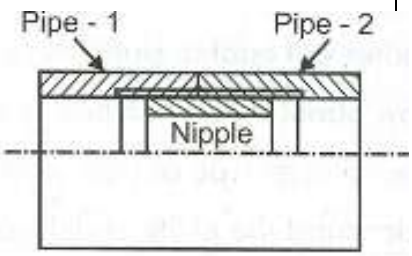
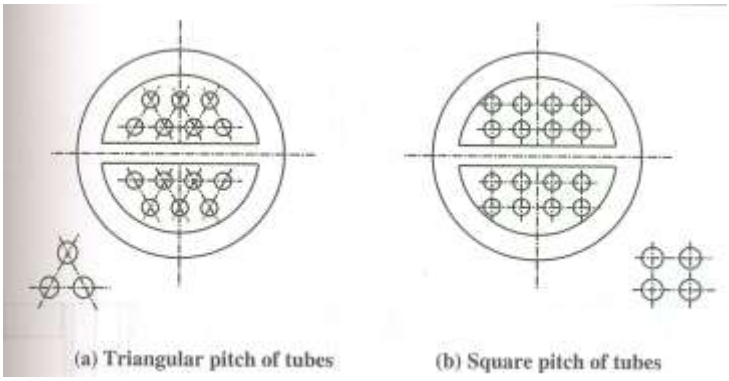
Important Instructions to examiners:

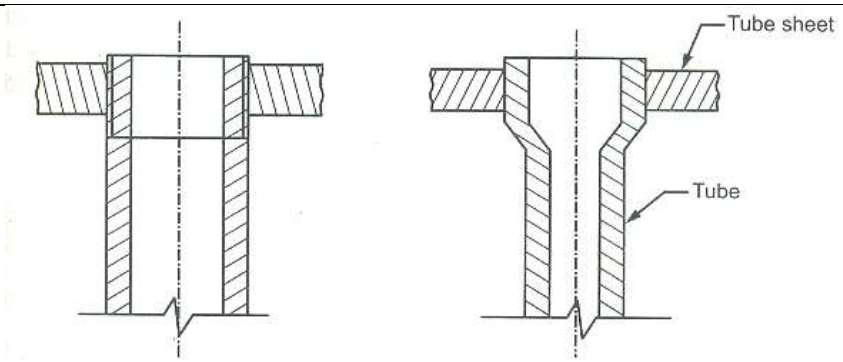
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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
1 (A)	**Attempt any three**	
a)	**Heat Exchanger**  OR  **Mixing**  **Centrifugal Pump**  **Rotary dryer (Marks can be given for rotary dryer or rotary vacuum filter)**  Any other symbol which shows heat exchange should be considered.	1 Mark for each

b)	**Instrumentation symbols for Temp, Press, Level and Flow controller** 	1 mark for each
c)	**Raschig ring and cross partition ring (marks should be given for other packing also)**  **Liquid distributor** 	2+2

d)	**Socket and Nipple joint**  	2+2
(B)	**Attempt any one**	
a)	**Specification sheet of batch reactor** **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 :	8

	20. Steam inlet ..... condensate size ..... 21. Water inlet .....water 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 : type .....No. ..... Bracket size ..... 42. Column support for bracket : size ..... 43. Remarks ..... Prepared by ..... Checked by ..... Approved by ..... Name and Address	
b)	**Tube sheet**  (a) Triangular pitch of tubes (b) Square pitch of tubes **Fixing tubes on tube sheet**	4+4



OR

b) **Shell and tube heat exchanger (1-1)**

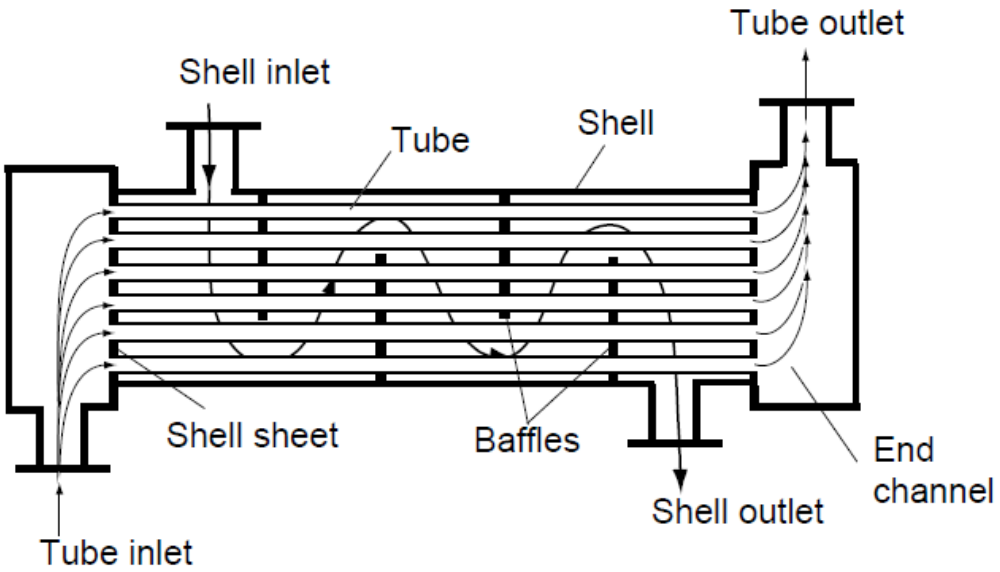
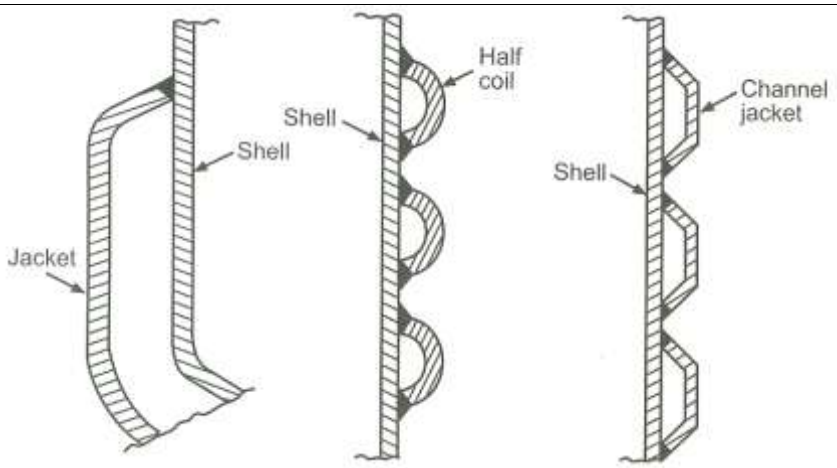
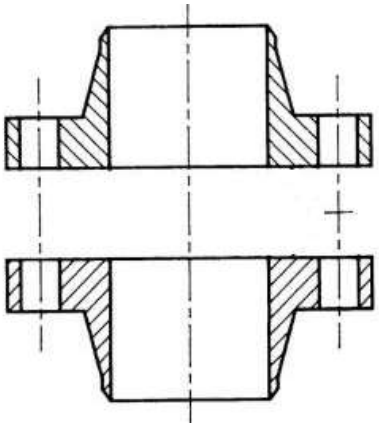
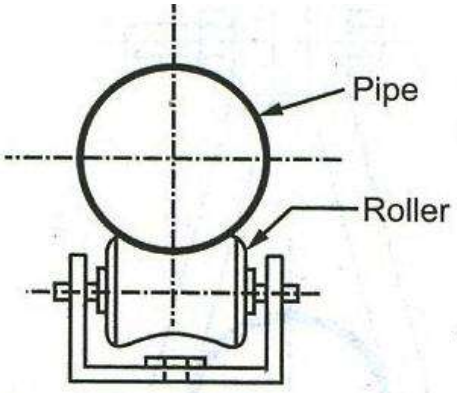
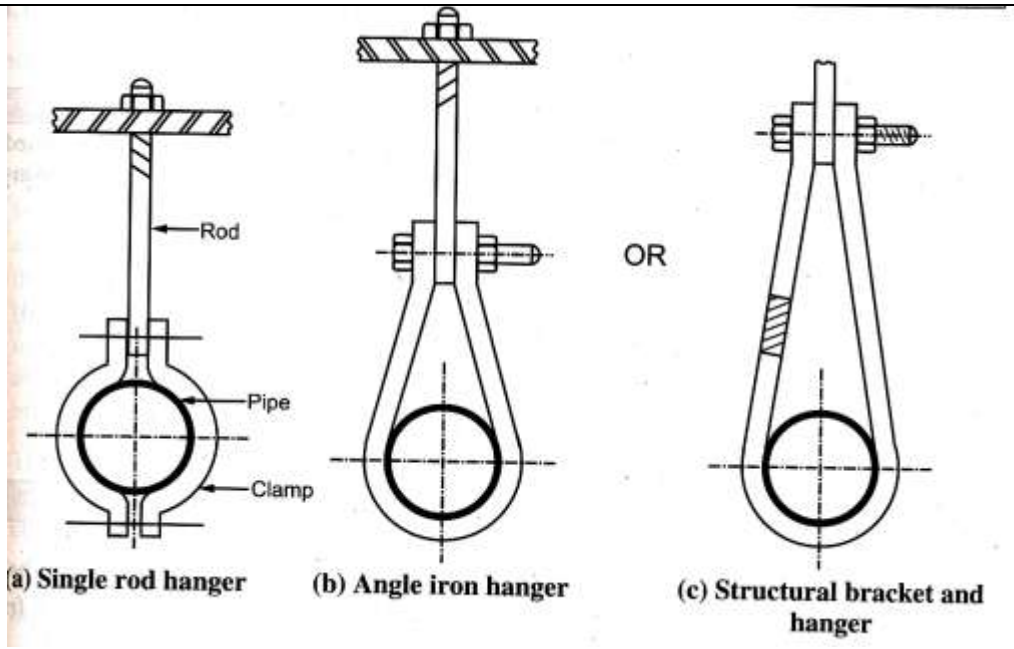


Diagram 5 marks, nomenclature 3marks

2 **Attempt any four**

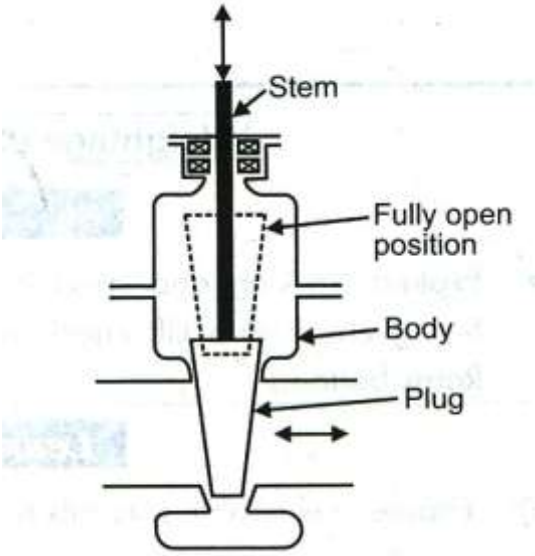
a) **Jackets** — 4 marks for any one

		
b)	**Plain Face Flange** 	4
c)	**Support for steam pipes** 	2 marks each for any two

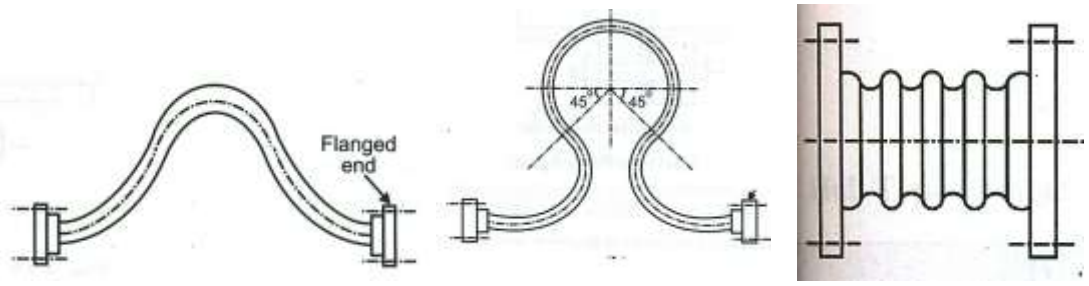
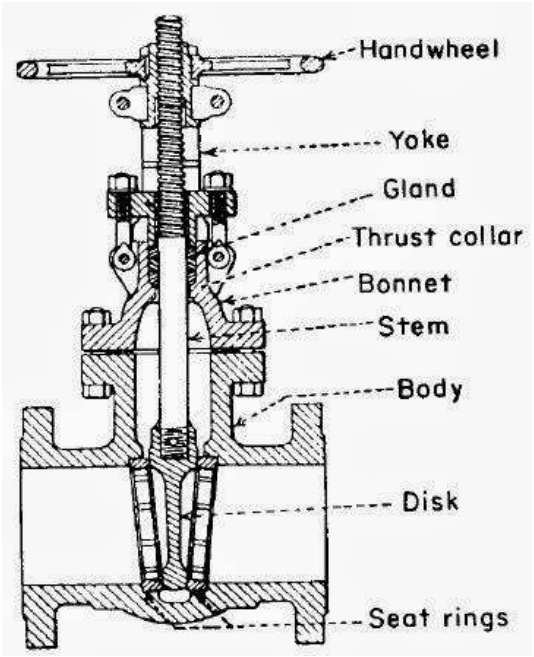


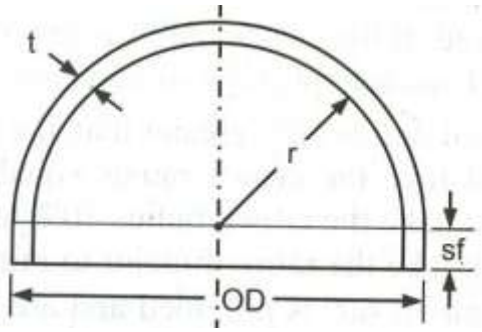
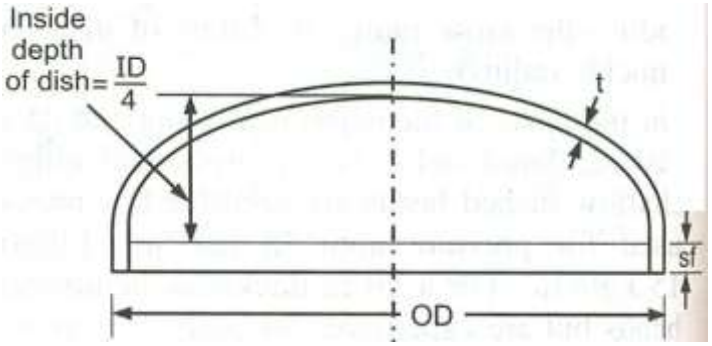
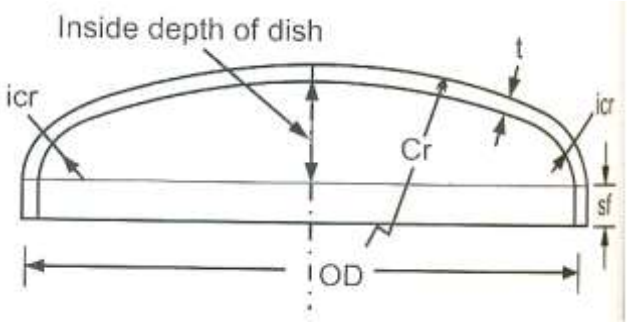
(a) Single rod hanger (b) Angle iron hanger (c) Structural bracket and hanger

d) **Gate valve**

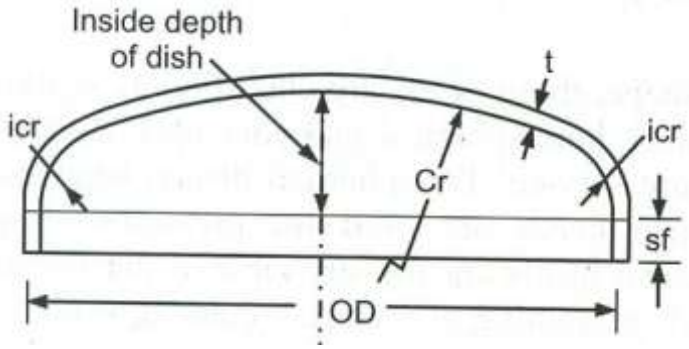


4

e)	**Expansion Joint** 	2 marks each for any two
f)	**Gate Valve sectional view** 	4

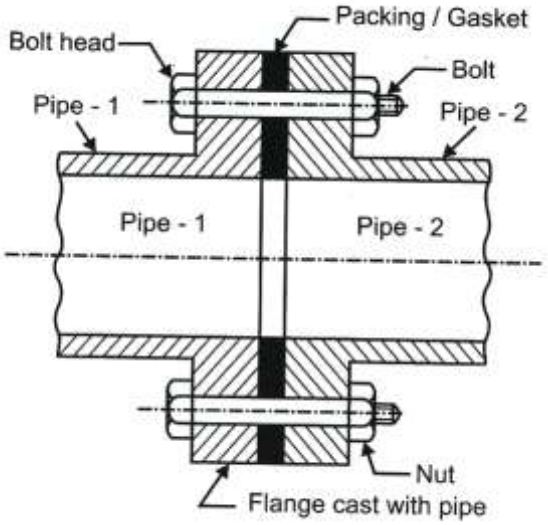
3	**Attempt any four**	
a)	**Hemispherical Head**  **Elliptical dished head**  **Flanged and Standard dished head**  	2 marks each for any two

Torispherical Dished head

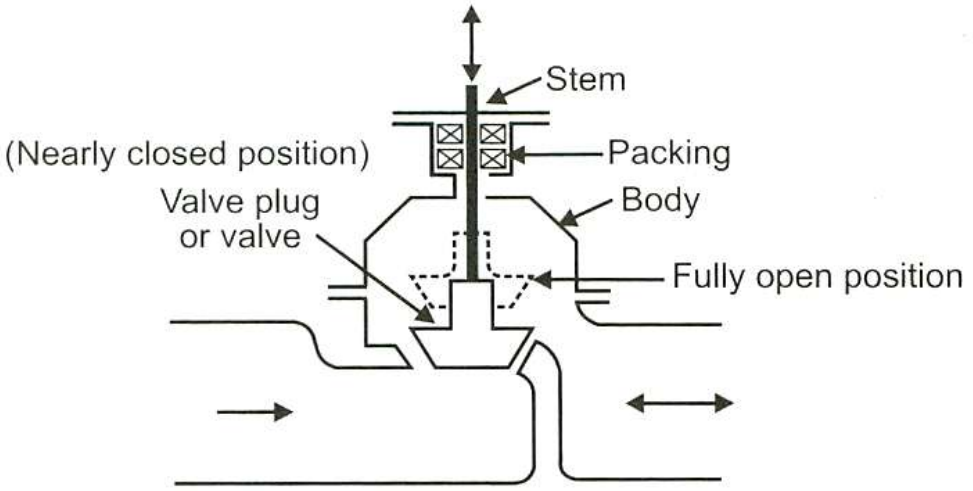
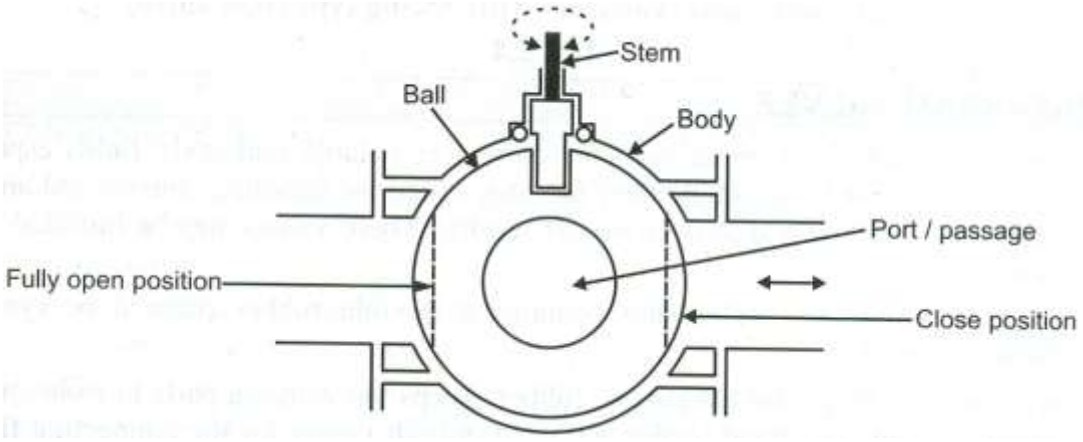


b) **Screwed joint**

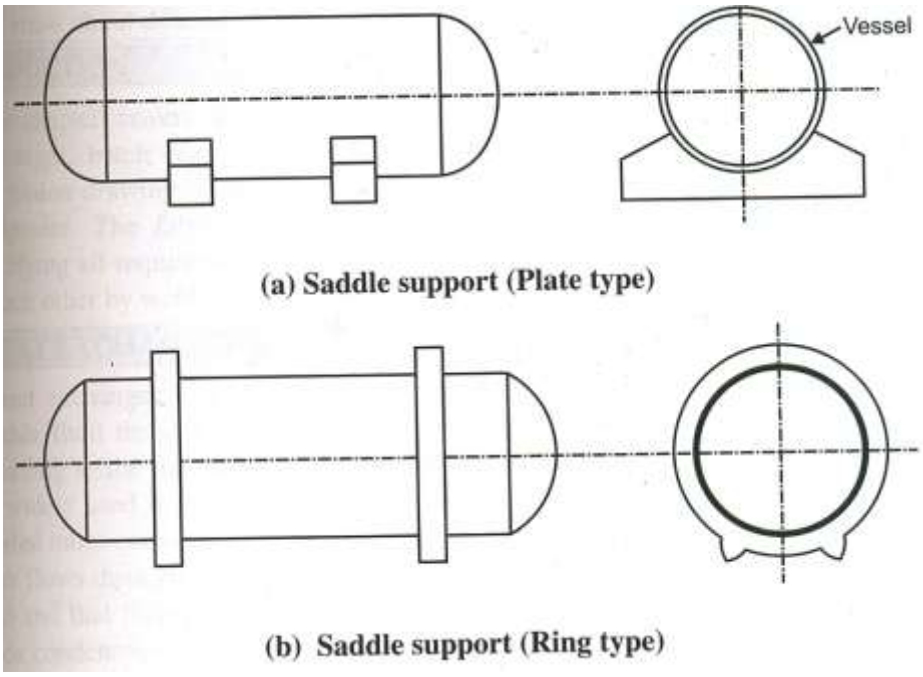
Flanged joint



2+2

c)	**Globe Valve** 	4
d)	**Ball valve** 	4

e) **Saddle support**

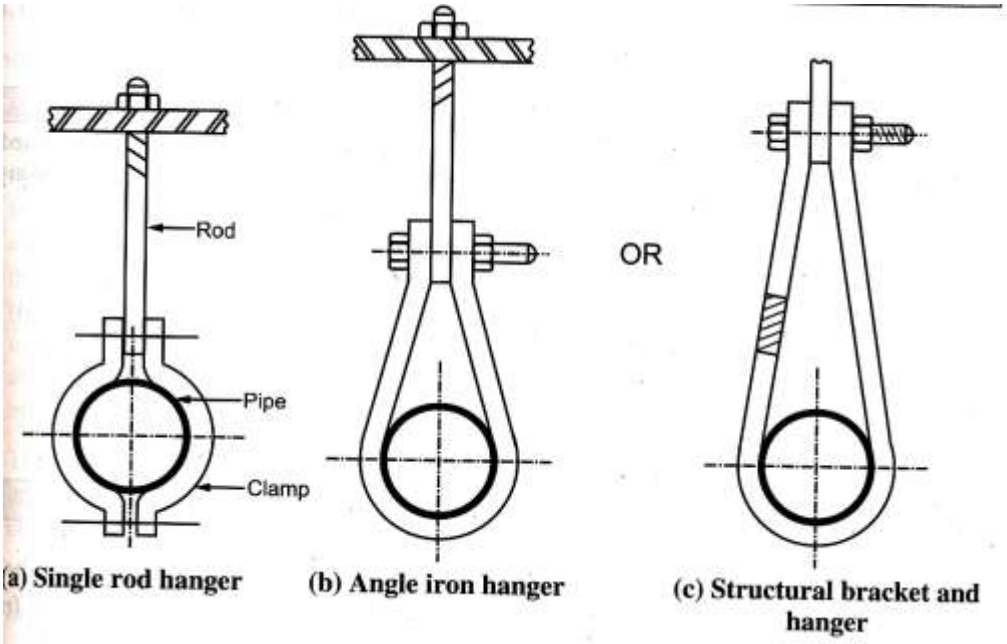


(a) Saddle support (Plate type)

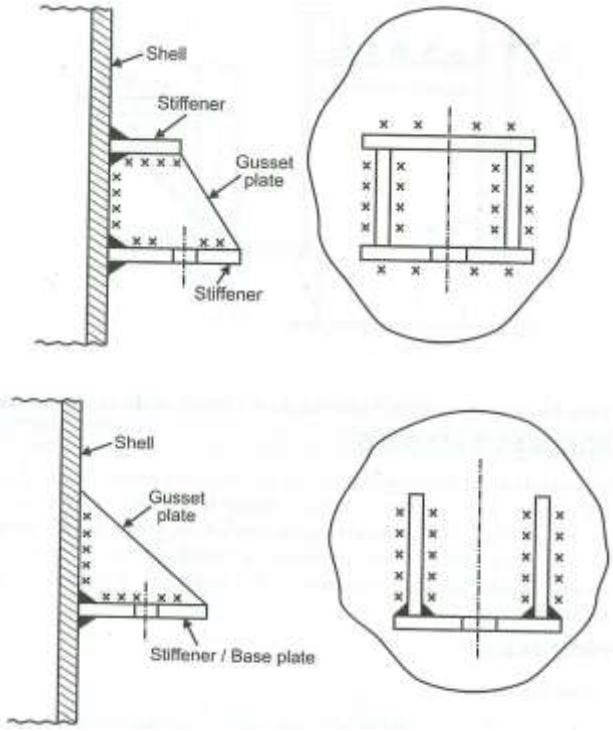
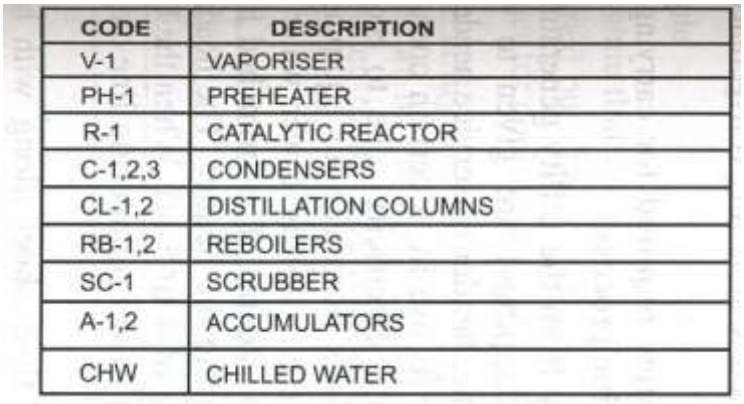
(b) Saddle support (Ring type)

2+2

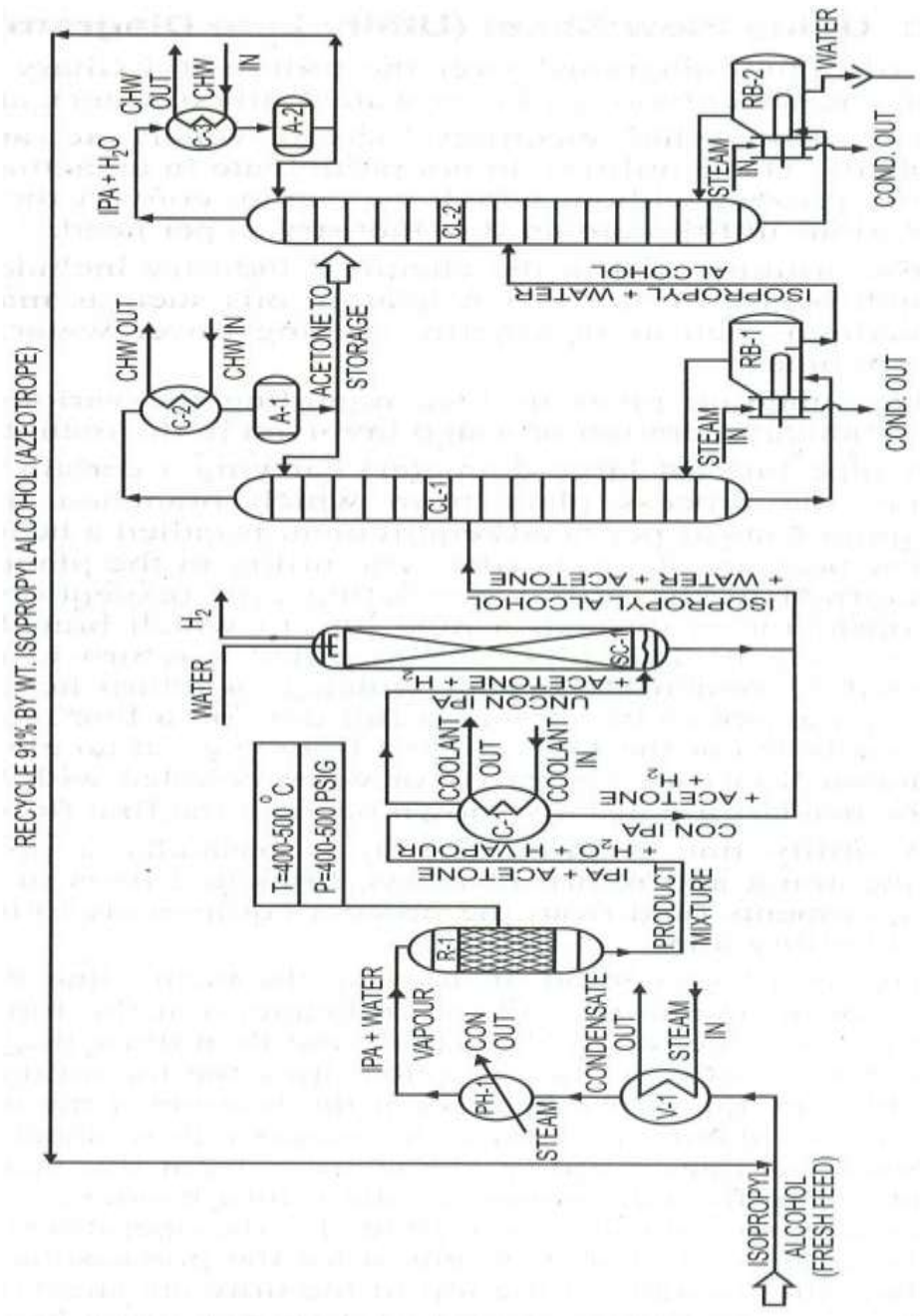
Hanger support

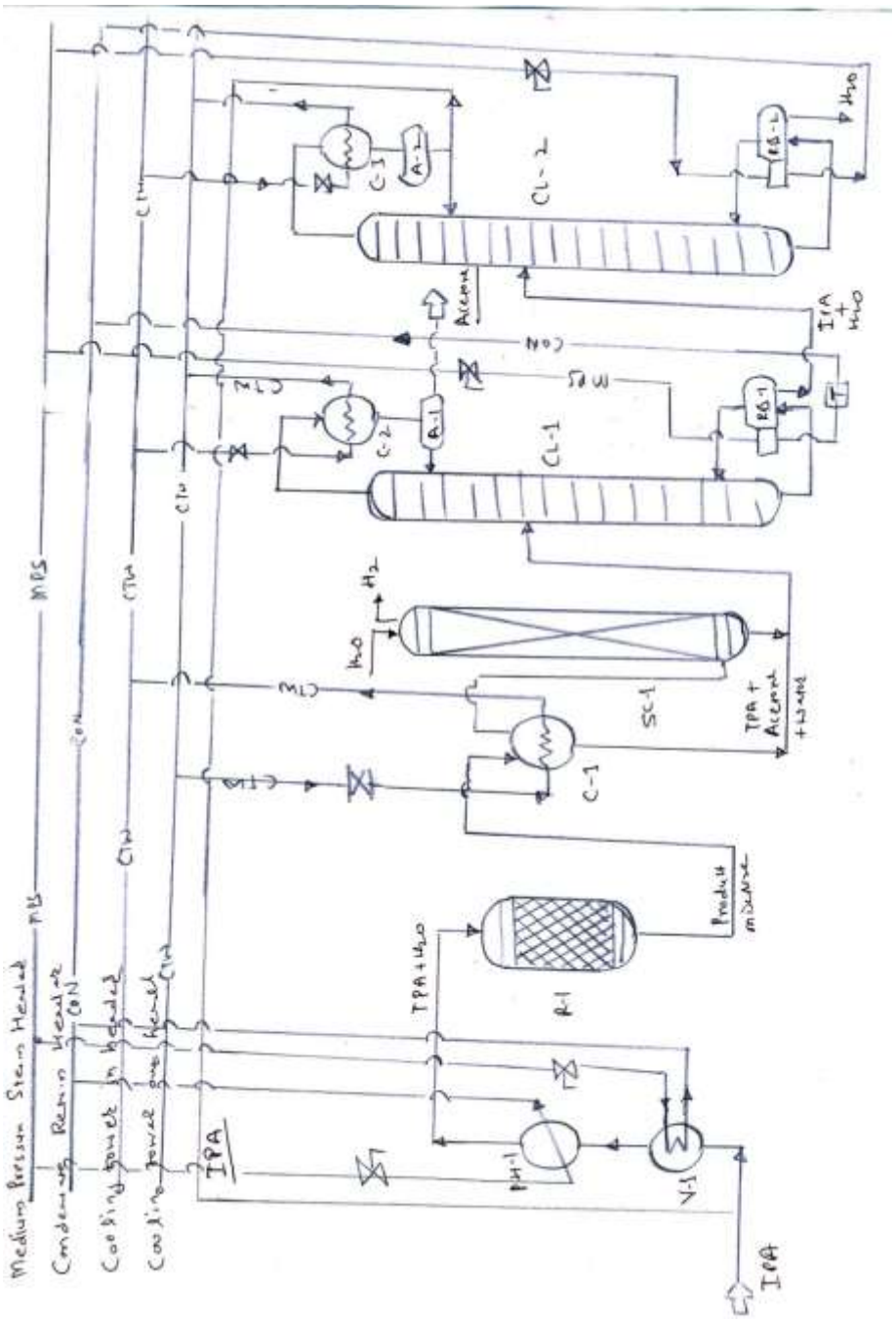


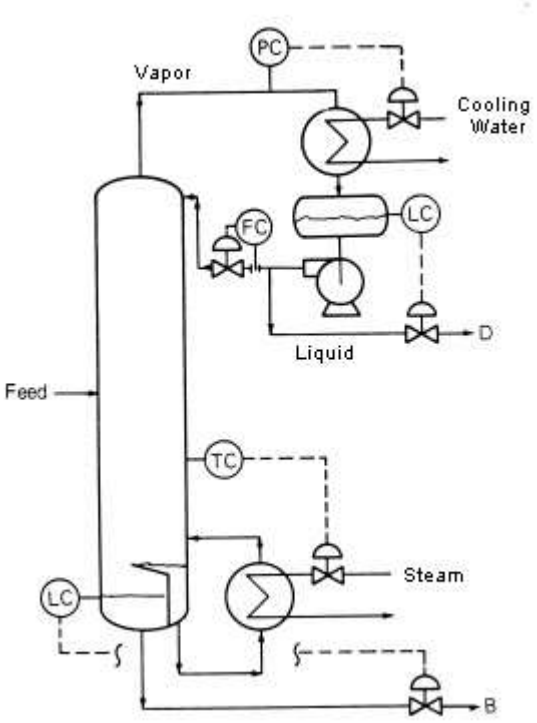
(a) Single rod hanger (b) Angle iron hanger (c) Structural bracket and hanger

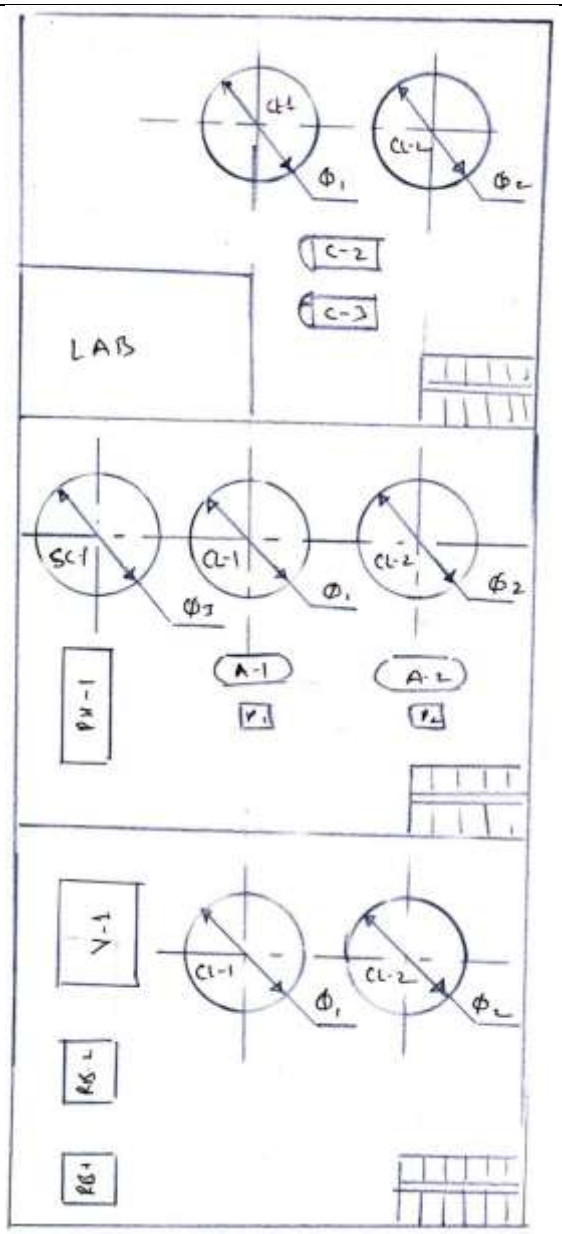
f)	**Bracket support** 	4
4	**Process Flow Diagram** **Legend for Q 4 , 5 and 6** 	PFD 12 marks + legend 4 marks

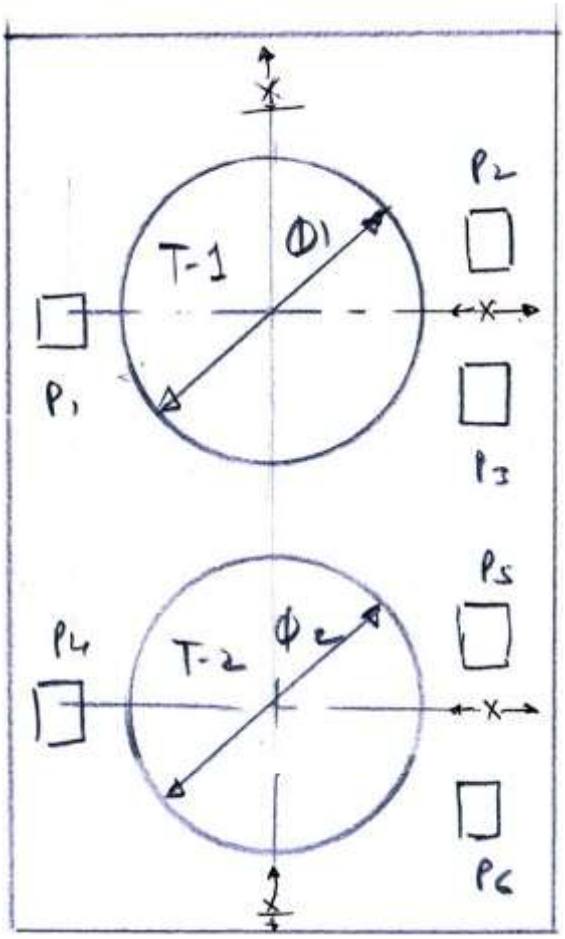
CODE	DESCRIPTION
V-1	VAPORISER
PH-1	PREHEATER
R-1	CATALYTIC REACTOR
C-1,2,3	CONDENSERS
CL-1,2	DISTILLATION COLUMNS
RB-1,2	REBOILERS
SC-1	SCRUBBER
A-1,2	ACCUMULATORS
CHW	CHILLED WATER


RECYCLE 91% BY WT. ISOPROPYL ALCOHOL (AZEOTROPE)
CHW OUT
CHW IN
C-3
A-2
IPA + H2O
CL-2
STEAM IN
RB-2
WATER
COND. OUT
ISOPROPYL + WATER
ALCOHOL
CHW OUT
CHW IN
C-2
A-1
ACETONE TO STORAGE
CL-1
RB-1
STEAM IN
COND. OUT
ISOPROPYL ALCOHOL
+ WATER + ACETONE
H2
WATER
SC-1
+ ACETONE + H2
UNCON IPA
COOLANT OUT
COOLANT IN
C-1
+ ACETONE + H2
CON IPA
+ H2O + H VAPOUR
IPA + ACETONE
T=400-500 °C
P=400-500 PSIG
R-1
PRODUCT MIXTURE
IPA + WATER
VAPOUR
CON OUT
PH-1
STEAM
CONDENSATE OUT
V-1
STEAM IN
ISOPROPYL ALCOHOL (FRESH FEED)

5	**For Process in Q.4**	
a)	**Utility Line Diagram** 	ULD 7 marks + legends 1 mark

b)	**Fractionating column control is divided into two part 1) Top Control 2) Bottom Control** 	8
6	**For Process in Q.4**	
a)	**Equipment layout**	Equipment layout 7 marks + legends 1 mark


LAB
C-2
C-3
SC-1
CL-1
CL-2
Φ1
Φ2
Φ3
A-1
A-2
PW-1
V-1
RS-2
RS-1

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**	6 2