

[Time: Three Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B:
1. Question No. 1 is compulsory.
 2. Answer any **three** questions from the **remaining** questions.
 3. Assume **suitable** data wherever necessary.

- Q.1 a) State the difference between evaporation cooling and refrigeration. 05
 b) What are the problems associated with Flaring? Explain in brief. 05
 c) If motive pressure is 15 bar and evaporation pressure 7 mm Hg, calculate compression ratio. 05
 d) Explain different types of relief devices. 05
- Q.2 a) The storage tank system shown in following figure is used to store process feedstock. Overfilling of storage tank is a common problem in process industries. To prevent overfilling, the storage tank is equipped with a high-level alarm and a high-level shut down system. The high-level shut down system is connected to a solenoid valve that stops the flow of input stock. 10

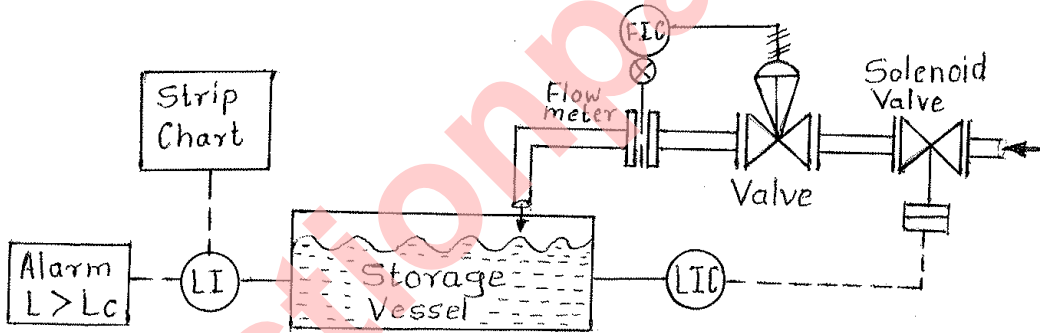


Figure Level control system with alarm.

Develop an event tree for the system using the "failure of level indicator" as the initiating event.

Given that the level indicator fails 4 times/year, estimate the number of overflow expected per year.

Use the following data:

System	Failures/demand
High-level alarm	0.01
Operator stops flow	0.1
High-level switch system	0.01

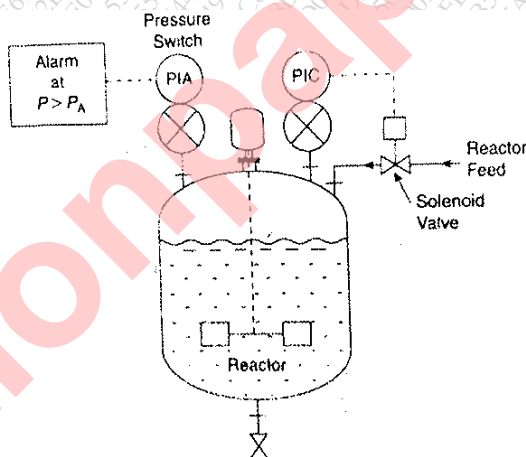
- b) Set up an analysis of variance table for the following per acre production data for three varieties of wheat, each grown on 4 plots and state if the variety differences are significant. Solve the problem by the direct method and set up the ANOVA table. 10

Plot of Land	Per acre Production data		
	Variety of wheat		
	A	B	C
1	6	5	5
2	7	5	4
3	3	3	3
4	8	7	4

- Q.3 a) Derive the expression for work done by a single stage Reciprocating air compressor without clearance volume for polytropic compression. 10

- b) Describe with the neat diagram, the construction and working of the Babcock and Wilcox boiler 10

- Q.4 a) Consider the alarm indicator and emergency shutdown system given below. Draw a fault tree for this system. 10



- b) Explain various applications of air in Chemical plant. 10

- Q.5 a) What are the statistical methods available to characterize accident and loss performance? If twice as many people used motorcycles for the same average amount of time each, what will happen to (i) the OSHA incidence rate, (ii) the FAR, (iii) the fatality rate, and (iv) the total number of fatalities? If all the riders used their motorcycles twice as much, what will happen to (i) the OSHA incidence rate, (ii) the FAR, (iii) the fatality rate, and (iv) the total number of fatalities? 10

- b) Explain operation of diffusion pump for high vacuum 10

- Q.6 a) What are the advantages of having an intercooler between two stages of compressor? 05

- b) What is fire triangle? 05

- c) What is the degree of freedom? 05

- d) What are the preventive methods available for fire and explosion? 05