KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks Scored:

Level : B.E.
Year : III

Course : CHEG 314
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

SECTION "A"
[20Q. × 0.5 = 10 marks]

Encircle the most appropriate answer.

1. Engineers in industry use .....as guide during design.
   a. Codes & manuals
   b. ISO 9001:2000
   c. Codes and standards
   d. CAD software

2. Projects in chemical engineering, which require designing can be
   a. Modifications of the existing plant
   b. Increasing the capacity of the existing plant
   c. Both a & b
   d. Chemical engineers are not involved in small design works

3. Once the process design is completed, it would give the .....
   a. Data flow sheet
   b. Process flow sheet
   c. Block flow diagram
   d. Design data sheet

4. Which of the following is an internal constraint?
   a. Time
   b. Plant layout
   c. Location of site
   d. Utilities

5. Which of the following is an external constraint?
   a. Method
   b. Physical laws
   c. Personnel
   d. Possible design

6. Which is not concerned with equipment design?
   a. Design basis
   b. Vendor data list
   c. Safety review
   d. Cost estimate

7. Which one of the following is not considered as trade-offs?
   a. More separations operating cost versus lower product purity
   b. More recycle costs versus increased waste formation
   c. More heat recovery versus cheaper heat exchange
   d. More raw material supply versus more product production

8. The most important step in starting a process design is translating the customer need into a .....
   a. Tangible concept
   b. Design basis
   c. Real concept
   d. Designer does not care about customer's idea

9. Most companies use .....to capture design basis information.
   a. Costumer's portfolio
   b. Customer's data plan
   c. Standard forms or questionnaires
   d. Customer's finance

10. The first step in equipment design or selection is the.....to intended operation.
   a. Selection of the right contractor
   b. Selection of the right gear
   c. Selection of the auxiliary equipment
   d. Selection of the appropriate process type

11. Factors not influencing the design of equipment in general is
   a. Material status inside equipment
   b. Its chemical and physical properties
   c. Type of paint to be used in interior and exterior
   d. Type of operation to be carried out

12. A material balance taken over the complete process will
   a. determine the quantities of raw materials required and products produced
   b. not determine the quantities of raw materials required and products produced
   c. determine the qualities of raw materials required and products produced
   d. determine the qualities of cooling process water usage

13. The system boundary defines the
   a. Boundary wall around the process plant system
   b. Part of the process being considered
   c. Equipment being considered for boundary usage
   d. Plant boundary

14. A recycle stream is one where
   a. a portion of the inlet to a process unit is split from the feed and instead of entering the process it is combined with the outlet from that process
   b. no mass moves across the boundaries
   c. a portion of the outlet of a process unit is combined with fresh feed and sent into the same unit again
   d. a portion of a recycle stream is removed from the system in order to avoid accumulation of undesired material in a recycled system

15. Which one in the following list is not a type of corrosion?
   a. Pitting b. Galvanic c. Erosion d. Creep

16. The tube fouling in heat exchanger is not the result of
   a. Low fluid velocity
   b. Use of untreated raw water
   c. Use of incorrect material of construction
   d. Use of correct material of construction

17. Which of the following is not a types of pressure relief device?
    a. Directly actuated valves
    b. Indirectly actuated valves
    c. Non return valves
    d. Bursting discs

18. Which of the following is not considered as ignition source for fire hazard?
    a. Flame traps
    b. Static electricity
    c. Process flames
    d. Electrical equipment

19. Technically, sites are classified as either ..... during design.
    a. Small site or large site
    b. Brownfield or greenfield
    c. Old or new site
    d. Sites are never classified

20. While developing plant layout, one should not consider about
    a. Safety factor
    b. Cost reduction during construction
    c. Ease of mobility around plant for personnel
    d. Equipment MOC

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SECTION "B"
[4Q. × 5 = 20 marks]

Attempt *ANY FOUR* questions.

1. What do you understand by design constraints? Explain any four constrains with example from both category. [1+1+1+1+1]

2. Define battery limit. Why is it necessary to show the battery limits of designed process? Draw a sample diagram with battery limits. [1+1+3]

3. Explain in details what can be seen in Figure 1? [5]

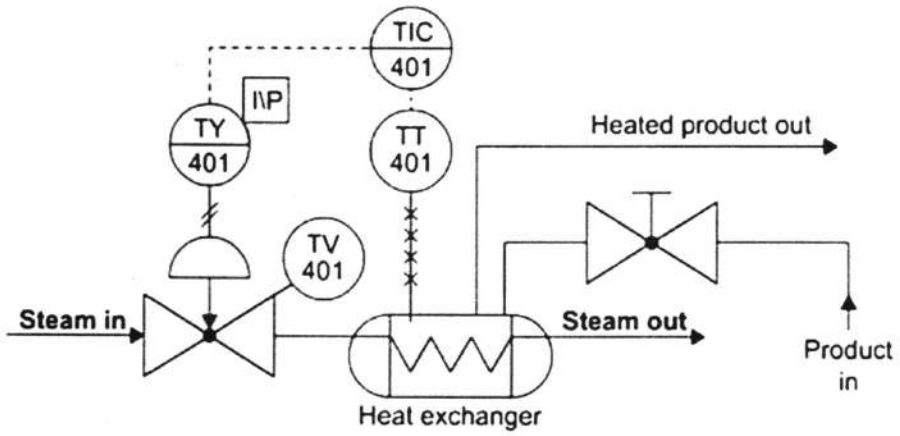


Figure 1

4. Answer the questions with respect to Figure 2. [1+1+1+1+1]
   a. Name the equipment A, B & C shown in the diagram.
   b. Briefly explain the principle of operation for equipment 'A'.
   c. Briefly explain the principle of operation for equipment 'B', & its use in this process.
   d. Suggest an alternative equipment that could be used in place of equipment 'B'.
   e. Briefly explain the principle of operation for equipment 'C'.

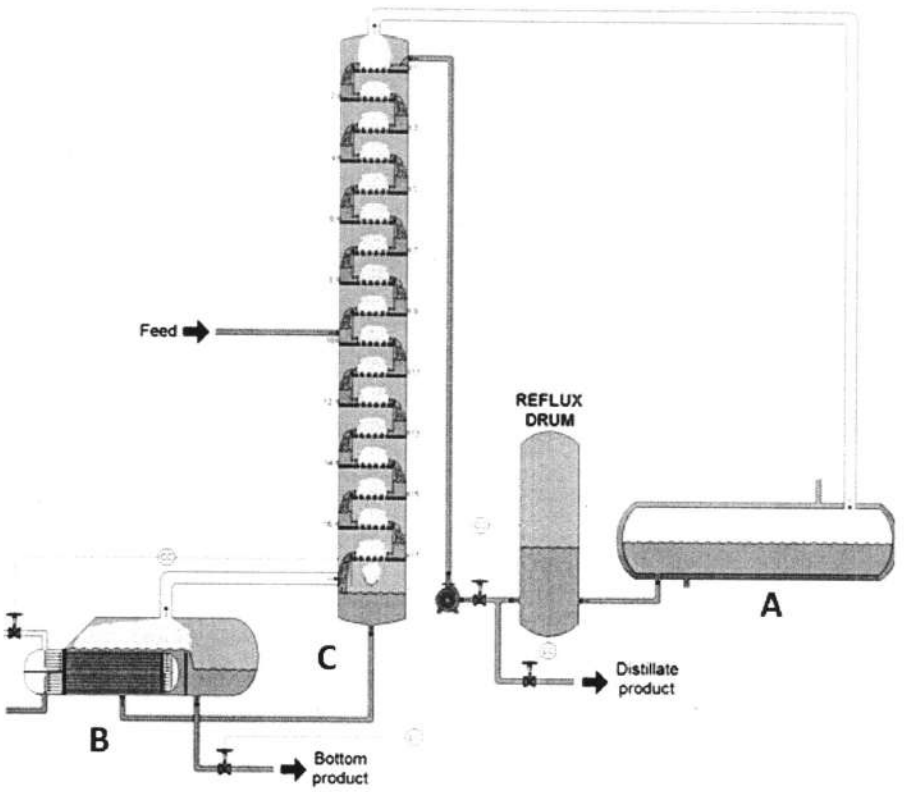


Figure 2

5. Draw a BFD, PFD and P & ID of water purification process to produce drinking water for Kathmandu University, using borewell water as source (*propose a general design*). [1+1+3]

SECTION "C"

[5 Q. × 4 = 20 marks]

Attempt *ANY FIVE* questions.

6. Define PFD and mention any 3 usages of it. Draw a sample PDF of any process, other than water purification process. [2+2]
7. Define boundary. Explain its importance. Mention materials that cross the boundary for units given in Figure 3. [1+1+1+1]

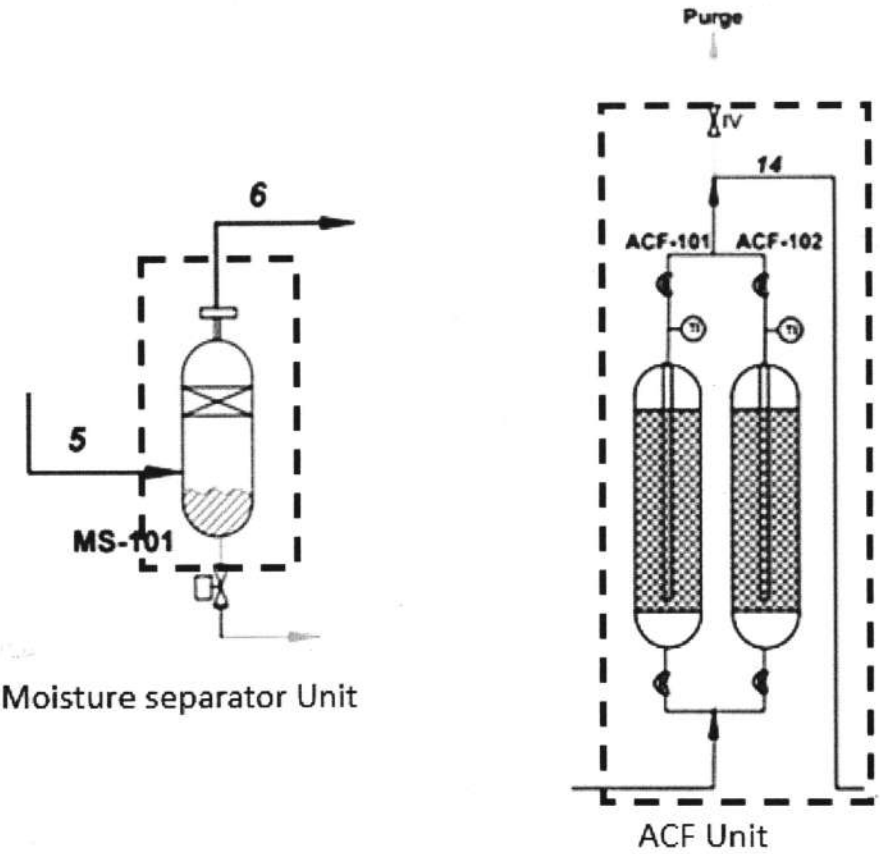


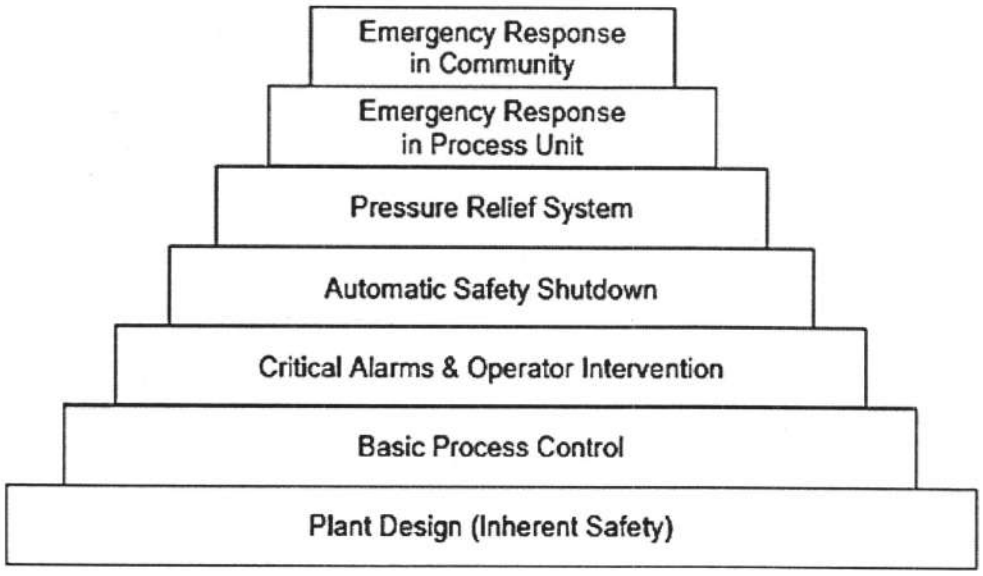
Figure 3

8. Why setting the design basis at initial phase of design is necessary? Explain with example. Why trade-offs are very common in design? Explain with example. [2+2]

9. Why engineers in industry use codes and standards during design? Suggest material of construction for following equipment & mention the basis for selection. [1+1+1+1]
   - Screw conveyor to be used in food industry.
   - Ribbon mixer for pickle factory that makes lemon pickles.
   - Heat exchanger for milk pasteurization.

10. Giving two examples, explain materials hazards. Why should we lookout for material hazard during design phase? What is materials safety data sheet (MSDS) and what information does it provide? [2+1+1]

11. Explain how this pyramid could be utilized during design process. Explain each step. [4]



Layers of plant safety.