BITS, PILANI – DUBAI

FIRST SEMESTER 2010 – 2011

FINAL YEAR CHEMICAL ENGINEERING

Course Code: CHE C413 **COMPREHENSIVE EXAM** Date: 28.12.10

Course Title: Process Plant Safety Max Marks: 80

Duration : 3hr (Closed Book) Weightage: 40%

Attempt ALL questions.

1.(a) Explain the following:
(i) Personal monitoring
(ii) Environmental monitoring
(iii) Biological monitoring (2 × 3 = 6 m)

1.(b) Mention the purpose of sampling in the process industries. (3 m)

2.(a) Determine the TLV for a uniform mixture of dusts containing the following particles: (3 m)

Type of the dust	Concentration (wt%)	TLV (mg/m^3)
Talc	70	20
Quartz	30	2.7

2.(b) Deduce an equation for estimation of vaporization rate for a spill of volatile liquid. (7 m)

2.(c) Mention the types of the hoods. (2 m)

3.(a) Discuss any three head protection, and eye and face protection PPE with its various types, characteristics and to which it protects against. (3 + 3 = 6 m)

3.(b) How the safety and a plant-layout of the site are linked for (i) storages area and (ii) process area? Discuss in detail. (2 + 2 = 4 m)

4.(a) Discuss the various divisions and its characteristics about Class 1 and Class 2 dangerous goods. (3 + 3 = 6 m)

4.(b) Define explosives. (2 m)

4.(c) Mention the significance of positive oxygen balance. (2 m)

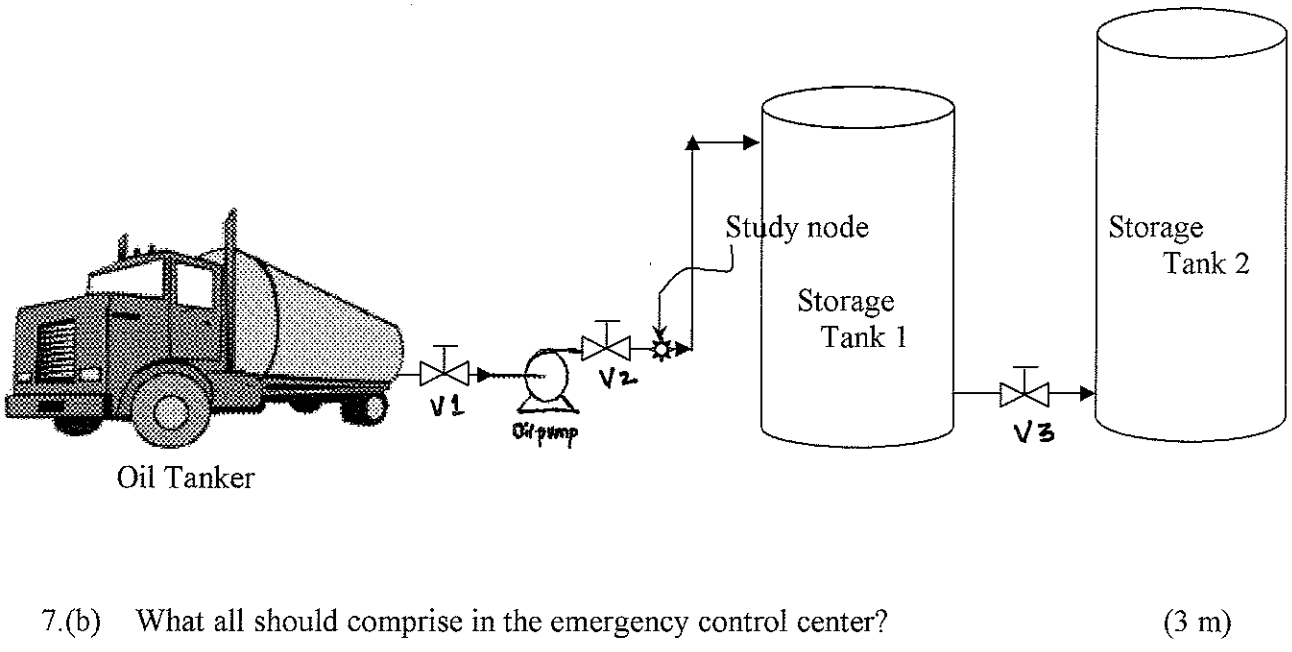
5.(a) How hydrostatic testing of a pipeline is carried out ? (2 m)

5.(b) Many incidents have occurred because the wrong material of construction was used. Discuss any 6 such failures due to wrong material used. (6 m)

6.(a) Discuss in detail about reaction hazards of the following reactions;
(i) Nitration
(ii) Halogenation
(iii) polymerization (2 × 3 = 6 m)

6.(b) Discuss why risk assessment is required for any chemical process industry. (4 m)

7.(a) Perform HAZOP study with the given guide words (no, reverse, more) and flow parameter for the following unloading section. (2 × 3 = 6 m)



Oil Tanker

7.(b) What all should comprise in the emergency control center? (3 m)

8.(a) Mention the steps for conducting the safety audit. (3 m)

8.(b) Explain in detail about combustible dust explosion. Explain with any 2 examples for the combustible dust explosion , with the following points:
Materials involved and properties of materials
Root cause
Best practices to avoid in future (3 + 3 + 3 = 9 m)

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FINAL YEAR CHEMICAL ENGINEERING

Course Code: CHE C413 **TEST 2** Date: 05.12.10

Course Title: Process Plant Safety Max Marks: 20

Duration : 50 minutes (Open Book) Weightage: 20%

Note : Permitted to use "only prescribed Text book and original hand written notes" for the open book evaluation component. No photocopies of any sought shall be permitted.

1. Explain HAZCHEM code with an example. (2 m)

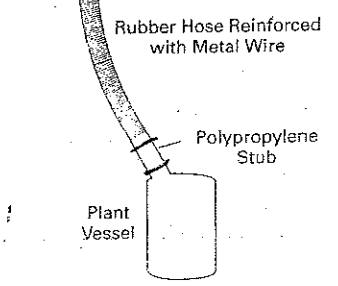
2. What is RHI ? Compute RHI for acetylene.(Td = 2898K, Ea = 40.5 kcal/mol) (2 m)

3. Explain when cooling towers become health hazards. (2 m)

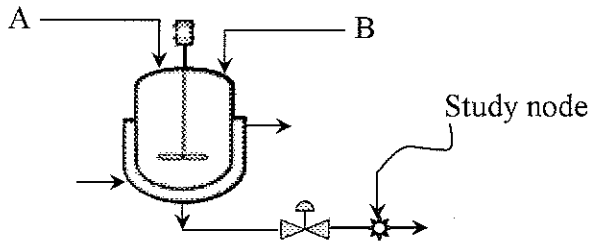
4. An explosive powder was emptied down through a metal duct into a plant vessel. The duct was replaced by a rubber hose reinforced with metal wire, as shown in figure.

   Discuss about safety concerns due to the above said modification. (2 m)

   Recommend other alternations for the safe operation. (2 m)



5. Using given guide works, complete HAZOP study on a reactor. All valves are operated by pneumatic control (0.5 × 12 = 6 m)
(each point carries 0.5 m)



Parameter : Flow

Sl No	Guide Word	Deviation	Consequences	Causes	Action
1	No	No flow	valve opened to unload the products from reactor	minimum two points	minimum two points
2	No	No flow	big lumps formed need to unload the material	minimum three points	minimum three points
3	More	More flow	During process there are chances to open the valve (automatically)	minimum one point	minimum one point

6. Explain creep failure with an example. (2 m)

7. Discuss the importance of protective coating with an example. (2 m)

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FINAL YEAR CHEMICAL ENGINEERING

Course Code: CHE C413 **TEST1** Date: 24.10.10

Course Title: Process Plant Safety Max Marks: 25

Duration : 50 minutes (Closed Book) Weightage: 25%

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1. What is function of the bleed valve? (2 m)

2. Give examples for antistatic agents for non conductive flammable liquids. (2 m)

3. Derive an equation for evaporation rate of volatile emissions during vessel filling operations. (7 m)

4. Sketch the negative and positive pressure ventilation systems. (4 m)

5. Mention the sampling strategies for airborne chemicals at any process plant workplace environment. (2 m)

6. Mention the characteristics and on which it protect against for the following PPE.
   a) gas-light goggles b) Lead apron (1 + 1 m)

7. Mention the operating functions of photoionization detectors with its advantages and disadvantages. (2 + 2 + 2 m)

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FIRST SEMESTER 2010 – 2011

FINAL YEAR

Course Code: CHE C413 | **QUIZ 2** | Date: 08.12.10
Course Title: Process Plant Safety | | Max Marks: 07
Duration : 20 minutes | (Closed Book) | Weightage: 7%

Name: ..... **ID No:** ..... **Sec / Prog:** .....

1. Dust controlling measures will help prevent (1 m)
   a) secondary explosion b) primary explosion. c) both d) none

2. Reaction hazard index is related to (1 m)
   a) maximum adiabatic temperature reached by the products of a decomposition reaction
   b) minimum adiabatic temperature reached by the products of a decomposition reaction
   c)) independent of adiabatic temperature
   d) either maximum or minimum adiabatic temperature reached by the products of a decomposition reaction

3. Titanium is ideal for (1 m)
   a) wet chlorine
   b) dry chlorine
   c) either wet or dry chlorine
   d) none

4. Thermal insulation and fire proofing provide the "cover" for corrosion to hide under and the right environment for it to start and grow in. This cover may trap moisture or spilled chemicals, that under certain circumstances, form corrosive conditions that attack the underlying steel. Because it is hidden from sight, the corrosion often progresses undetected for many years and may result in failure.

   How the above said can be detected and prevent hidden corrosion. (1.5 m)

5. A small stripper was used to separate a light solvent from heavier oil (non reactive/non corrosive). Annually, the unit was shut down for internal inspection and cleaning. The practice had been to allow 24 hours for cooling down before starting maintenance work and opening the stripper. This time, the shutdown team decided to shorten the cool down period to 12 hours to reduce the time the unit would be out of service. The unit was shut down, allowed to cool for 12 hours and then the stripper was opened for internal inspection.
   Discuss the consequences can happen if the above said is followed. (1 m)

6. Explain working principles of a flame arrester. (1.5 m)

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FINAL YEAR

Course Code: CHE C413 | **QUIZ 1** | Date: 22.11.10
Course Title: Process Plant Safety | | Max Marks: 08
Duration : 20 minutes | (Closed Book) | Weightage: 8%

Name: ..... **ID No:** ..... **Sec / Prog:** .....

(Each question carries 0.5 marks)

A. **Match the following.**

1.	Soap film flow meter	Mass flow rate
2.	Rotameter	Integrated mass
		Volumetric flow rate
		Integrated volume
3.	Unstable reactive hazard	Silane
4.	Polymerizing reactive hazard	Phosphorus
5.	Water reactive hazard	Acetylene
		Styrene
		Chlorine
		Acetic anhydride
6.	Filter for lead particulate	Ceramic membrane
		Cellulose ester membrane
		Cellulose acetate membrane
		PVC membrane
7.	Highly flammable substances	FP< 0°C
		21 < FP ≤ 55°C
		FP < 21°C
8.	Mutagenic substances	Induce cancer
		Genetic damage
		Birth defects
9.	Explosive (class of hazardous substance)	Class 3 hazardous substance
10.	Radioactive material (class of hazardous substance)	Class 8 hazardous substance
		Class 2 hazardous substance
		Class 1 hazardous substance
		Class 6 hazardous substance
		Class 7 hazardous substance
11.	Low explosives	Primary explosives
12.	Binary explosives	Detonators
		Propellants
		High Explosives

B. Each industry is required to maintain _____ ambient air quality measuring stations at a _____ ° angle between stations. (2 m)