Name:

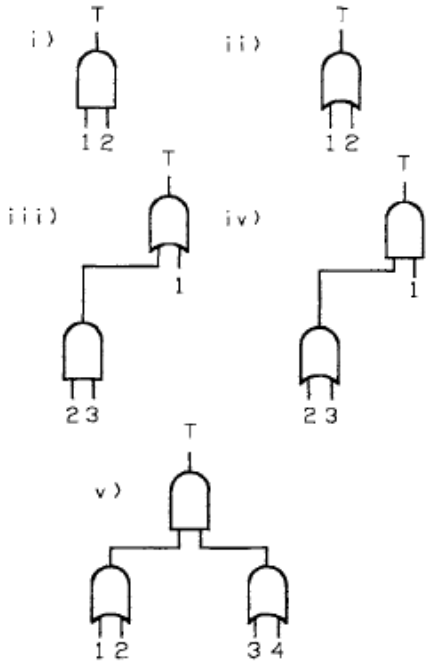
Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course: Hazop & Hazan Technique **Semester: III**
Programme: M.Tech(HSE)
Course Code :HSFS8003
Time: 03 hrs. **Max. Marks: 100**
Instructions: Please read all instructions carefully

SECTION A

S. No.		Marks	CO
Q 1	Explain the following terms in brief: i) AIT ii) SIL iii) Probit iv) ALARP	**4**	**CO1**
Q 2	Discuss about the contingency plan while carrying Hazardous chemicals. Also explain Onsite Emergency plan as per MSIHC Rules.	**4**	**CO1**
Q 3	What do you understand by RBI Matrix?	**4**	**CO1**
Q 4	Discuss some salient features of MSIHC rules? Describe the Accident Investigation process?	**4**	**CO2**
Q 5	Explain the following terms i)Jet fire ii) Pool fire iii)HAZCHEM	**4**	**CO1**
	SECTION B		
Q 6	Consider a leak of Toluene from 0.60 cm orifice-like hole in a tank at a height of 15 meters. If the pressure in the pipe is 100 psig, Evaluate the amount of benzene that would be spilled in 90 minutes? The density of toluene is 867 kg/m^3.	**10**	**CO4**
Q 7	Explain qualitative and quantitative risk assessment? Describe the layers of protection analysis with suitable example?	**6** **4**	**CO2** **CO3**
Q 8	Evaluate the Fire and explosion index in a plant storing Ethylamine and Fluorine. It is given : i) It is an exothermic reaction having input as 1.0(GPH) ii) Operation near or in flammable range take input as 0.7(SPH) Take Base factor as 1.0 and it is given the material factor for Ethylamine is 21 and for Fluorine is 40. **OR**	**10**	**CO4**

	 **Figure 11-17** Fault tree gates. Evaluate the overall failure probability and Process Reliability of the above mentioned flow diagram? **Component** / **Failure probability** 1 — 0.1 2 — 0.2 3 — 0.3 4 — 0.4	**10**	**CO4**
Q 9	Illustrate with examples different types of EIA? Discuss the procedure for getting Environment clearance for category B projects?	**4** **6**	**CO2** **CO3**
	SECTION-C		
Q 10	Consider the reactor system shown in Figure 10-8. The reaction is exothermic, so a cooling system is provided to remove the excess energy of reaction. In the event that the cooling function is lost, the temperature of the reactor would increase. This would lead to an increase in reaction rate, leading to additional energy release. The result would be a runaway reaction with pressures exceeding the bursting pressure of the reactor vessel. The temperature within the reactor is measured and is used to control the cooling water flow rate by a valve. Perform a HAZOP study on this unit to improve the safety of the process. Use as study nodes the cooling coil (process parameters: flow and temperature) and the stirrer (process parameter: agitation).	**20**	**CO4**

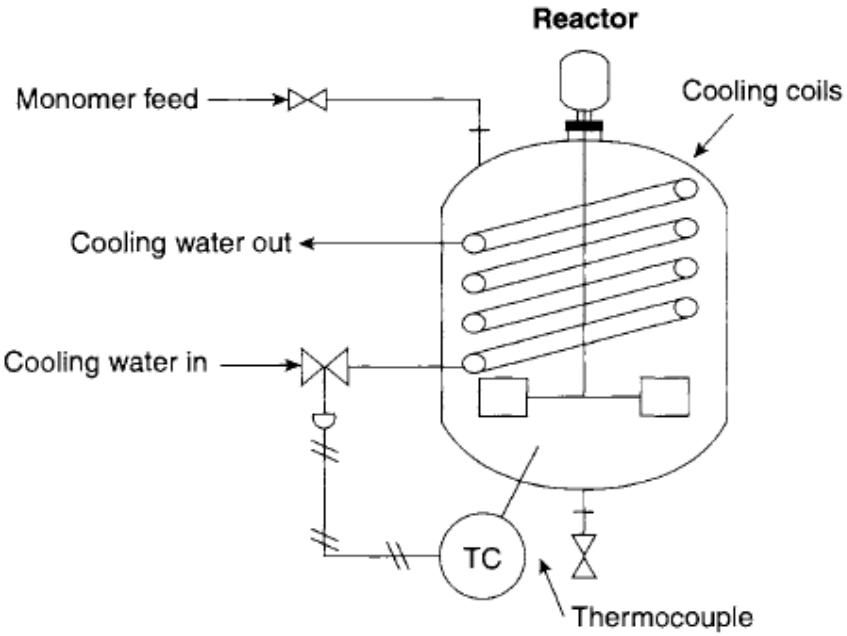


Figure 10-8 An exothermic reaction controlled by cooling water.

CO4

OR

Develop the EIP of a chemical having MSDS as stated below

MSDS of Ethyl alcohol

Material safety data sheet product name: Ethyl alcohol (96,1-96,5% vol, 192 proof, food grade) Msds no: 01 effective date: march 3, 2011 exported by: xyz company primary class: 3 ,class name: flammable liquid ,ec: 200-578-6 cas: 64-17-5 UN: 1170 no need any emergency document by air transport if ethanol is sample and total is volume under 100ml

Emergency and first aid procedure

INGESTION

• Never give anything by mouth if victim is rapidly losing consciousness or is unconscious or convulsing.
• DO NOT INDUCE VOMITING.
• Have victim drink about 250ml (8fl. oz.) of water to dilute material in stomach.
• If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration.
• Seek medical assistance.

SKIN

• Flush contaminated area with water for at least 20 minutes.
• Remove contaminated clothing under running water.
• Completely decontaminate clothing before re-use, or discard.
• If irritation occurs seek medical attention. INHALATION
• Remove victim to fresh air.
• Artificial respiration should be given if breathing has stopped and cardiopulmonary resuscitation if heart has stopped.
• Oxygen may be given if necessary.
• Seek medical attention immediately.

EYES

• Immediately flush eyes with water for at least 20 minutes, holding the eyelids open. • Seek medical attention immediately

Q 11	A diagram of the safety systems in a certain chemical reactor is shown in Figure 11-5. This reactor contains a high-pressure alarm to alert the operator in the event of dangerous reactor pressures. It consists of a pressure switch within the reactor connected to an alarm light indicator. For additional safety an automatic high-pressure reactor shutdown system is installed. This system is activated at a pressure somewhat higher than the alarm system and consists of a pressure switch connected to a solenoid valve in the reactor feed line. The automatic system stops the flow of reactant in the event of dangerous pressures. Compute the overall failure rate, the failure probability, the reliability, and the MTBF for a high-pressure condition. Assume a I-yr period of operation. Given	**20**	**CO4**

Component	Failure rate μ (faults/yr)	Reliability $R = e^{-\mu t}$	Failure probability $P = 1 - R$
1. Pressure switch 1	0.14	0.87	0.13
2. Alarm indicator	0.044	0.96	0.04
3. Pressure switch 2	0.14	0.87	0.13
4. Solenoid valve	0.42	0.66	0.34