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| Name: |  |
| Enrolment No: | |

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

| | |
|---|------------------------|
| 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 | |

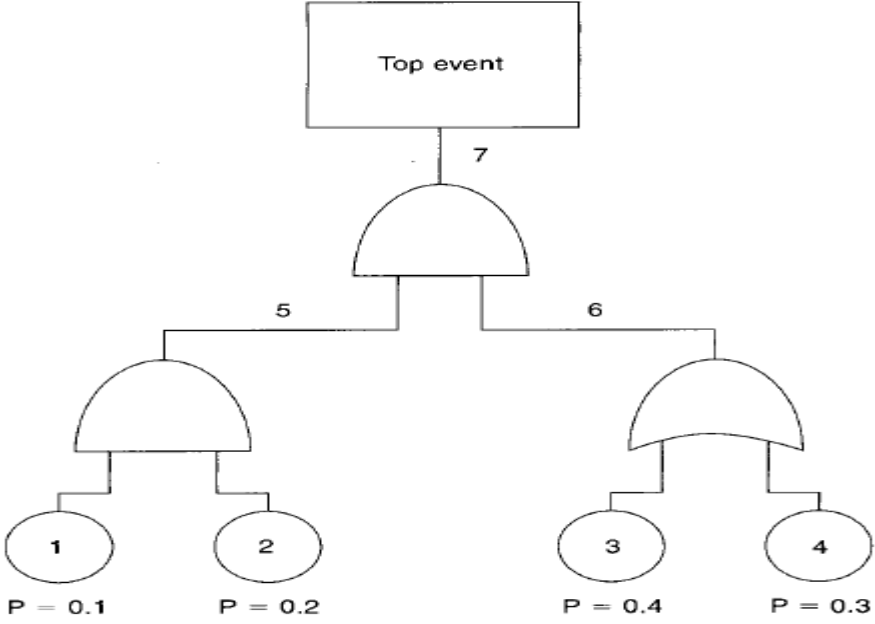
SECTION A

| S. No. | Question | Marks | CO |
|--------|--|-------|-------------|
| Q 1 | Explain salient features of MSIHC rules? Also discuss about Accident Investigation process? | 4 | CO1 |
| Q 2 | What are the classification of Petroleum as per Petroleum Act? Also discuss about EPA Compatibility chart for Hazardous chemicals? | 4 | CO1 |
| Q 3 | What do you understand by RBI Matrix? | 4 | CO4 |
| Q 4 | Explain the following terms i) Jet fire ii) Pool fire iii)HAZCHEM | 4 | CO3 |
| Q 5 | Explain the following terms in brief: i) AIT ii) SIL iii) Probit iv) ALARP | 4 | CO1,C O3 |

SECTION B

| | | | |
|-----|---|----|-------------|
| Q 6 | Consider a leak of benzene from 0.63 cm orifice-like hole in a tank at a height of 15 meters. If the pressure in the pipe is 100 psig, how much benzene would be spilled in 90 minutes? The density of benzene is 879 kg/m ³ . | 10 | CO4,C O1 |
| Q 7 | Calculate the Fire and explosion index in a plant storing Acetic acid and Acetyl peroxide. 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 0.8(SPH) Take Base factor as 1.0 and it is given the material factor for Acetic acid is 14 and for Acetyl Peroxide is 40. | 10 | CO3,C O2 |
| Q 8 | Explain qualitative and quantitative risk assessment. Describe the layers of protection analysis with suitable example. | 10 | CO4,C O5 |

OR

| | | | |
|------------------|---|----|---------------------|
| |  <p>Find out the overall failure probability and Process Reliability for the above mentioned flow diagram.</p> | | |
| Q 9 | What is EIA? Explain the types of EIA. Discuss the procedure for getting Environment clearance for category A projects. | 10 | CO3,C O4,CO 5 |
| SECTION-C | | | |
| Q 10 | <p>A heat exchanger is used to heat flammable, volatile solvents, as shown in the following Figure . The temperature of the outlet stream is measured by a thermocouple, and a controller valve manipulates the amount of steam to the heat exchanger to achieve the desired set point temperature. Take guide words as Flow and temperature only.</p> <p>a. Identify the study nodes of the process. b. Perform a HAZOP study on the intention "hot solvent from heat exchanger." Recommend possible modifications to improve the safety of the process.</p> | 20 | CO5,C O2,CO 3 |

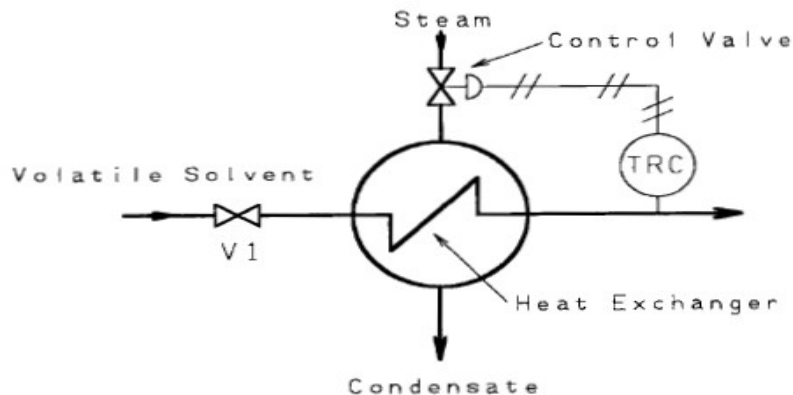


Figure 10-15 Volatile solvent heating system.

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 v ictim 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

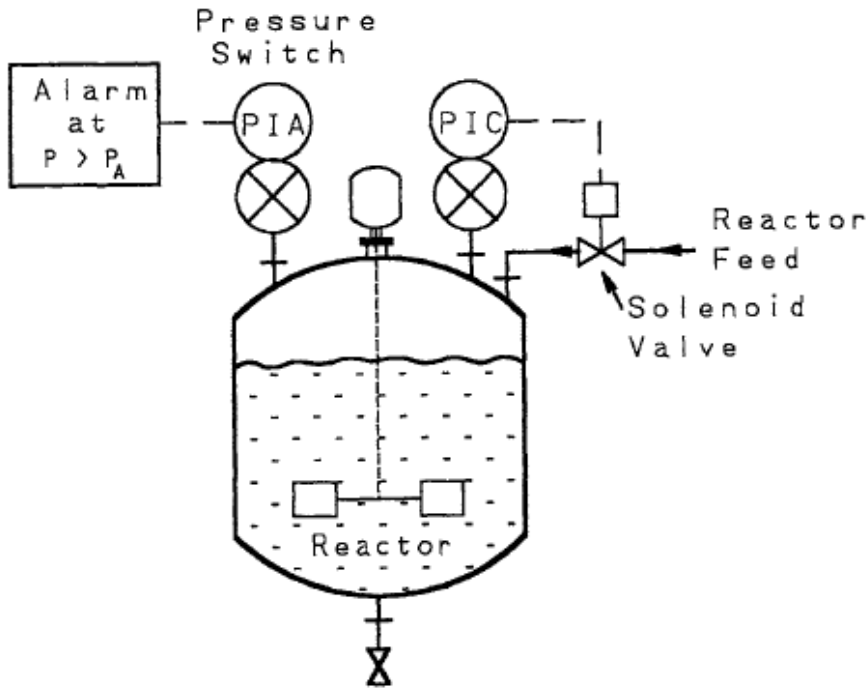
- Immediately flush eyes with water for at least 20 minutes, holding the eyelids open. • Seek medical attention immediately

Q 11

A diagram of the safety systems in a certain chemical reactor is shown in the following figure. 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 1-yr period of operation.

Given

| 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 |



20

CO4,C
05,CO
2

CONFIDENTIAL

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|--|---|------------------------------------|---|-------------|---|---------------|---|
| Name of Examination (Please tick, symbol is given) | : | MID | | END | ☐ | SUPPLE | ☐ |
| Name of the School (Please tick, symbol is given) | : | SOE | ☐ | SOCS | | SOP | |
| Programme | : | M.Tech(HSE) | | | | | |
| Semester | : | III | | | | | |
| Name of the Course | : | HAZOP & HAZAN Technique | | | | | |
| Course Code | : | HSFS 8003 | | | | | |
| Name of Question Paper Setter | : | Akshi Kunwar Singh | | | | | |
| Employee Code | : | 40001589 | | | | | |
| Mobile & Extension | : | 7259672220 | | | | | |
| Note: Please mention additional Stationery to be provided, during examination such as Table/Graph Sheet etc. else mention “NOT APPLICABLE”: | | | | | | | |
| FOR SRE DEPARTMENT | | | | | | | |
| Date of Examination | : | | | | | | |
| Time of Examination | : | | | | | | |
| No. of Copies (for Print) | : | | | | | | |

Note: - Pl. start your question paper from next page

Model Question Paper (Blank) is on next page

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SECTION B

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| 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, how much benzene would be spilled in 90 minutes? The density of toluene is 867 kg/m ³ . | 10 | CO4,C O1 |
| Q 7 | Explain qualitative and quantitative risk assessment. Describe the layers of protection analysis with suitable example. | 10 | CO4,C O5 |
| Q 8 | Calculate 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. | 10 | CO3,C O2 |

OR

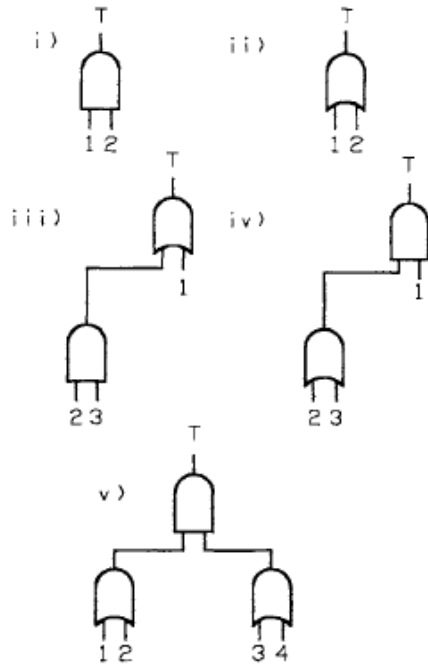


Figure 11-17 Fault tree gates.

Find out 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 |

Q 9 What do you understand by EIA? Explain the types of EIA. Discuss the procedure for getting Environment clearance for category B projects?

10

CO3

SECTION-C

Q 10 A heat exchanger is used to heat flammable, volatile solvents, as shown in the following figure.
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CO5,C
O2,CO
3

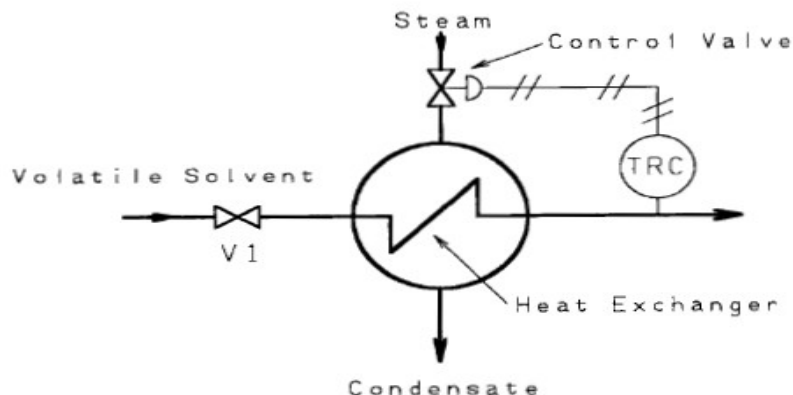


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EYES

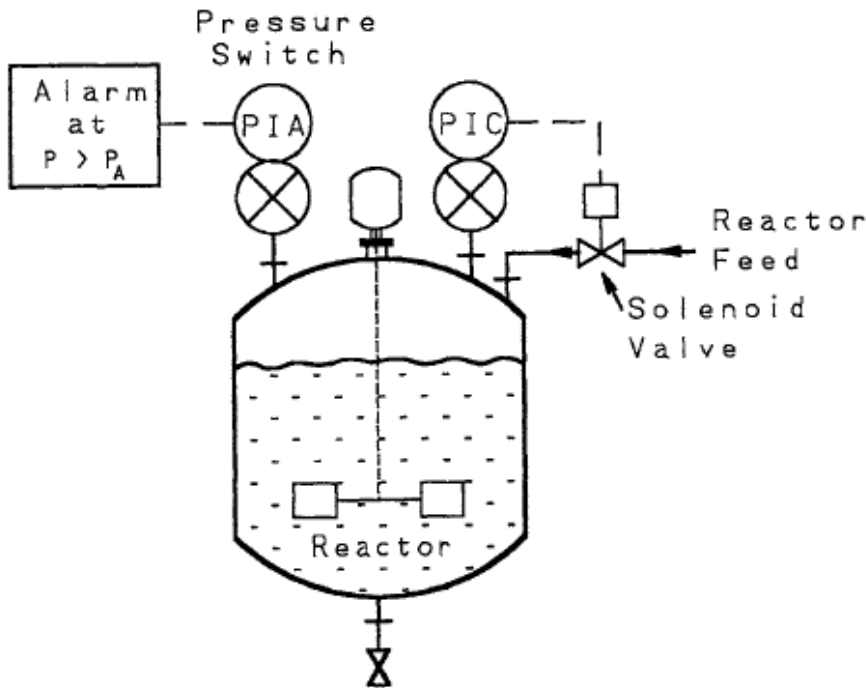
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CO4,C
05,CO
2

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