B.E. Chemical Engineering Second Semester – 2022

Chemical Process Safety and Risk Management (Hons.)

Total marks 70

Attempt any three questions among 1,2, 3 and 4, and any one among 5 and 6

1. (a) List the hazards that could lead to failure of equipment
   (b) List the causes of accidents in case of (i) reactors (ii) heat exchangers (iii) pressure vessels and tanks (iv) piping, valves and pumps   (4+16)

2. (a) Explain the different classification of fires. How fire under each classification can be extinguished?
   (b) What are the common causes of plant fire?
   (c) Write short notes on the classification of flame behaviour?   (8+4+8)

3. (a) Sketch and explain the typical stages in dispersion of gases
   (b) How does atmospheric factor affect dispersion pattern of gases or vapor once they are released
   (c) State the method to estimate release rate of gases and liquids
   (d) State the equations used to estimate the concentration of gases in the atmosphere?(4+4+8+4)

4. (a) What is Hazop?
   (b) List the causes for temperature deviation, pressure deviation, level deviation, blockage of equipment
   © Explain the following guide words with examples; not, more, as well as, part of, reverse, other than.   (2+12+6)

5. (i) The failure rate, test interval and demand rate of car braking system is 10^{-4} yr^{-1}, 1 yr and 5×10^4 yr. Calculate the hazard rate   (4)
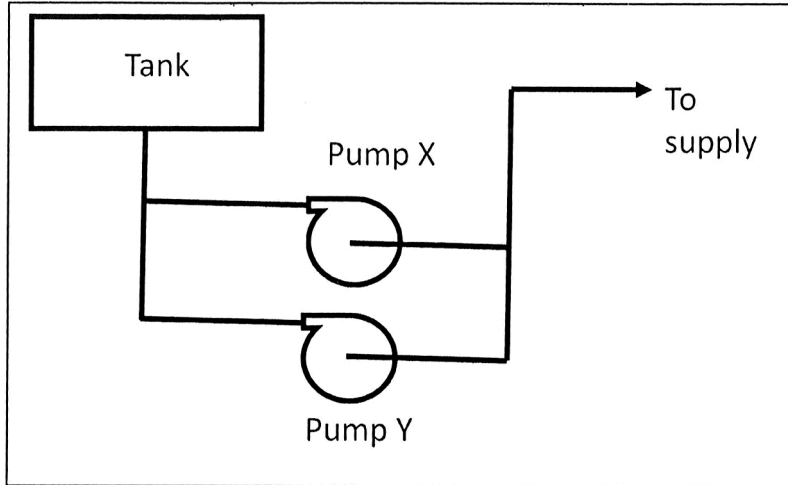
   (ii) A flammable vapor flows through a 20 cm diameter insulated pipeline at a flow rate of 1m^3/min. A lagging fire started and heated 1 m length of pipe line to 150 oF which is above the ignition temperature of the vapor. The ignition delay time of the vapor is expressed as

   $$ln(t) = \frac{250}{T} + 0.5$$

   Where t is ignition time delay (s) and T is absolute temperature ($^{\circ}$R). Will ignition take place?   (6)

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6. Consider the system to supply water. The pumps can fail due to mechanical failure or electrical failure. The mechanical failure rate of pump X and Y are 0.25 yr^{-1} and 0.1 respectively whereas the electric supply failure rates to the pumps is 0.1. Construct a fault tree and then estimate the failure rate to supply water. (10)