

[Time: 3 Hours]

[ Marks:80]

Please check whether you have got the right question paper.

- N.B:
1. Question No.1 is compulsory.
  2. Attempt any **Three** out of remaining questions.
  3. Assume any suitable data if necessary and indicate it clearly.
  4. Draw neat sketches wherever required.
  5. Answer to the sub-questions of an individual question should be grouped and written together i.e. one below the other.
  6. Steam Tables can be referred.

- Q.1**
- a Draw fire triangle and describe it. 5
  - b A process has a report FAR of 2.If an employee works a standard of 8-hr shift 300 days per year, compute the death per person per year. 5
  - c Write note on Detonation and Deflagration. 5
  - d Give classification of Boilers. 5
- Q.2**
- a Xylene is used as a solvent in paint. A certain painting operation evaporates an estimated 3 gal of xylene in an 8-hr shift. The ventilation quality is rated as average. Determine the quantity of dilution ventilation air required to maintain the xylene concentration below 100 ppm, the TLV-TWA. Also, compute the air required if the operation is carried out in an enclosed hood with an opening of 50 ft<sup>2</sup> and a face velocity of 100 ft./min. The temperature is 77°F and the pressure is 1 atm. The specific gravity of the xylene is 0.864, and its molecular weight is 106.  $k = 0.125$ . 10
  - b Write on disaster of Pasadena Texas from the perspective of Technical Failures and Consequences with the help of proper diagram. 10
- Q.3**
- a Explain MSDS covering contents of it. 8
  - b What are the LFL and UFL of a gas mixture composed of 0.8 % hexane (LFL = 1.2 % and UFL = 7.5 %), 2.0 % methane (LFL = 5.0 % and UFL = 15 %) and 0.5 % ethylene (LFL = 2.7 % and UFL = 36 %) by volume. 6
  - c Air contains 5 ppm of diethyl amine (TLV-TWA of 5 ppm), 20 ppm of cyclohexanol (TLV-TWA of 50 ppm) and 10 ppm of propylene oxide (TLV-TWA of 2 ppm). What is the TLV-TWA of mixture and has this level been exceeded? 6
- Q.4**
- a Describe how HAZOP is carried out. Write its checklist. 10
  - b Describe Even tree and Fault tree analysis with one example each. 10
- Q.5**
- a Exhaust steam at a pressure of 0.5 bar and 0.8 dry enters a surface condenser, the water resulting from the condensation leaves the condenser at a temperature of 56 °C. Assuming that all the heat lost by steam is taken up by the cooling water, find the heat removed from the steam per kg and also the mass of cooling water required per kg of steam, if the temperature rise of cooling water is 28 °C. Take specific heat of water as 4.187 kJ/kg K. 6
  - b Explain various applications of air in chemical plant. 6

c Explain with proper diagram: - Distribution of steam in plant.

8

- Q.6**
- a Derive the formula for minimum work per kg of air delivered by multistage compressor 10 with perfect intercooling
  - b A single stage double acting air compressor of 62.5 kW I. P. at 120 r.p.m. takes air at 1 bar 10 and delivers at 10 bar. Assuming the law of and compression as  $p v^{1.35} = \text{constant}$ , find the diameter and stroke of the cylinder. Take piston speed = 200 m/min, Volumetric efficiency = 90 %. Also find the clearance volume as percentage of stroke volume.

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