

**VIT**Vellore Institute of Technology  
(Deemed to be University under section 3 of UGC Act, 1956)

REG.NO.:

**SCHOOL OF CHEMICAL ENGINEERING  
CONTINUOUS ASSESSMENT TEST -II  
FALL SEMESTER 2025-2026**

SLOT: F2+TF2

Course Code : BCHE318L  
 Course Name : Safety and Hazard Analysis  
 Faculty Name(s) : Dr. A. Babu Ponnusami  
 Class Number(s) : VL2025260103959  
 Date of Examination : 10-10-25  
 Exam Duration : 90 minutes Maximum Marks: 50

**General instruction(s): NIL**

M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

**Course Outcomes:**

CO3: Analyse the root cause of the work-related accidents using safety analysis.

CO4: Apply Hazard and Operability Study (HAZOP) for Hard and Soft Industries.

Answer all the Questions (5 x 10 = 50 Marks)

| S.No | Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M  | Course Outcome | B L |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----------------|-----|
| 1    | (i) How are chemicals classified according to their hazardous nature? Explain safe handling procedure of dangerous and toxic chemicals. (5)<br>(ii) Handling of high pressure and high temperature operations is difficult. Describe in detail about safe handling procedure of high temperature and high-pressure operation. (5)                                                                                                                                                                                                                                                                                                                                             | 10 | CO3            | 2   |
| 2    | An ABC company wanted to set a new oil exploration facility in a location nearby ocean. You are appointed as a plant layout designer for the new project. Construct a plant layout strategy and important factors to be considered while designing a plant layout including safety aspects in refinery.                                                                                                                                                                                                                                                                                                                                                                       | 10 | CO3            | 3   |
| 3    | A backyard barbeque grill contains a 20-lb tank of propane. The propane leaves the tank through a valve and regulator and is fed through a 1/2-in rubber hose to a dual valve assembly. After the valves the propane flows through a dual set of ejectors where it is mixed with air. The propane-air mixture then arrives at the burner assembly, where it is burned. Describe the possible propane release incidents for this equipment.                                                                                                                                                                                                                                    | 10 | CO3            | 4   |
| 4    | (a) A trash incinerator has an effective stack height of 100 m. On a sunny day with a 2 m/s wind the concentration of sulfur dioxide 200 m directly downwind is measured at $5.0 \times 10^{-5}$ g/m <sup>3</sup> . Estimate the mass release rate (in g/s) of sulfur dioxide from this stack. Also estimate the maximum sulfur dioxide concentration expected on the ground and its location downwind from the stack. Assume atmospheric stability condition of A class and consider both urban and rural areas. (5)<br>(b) A burning at ground level dump emits an estimated 3 g/s of oxides of nitrogen. What is the average concentration of oxides of nitrogen from this | 10 | CO3            | 3   |

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|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---|
|   | source directly downwind at a distance of 3 km on an overcast night with a wind speed of 7 m/s? Assume atmospheric stability condition of D class and consider both urban and rural areas. (5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    |     |   |
| 5 | Consider the batch reactor system used for an exothermic reaction. 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). | 10 | CO4 | 4 |

----- All the Best -----