

**COLLEGE OF ENGINEERING AND TECHNOLOGY**

**SCHOOL OF BIOENGINEERING, DEPARTMENT OF CHEMICAL ENGINEERING**

**B. Tech. Open elective**

**ACADEMIC YEAR 2023-24 – ODD SEMESTER**

**Continuous Learning Assessment II B**

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| Reg. No. | R | A |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| Course Code: **18CHO104T** | Course Title: **PROCESS PLANT SAFETY** | | |
| Sem & Year: V & III year | Date: 13/10/2023 | Duration: 100 Minutes | Max. Marks: 50 |

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|  | **Course Outcomes (COs)** | **Program Outcomes (POs)** | | | | | | | | | | | | | **PSOs** | | | |
|  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | | 2 | 3 |
| **CO2** | *Understand the various aspects of Chemical plant safety* | 1 | 2 | 3 | - | 1 | - | - | - | - | - | - | - | - | | - | - |
| **CO3** | *Understand the various aspects of Industrial accidents and Fire safety* | - | 1 | - | - | - | - | - | - | - | - | - | 3 | - | | 2 | - |

**Part A Answer the Following 10x1 Marks = 10 Marks**

|  |  |  |  |  |  |  |
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| **Q. No.** | **Questions** | **Marks** | **CO** | **BL** | **PO** | **Marks Scored** |
| **1.** | How hazard can be described for the chemicals that at low levels cause damage to health   1. Highly flammable 2. **toxic** 3. oxidising 4. explosive | 1 | 2 | L2 | 1,3 |  |
| **2.** | The HAZCHEM code for Naptha is 3YE, in this number ‘3’ relates to what?   1. **Fire extinguisher type** 2. Property of the chemical 3. Evacuation of the personnel 4. Personal Protective equipment | 1 | 2 | L2 | 1,3 |  |
| **3.** | The measure of how toxic a chemical in a single dose is -------------   * 1. **Acute toxicity**   2. Sub-acute toxicity   3. Sub- chronic toxicity   4. Chronic toxicity | 1 | 2 | L1 | 1,3 |  |
| **4.** | A radioactive material falls under which hazardous class?   * 1. Class 9   2. Class 8   3. **Class 7**   4. Class 6 | 1 | 2 | L1 | 1,3 |  |
| **5.** | This machine guarding uses a series of cables attached to the operator’s wrist   * 1. Fixed guard   2. **Pullback device**   3. Two hand control   4. Gate | 1 | 2 | L1 | 1,3 |  |
| **6.** | To help prevent accidents, people who use tools must   1. Be very careful 2. Not wear glasses 3. **Be trained and authorized to use them** 4. Not be sleepy | 1 | 3 | L1 | 1,3 |  |
| **7.** | Fires that are fuelled by --------- require you to use water fire extinguishers inorder to fight them.   1. Live electricity 2. Gasoline, kerosene and other flammable liquids 3. **Solid materials; such as wood, paper and textile** 4. Propane, butane and other flammable gases | 1 | 3 | L2 | 1,3 |  |
| **8.** | If the fire produced from electrical contact, what type of fire extinguisher you will use?   1. Water type 2. **CO2 type** 3. Foam type 4. Wet chemical | 1 | 3 | L2 | 1,3 |  |
| 9. | During fire extinguishing, if we exclude the oxygen content, then the method is called -------   1. **Smothering** 2. Starvation 3. Cooling 4. Inhibiting | 1 | 3 | L2 | 1,3 |  |
| **10.** | Which does not belong to safety performance parameters?   1. Severity rate 2. Frequency rate 3. **Accident rate** 4. Incidence rate | 1 | 3 | L1 | 1,3 |  |

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| **Q.No.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **Ans.** |  |  |  |  |  |  |  |  |  |  |

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| Reg. No. | R | A |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Part B Answer the following 4 x 4 Marks = 16 Marks**

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| **Q. No.** | **Questions** |
| **11.** | Explain the four routes of exposure of chemicals into the human body. |
| **12.** | Define Chemical hazard and discuss its various health hazards.  The undesired effects which are caused with the absorption of hazardous chemicals by the human body- are called chemical hazards.   * Acute toxicity * Skin   corrosion/irritation   * Serious eye damage/eye irritation * Respiratory or skin sensitization * Germ cell mutagenicity |
| **13.** | Explain the multiple causation theory.  **Multiple causation theory**  Multiple causation theory is an outgrowth of the domino theory, but it postulates that for a single accident there may be many contributory factors, causes and sub-causes, and that certain combinations of these give rise to accidents  download (15).png  According to this theory, the contributory factors can be grouped into the following two categories:   1. *Behavioural.*   *2. Environmental*. |
| **14.** | Discuss the classification of fires with examples and how you will use fire triangle.    The **fire triangle** is **used to** show the three elements that when present together can cause a **fire to** start. These three ingredients are fuel, heat and oxygen, under all circumstances they **should** be kept apart **to** avoid a **fire** starting. |

**Part C Answer the following 2 x 12 Marks = 24 Marks**

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| **Q. No.** |  |
| **15.** | Explain the criteria, factors and environmental guidelines followed for the Industrial siting**.**  Industry – siting criteria   * Preventive steps are needed for time of siting rather than going in for curative measures at later stage * Before setting up the industry should obtain clearance from “Ministry of Environmental and Forests”, to achieve ecological safety * Industries are required to be sited, needs a balance between economic and environmental considerations   **Following factors**   * ***No forest land shall be converted*** into non-forest activity for the sustenance of the industry (Forest conservation act – 1980) * ***No prime agricultural land shall be converted*** into an industrial site * ***Land acquired shall be sufficiently large enough*** to provide space for appropriate treatment of wastewater after maximum possible reuse and recycling * ***Enough space should be provided for storage of solid wastes*** so that it will be possible for reuse * ***Layout and form of industry that may come up in the area must conform to the landscape of the area*** without affecting the scenic features of that place * ***Physiographic barrier*** between the industry and township   Environmental guidelines   * To ensure optimum use of natural and man-made resources in a sustainable manner:  1. **Minimal depletion** 2. **Degradation, and/or** 3. **Destruction of the environment**   The following distances from industrial sites should be taken into account   1. Ecological /sensitive areas   - atleast 25 km away depending on geo-climatic conditions  2. Coastal Area  - At least ½ km from high tide line  3. Floodplain of the Riverine systems  - At least ½ km from floodplains or modified floodplains, affected by dams in the upstream or by flood control systems  4. Transport/communication system  - At least ½ km from the highway lines and railway station |
| **16.** | Explain the classification of dangerous chemicals in detail. Discuss the safe handling and storage methods of flammables and combustibles. |
| **17.** | Explain the process steps involved in Job safety analysis (JSA) and discuss with a neat JSA sheet for a job description.   * **JSA:**    + **Breaking down a job into steps**   + **Identifying safety hazards at each step**   + **Developing safe job procedures for each step** * **STEP 1:**   + **Select the job**     - **JSA’s need to be completed when the following occurs: Fatalities, accident trends, new procedure or new job, or new equipment that has a hazard associated with it.**     - **You can also perform JSAs based on Freq of Accidents, Severity of Accidents, Potential Severity.** * **STEP 2:**   + - **Perform the Analysis Who is the most qualified person to conduct the JSA– Supervisors of the department where the jobs are performed.**     - **Employees that actually perform the work are also qualified to conduct the JSA. Getting employees involved in the process helps to “sell the process”.**     - **Observe performance of task, record each step, review the steps with employee who performed task.**     - **Avoid common errors** * **STEP 3:**   + - **IDENTIFY HAZARDS Is there danger of striking against, being struck by, or otherwise making injurious contact with an object?**     - **Can the employee be caught in ,caught by or between the objects?**     - **Is there a potential for a slip or trip?**     - **Can an employee strain himself/herself by pushing, pulling, lifting, bending, or twisting?**     - **Is the environment hazardous to one’s health (toxic gas, vapor, mist, fumes, dust, heat or radiation)?** * **STEP 4:**   + - **DEVELOP SOLUTIONS - Find a** **new way to do the job** (**determine the goal of the operation and select the safest method**)     - **Change the physical conditions that created the hazard ( such as tools, equipment, work area layout)** * **STEP 5:**   **Conduct a Follow-up Analysis: Supervisors should observe employees as they perform at least one job per month for which a JSA have been completed**   * **STEP 6:** * **Use of the Job Safety Analysis: Document use of. The JSA provides a learning opportunity for supervisor and employees.** * **New employees should be trained using the JSA and ALL employees should be trained at least annually.**   + - **Recordkeeping:JSA should be maintained in the department where they were created.**     - **JSA should be readily accessible to employees.**   JSA sheet (for one example) |
| **18.** | An Electronics manufacturing industry, employs 900 people for its production. The data provided below is two years accident data.   |  |  |  |  | | --- | --- | --- | --- | | **Year** | **Occupational injury** | **Average hours worked** | **Days lost due to injury** | | 2019 | 20 | 2800 | 650 | | 2020 | 22 | 2950 | 800 |   Calculate Frequency rate, Incidence rate, Severity rate, Frequency severity Incidence, Frequency severity rate, Safe-T-Score |

**Attainment Level (H:76 to 100%; M :50 to 75%; L: ≤ 50%)**

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|  | **Quality** | **Marks Scored** | **% of Marks** | **Attainment** |
| **CO2** | **L1 = 18 Marks** |  |  | **H/M/L** |
| **L2 = 19 Marks** |
| **CO3** | **L1 = 6 Marks** |
| **L2 = 19 Marks** |
| **L3 = 12 Marks** |  |
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