

**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 III Set 3**

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

|  |  |  |  |
| --- | --- | --- | --- |
| Course Code: **18CHO104T** | Course Title: **PROCESS PLANT SAFETY** | | |
| Sem & Year: V & III year | Date: **05/05/2023** | Duration: 100 Minutes | Max. Marks: 50 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Course Outcomes (COs)** | **Program Outcomes (POs)** | | | | | | | | | | | | | **PSOs** | | | |
|  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | | 2 | 3 |
| **CO4** | *Understand the various concepts of Hazard identification techniques* | 2 | 3 | *-* | 2 | *-* | *-* | *-* | *-* | *-* | *-* | *-* | *-* | 3 | | 1 | - |
| **CO5** | *Understand the various aspects of Occupational Health hazards, Safety legislation* | 1 | - | 2 | *-* | *-* | *-* | *-* | *-* | *-* | *-* | *-* | *1* | 3 | | - | 2 |

**Part A Answer the Following 10×1 Marks = 10 Marks**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | **Marks** | **CO** | **BL** | **PO/PSO** | **Marks Scored** |
| **1.** | What type of protection is needed when you are exposed to hazards from flying particles?   1. Eye protection c) Head protection 2. Face protection **d) Both a and b** | 1 | 5 | L2 | 3,2 |  |
| 2. | Personal Protective Equipment is required when   1. Employers suffer an injury   b) The employees suffer an injury  c) An employee asks for it  d) **Engineering, work practice, and administrative controls do not provide sufficient protection against hazards** | 1 | 5 | L1 | 3,2 |  |
| **3.** | What type of gloves protects your hands from working with chemicals?   1. **Butyl rubber gloves** 2. Fabric gloves 3. Leather gloves 4. Both a and c | 1 | 5 | L2 | 3,2 |  |
| **4.** | --------------- hard hat protects you from only falling objects   1. Class A 2. Class B 3. **Class C** 4. Bump caps | 1 | 5 | L1 | 3,2 |  |
| **5.** | To emerge from Bhopal gas tragedy --------------- is enacted?  a) Factories act **b) environmental protection act**  c) Indian boiler’s act d) Mine’s act | 1 | 5 | L1 | 3,2 |  |
| **6.** | Which is the way of determining risks and dangers in workplace?   1. Hazard analysis **b) risk assessment** c) fault tree analysis d) human error analysis | 1 | 4 | L2 | 1,3 |  |
| **7.** | -------- method is used to evaluate the potential risks from a process and also to assess the potential loss is assessed   1. Fault tree analysis 2. HAZOP study   **c) Dow fire and explosion index**  d) Risk assessment | 1 | 4 | L1 | 1,3 |  |
| **8.** | The guide word ‘NO or NOT’ in hazop study means   1. Quantitative increase 2. Quantitative decrease 3. **Complete negation of the intentions** 4. Complete substitution | 1 | 4 | L2 | 1,3 |  |
| **9.** | If the fire and explosion index within 97-127 range, then the degree of hazard is   1. Light b) Moderate **c) Intermediate** d) Heavy | 1 | 4 | L1 | 1,3 |  |
| **10.** | Calculate the risk from the risk table:   |  |  |  |  | | --- | --- | --- | --- | | Hazard | Likelihood | Severity | Risk | | A | 5 | 6 | ? |  1. 20 b)15 c) 11 **d) 30** | 1 | 4 | L2 | 1,3 |  |

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



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

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | **Marks** | **CO** | **BL** | **PO** | **Marks Scored** |
| **11.** | What is risk? Discuss the risk analysis method. | 4 | 4 | L2 | 3,2 |  |
| **12.** | What is FMEA? Discuss its principle and importance.   * **Failure Mode and Effect Analysis (FMEA)** is a step by step approach for identifying all possible failures in a design, a manufacturing or a product or service. * Methodology that facilitates Process Improvement. * Improve internal and external customer satisfaction. * Focuses on prevention. | 4 | 4 | L2 | 3,2 |  |
| **13.** | Explain on any two acts enacted for safety and health.  Factories act  Worker’s compensation act | 4 | 5 | L1 | 3,1 |  |
| **14.** | Discuss the importance of good housekeeping in industries.  A clean, well-ordered, attractive work environment  sets the tone of your establishment. It encourages  tidy work habits in employees. It helps reduce  fatigue. It promotes good worker-management  relations. It also gives a lift to morale, which is  reflected in the quality of production and overall  efficiency.  Good housekeeping is also a good advertisement for  your company. | 4 | 5 | L2 | 3,1 |  |

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

|  |  |
| --- | --- |
| **Q. No.** | **Questions** |
| **15a.** | Explain the procedure of HAZOP study for any suitable process plant example with a neat diagram.  Procedure:      **HAZOP) process example:**  **P_20181007_201652.jpg**  Consider stream supply line and associated control instrumentation   * Stream shall be supplied at a pressure and flow rate to match the required chlorine demand   **Guide Word NO:**   * Possible Deviation – No steam flow * Possible causes – Blockage, valve failure, Failure of steam supply * Consequences – loss of chlorine flow to chlorination reactor   **Guide Word MORE:**   * Possible Deviation – More steam flow * Possible causes – valve stuck open * Consequences – low level in vaporizer, higher rate of flow to reactor   Hazard – Depends on possible effect of high flow on the reactor   * Possible Deviation – more steam pressure * Possible causes – failure of pressure regulating valves * Consequences – increased vaporization rate   Hazard – line rupture, effect of sudden increase in chlorine flow on reactor |
|  | **OR** |
| **15b.** | Describe the Dow fire explosion index calculation procedure with a neat block diagram.     * The first step is to identify the units that would have the greatest impact on the magnitude of any fire or explosion. The index is calculated for each of these units. * The basis of the F & El is a *Material Factor* (MF). The MF is then multiplied by a *Unit Hazard Factor,* F3, to determine the F & El for the process unit. * The Unit Hazard factor is the product of two factors which take account of the hazards inherent in the operation of the particular process unit: the general and special process hazards   ***General process hazards* The general process hazards are factors that play a primary role in determining the magnitude of the loss following an incident.**   * A. *Exothermic chemical reactions:* the penalty varies from 0.3 for a mild exotherm, such as hydrogenation, to 1.25 for a particularly sensitive exotherm, such as nitration. * B. *Endothermic processes',* a penalty of 0.2 is applied to reactors, only. It is increased to 0.4 if the reactor is heated by the combustion of a fuel. * C. *Materials handling and transfer:* this penalty takes account of the hazard involved in the handling, transfer and warehousing of the material. * D. *Enclosed or indoor process units:* accounts for the additional hazard where ventilation is restricted. * E. *Access of emergency equipment:* areas not having adequate access are penalised. Minimum requirement is access from two sides. * F. *Drainage and spill control:* penalises design conditions that would cause large spills of flammable material adjacent to process equipment; such as inadequate design of drainage.   **Special *process hazards***   * **Twelve factors are listed on the calculation form** * A. *Toxic materials* * B. *Sub-atmospheric pressure* * C. *Operation in or near flammable range* * D. *Dust explosion* * E. *Relief pressure* * F. *Low temperature* * G. *Quantity of flammable material* * H. *Corrosion and erosion* * I. *Leakage—joints and packing* * J. *Use of fired heaters:* * K. *Hot oil heat exchange system:* * L. *Rotating equipment:*   **The procedure for estimating the potential loss**   * The first step is to calculate the *Damage factor* for the unit. The Damage factor depends and the value of the Material factor and the Process unit hazards factor * An estimate of the replacement value of the equipment within the exposed area is then made, and combined with by the damage factor to estimate the *Base maximum probable property damage* (Base MPPD). * The *Maximum probable property damage* (MPPD) is then calculated by multiplying the Base MPPD by a *Credit control factor.*   The MPPD is used to predict the maximum number of days which the plant will be down for repair, the *Maximum probable days outage* (MPDO). The MPDO is used to estimate the financial loss due to the lost production: the *Business interruption (Bl).* The financial loss due to lost business opportunity can often exceed the loss from property damage |
| **16a.** | Discuss the following for head protection:   1. Potential hazards 2. Control of hazards 3. Care and maintenance 4. List of PPEs   **Head Protection**  **Types of Head hazards**   * Impact * Electric shock * Drips * **Potential Incidences of Head Hazards** * **Impact** * Falling or flying objects * **falling or walking into hard objects** * injuries include neck sprains, concussions, and skull fractures * **Electric Shock** * Live exposed electric wires * Injuries include electrical shocks and burns * **Drips** * Toxic liquids such as acids, caustics, and molten metals can irritate and burn the head/scalp.   Elimination or Control of Hazards   * Safe Work Practices * Grounded equipment/shock resistant tools * Signs posted warning of hazards   **Proper use and care of hard hat**   * Always wear your hard hat while you are working in areas where there are potential head hazards * Adjust the suspension inside your hard hat so that the hat sits comfortably, but securely on your head   **PPE**   * Class A Hard Hats   + Protect you from falling objects   + Protect you from electrical shocks up to 2,200 volts * Class B Hard Hats   + Protect you from falling objects   + Protect you from electrical shocks up to 20,000 volts * Class C Hard Hats   + Protect you from falling objects * Bump Caps   + Bump caps are made from lightweight plastic and are designed to protect you from bumping your head on protruding objects |
|  | **OR** |
| **16b.** | Explain briefly on Occupational work hazards and their types with examples.  Depending upon the occupation an industrial worker may be exposed to five types of hazards:-   1. Physical Hazards – explain it 2. Chemical Hazards explain it 3. Biological Hazards explain it 4. Mechanical Hazards explain it 5. Psychosocial Hazards explain it   **Physical Hazards**   1. **HEAT AND COLD**   Direct effects:-   * Burns * Heat exhaustion   Indirect effects are:-   * Decreased efficiency * Increased fatigue * Enhanced accidents rates * **COLD**   Effects associated with cold works are:-   * Chilblains * Erythrocyanosis * Frostbite  1. LIGHT   **POOR ILLUMINATION**  Acute effects:-   * Eye strain * Headache * Eye pain   Lacrimation  Chronic effects:-   * Miner’s nystagmus * **EXCESSIVE BRIGHTNESS**   Effects due to glare :-   * Discomfort, annoyance and visual fatigue * Blurring of vision   **C) NOISE**  **Auditory effects**   1. **VIBRATION**  * It is encounter in work with drills and hammers * Continuous work with such machines affects hands and arms. * The blood vessels of fingers may become increasingly sensitive to spasm.   **Chemical hazards**  Local action Inhalation   * Dusts * Gases * Metal and their compounds     **Biological Hazards**   * Workers exposed to infective and parasitic agents at the place of work. * Mainly prevalent in developing countries resulting in higher risk for the workers.   **Mechanical Hazards**  May cause due to protruding moving parts of machinery.  **Psychosocial Hazards**   * **Rise when worker fails to adopt to an alien psychosocial environment which leads to psychological factors such as:-**   + **Frustration**   + **Lack of job satisfaction**   + **Poor human relationship** |

**% of CO attainment is above 75% - Level 3 % of CO attainment is 60% -75% - Level 2**

**% of CO attainment is 50% -60% - Level 1 % of CO attainment is below 50% - Level 0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Quality** | **Marks Scored** | **% of Marks** | **Attainment** |
| **CO4** | **L1 = 2 Marks** |  |  |  |
| **L2 = 11 Marks** |
| **L3 = 24 Marks** |
| **CO5** | **L1 = 7 Marks** |
| **L2 = 30 Marks** |
| POs/PSOs: | **1,2,3** | | | |



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

|  |  |  |  |
| --- | --- | --- | --- |
| Course Code: **18CHO104T** | Course Title: **PROCESS PLANT SAFETY** | | |
| Sem & Year: V & III year | Date: 07/11/2023 | Duration: 5 Minutes | Max. Marks: 5 |

**Continuous Learning Assessment IV**

**Match the following (Quiz component) (5x1 = 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **1.** | Factories act | **a.** | Logical diagram |
| **2.** | Gas mask | **b.** | Health and safety |
| **3.** | Fault tree analysis | **c.** | PID diagram |
| **4.** | Poor illumination | **d.** | Filters 0.1 - 2 % concentration |
| **5.** | HAZOP | **e.** | Lacrimation |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q.No.** | **1** | **2** | **3** | **4** | **5** |
| **Ans** | b | d | a | e | c |