Scheme of Evaluation IAT 3 – July 2021

Sub:	INDUSTRIAL SAFETY					Sub Code:	17ME662	Branch:	ME
Date:	30/07/2021	Duration:	90 min's	Max Marks:	50	Sem / Sec:	6th B Sec		

	Answer any 5 Questions	Split up	MARKS
1.	Explain the various methods for Labelling of Chemicals. **Explaining 5 labels – each carry 2 marks**	2*5	[10]
2	Explain the various emergency measure carried out while operating with chemicals. **Explaining 8 safety measures -Each carry 1.25 marks**	1.25*8	[10]
3	List and explain the safety measures to be followed while installing LPG circuits **Mention 5 measures – Explaining – 2 marks each**	2*5	[10]
4	Explain the safety precautions to be followed while installing CNG. **Mention 5 measures – Explaining – 2 marks each**	2*5	[10]
5	Explain the chemical safety measures required to follow while working in confined Space. **Mention 5 measures – Explaining – 2 marks each**	2*5	[10]
6	With a suitable case study, explain the Safety measures in Chemical laboratory of the college. **Explaining – Introduction, safety measures, - 5 marks each**	2*5	[10]

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Internal Assessment Test III – July 2021

Sub:	INDUSTRIAL SAFETY					Sub Code:	17ME662	Branch:	MECHANICAL
Date:	30/07/2021	Duration:	90 min's	Max Marks:	50	Sem/Sec:	6th Sem B		OBE

	Answer any FIVE FULL Questions	MARKS	CO	RBT
1.	Explain the various methods for Labelling of Chemicals.	[10]	CO3	L1
2.	Explain the various emergency measure carried out while operating with chemicals.	[10]	CO1	L1
3.	List and explain the safety measures to be followed while installing LPG circuits	[10]	CO2	L2
4.	Explain the safety precautions to be followed while installing CNG.	[05]	CO3	L1
5.	Explain the chemical safety measures required to follow while working in confined Space.	[10]	CO2	L1
6.	With a suitable case study, explain the Safety measures in Chemical laboratory of the college	[10]	CO5 CO6	L2

Solutions of 3rd IAT

1. Chemicals when transferred to secondary bottles/cans must be provided with proper labels. - Chemical formulae or short forms must not be used for labelling of the containers. The label must contain • the full name of the chemical, • its hazards, • information for safe handling and • the signage/pictogram indicating the hazard class. - Labels of bottles which got deteriorated or worn off must be replaced immediately. - Chemical bottles without labels or improper labeling can result in the wrong chemical being used. - Further it will also cause difficulty in case of a spill or body contact or at the time of disposal of the chemical. The Lab Standard requires that all chemicals be labeled. If you transfer a chemical from the original container to a new container, you need to also label that new container with the name of the chemical. This is very important because in the event of an emergency you need to know the exact chemical name or chemical formulation you are working with so that you will know which MSDS to consult. Containers must be labeled with: • Chemical name • Manufacturer's name • Health hazards • Physical hazards • Long & short term health effects For frequently used

chemicals, you can create your own labels for secondary containers using a word processing program and standard labels so that you can print them out as they are needed. All hazardous chemicals must be clearly labelled for the benefit of current users, emergency personnel, and future users. Unknown chemicals can be expensive to dispose of. Make sure all labels are legible and in good condition. Repair or replace damaged or missing labels. Manufacturers' Labels Cal/OSHA requires that manufacturers provide labels with the following information: • Contents of the container • Physical and health hazard information • Name, address, and emergency phone number of the manufacturer or other responsible party Original manufacturers' labels must not be removed or defaced. Material Safety Data Sheets (MSDSs) must be accessible to anyone working with these chemicals.

Your Own Labels Hazardous chemicals that are not in the manufacturer's original container (e.g., working solutions prepared in the lab) must, at a minimum, be labeled with the contents of the container. If the contents are hazardous, attach a label indicating the hazard to warn individuals in the work area. It is not necessary to label containers that will be used temporarily (during one work shift) and are under your immediate control.

2. Every person in the lab must be aware of the location of the emergency equipments and exits. This include- ¬ Fire blanket ¬ Emergency shower and eye wash ¬ Fire extinguishers ¬ First aid box. This equipment must be located at an easily accessible location and must not be obstructed. Emergency contact numbers must be displayed at a conspicuous location, preferably near the telephone.

   • Splashes on the skin - All chemical splashes on the skin must be immediately flushed under running water. - If the splash has happened on a large area of the body, an emergency shower must be used. - Contaminated clothing must be removed while flushing the body. Flushing must be continued for at least 15 minutes. - If the substance is known to be insoluble in water gentle cleaning of the surface with soap while the drenching continues will help to remove the chemical.

   Emergency Showers & Eye Wash Stations: If there is an accident, two of the most important pieces of safety equipment you have are the emergency shower and the eye wash station. If you contaminate yourself over a large part of your body or over a part of your body that you cannot rinse off in the sink, immediately go to the emergency shower, strip off any contaminated clothing, and stay under the water for at least 15 minutes. If something splashes into your eye, immediately flush with water for as long as possible. The general rule is to flush with water for 15 minutes. - Eyes must be immediately flushed with copious amount of water for at least 15 minutes. - Certain chemicals like sodium hydroxide, phenol, aniline, hydrofluoric acid, etc, penetrates deep into the tissues. - An eye wash fountain must be used for the same. - During a chemical splash, a spasm may develop in eye lids and keep them firmly shut. So while flushing, the eye lids must be raised with fingers to ensure that no chemical remains in the space below the eye lid. - Medical attention must be sought only after thorough flushing of the eyes. Failure to flush the eyes can result in partial or permanent loss of vision.

• Inhalation of chemical vapours: - In case of exposure to toxic fumes or vapours, the person must be immediately shifted to an area where there is fresh air. - If the person is conscious and breathing his condition must be observed for sometime. - In case the person is not breathing Cardiopulmonary Resuscitation (CPR) must be started immediately by a trained person. - Medical help must be sought immediately. - In certain cases the symptoms appear late. For example, dilute hydrofluoric acid and phosgene gas. So the person must be provided with medical attention immediately even if there are no visible symptoms. • Inhalation Protection To prevent inhalation of chemical gases, vapors, dusts or aerosols: 1. Work in a fume hood. The fume hood is your preferred engineering control defense against inhalation uptake of chemicals. Make sure the fume hood is working well before use and work at least six inches in from the edge of the hood to maximize the capture efficiency of your fume hood. 2. Glove boxes are another way to prevent hazardous chemicals exposure.

Wearing a respirator is the very last option to consider when providing inhalation protection. a. Before anyone can be approved to wear a respirator, they must satisfy these two OSHA requirements: (1) An annual medical evaluation to determine whether or not a person is physically capable of wearing a respirator and (2) OSHA requires a fit-test evaluation to ensure that the respirator seals properly around the face and does not allow unfiltered air to leak in. b. Respirator filters are chemical specific. You must make sure that the cartridges in your respirator will absorb the chemical(s) you are planning on working with.

Ingestion of chemicals: Ingestion Protection: To prevent accidental ingestion of chemicals: 1. Wear gloves during procedures involving chemicals. 2. Wash your hands after each procedure. 3. Never store food or beverages in the lab with chemicals. 4. Never eat or drink in the lab. - If the chemical ingested is corrosive, it can result in burns in the mouth. For such injuries, mouth must be washed repeatedly with water. - In case the chemical has been swallowed, it must be diluted by drinking water or milk (one or two glasses). And the person must be shifted to hospital immediately. - Whenever the injured person is shifted to hospital, the person accompanying him must carry the material safety data sheet along with him or provide details of the chemical. - This will help in giving quick information about the chemical to the doctor treating the injured person and help to avoid delay. - Emergency eye wash and shower must be checked at least once in a week and the details of which must be displayed nearby. This will prevent contamination of water inside and ensure the operability in an emergency. • Fire on the cloth - If a person's clothes are on fire, the flames must be extinguished by drenching with water from an emergency shower. - Never run when the clothes are on fire, as this will fan the fire. Roll on the ground.

3.

Sl. No.	INSPECTION ITEMS	A	D	NA
1	Check the plans and additional data			
2	LPG Containers shall be located outside of the building			
3	Cylinders under 125 gallons filled on site shall be a minimum of 3' from windows or openings and a minimum of10' from window AC			
4	Cylinders under 125 gallons filled on site shall be a minimum of 5' from Central AC			
5	Cylinders over 125 gallons shall be located 10' from building and property line			
6	Cylinders over 500 gallons shall be located 25' from building and property line			
7	Underground cylinders under 2,000 gallons shall be located 10' from building and property line			
8	Loose or piled combustible material , weeds, long grass shall be separated by a minimum distance of 10'			
9	Containers shall be readily identifiable. approved and listed			
10	Cylinders that are expired shall not be used			
11	Vertical containers over 125 gallons shall be designed with steel supports and secured per NFPA			
12	Valves, regulators, gauges and other containers shall be protected from physical damage			
13	LPG shall not be installed in prohibited locations such as elevator shafts. Clothes chutes, ducts			
14	Pressure relief valves shall be installed so that gas is vented away from container to open atmosphere			
15	Verify that all piping in the ground is suitably protected			
16	Flexible connectors must be designed for LPG			
17	Any gas fired appliance located within a garage shall be locate 18" above the floor			
18	Provide combustion air requirements in confined spaces			
19	Pipe shall be wrought iron, steel, brass, copper or other approved materials			
20	Provide CO/gas detector			
21	Piping through foundation wall shall be encased in a protective pipe			
22	Each aboveground portion of a gas piping system upstream from the equipment shutoff shall be electronically bonded			
23	Piping above ground outside shall be securely supported			
24	Piping above ground inside buildings shall be sloped ¼ in 15'			
25	Inspect gas pipe for leaks and tightness			
26	Gas fired appliances shall be equipped with automatic devices designed to shutoff flow of gas to the main burner and pilot			
27	Test pressure shall not be less than 1.5 times the working pressure but not less than 3 psig. NFPA 54 8.1.2 Test the gauge			

4. Safety issues in CNG filling stations When CNG buses are filled at filling stations, normal precautionary measures are implemented according to Indian and international standards. But there is scope for improving the layout of the existing gas filling stations to ensure better approachability and safety. In a number of gas filling stations catering to non-DTC vehicles in Delhi, there is a minor risk of damaging the gas pump. This is because there is too tight radius for a bus to approach the pump easily. The lay-out of filling stations should give the privately operated buses plenty of room for a safe approach. If there is not enough room, the "island" either where the pump is located could be made larger or a steel barrier could be anchored in a suitable way for protection

of the pump. Nozzles and safety: These are prone to frequent o-ring failures – an item in nozzles. We are informed that they occur on an average about once every 20 fills. This failure not only interrupts fueling and requires replacement of the o-ring, it also creates a fire hazard due to the release of a significant amount of high-pressure gas. Safety of CNG cylinders As of today, the cylinders meet the common standards set for all high pressure gas cylinders from oxygen to hydrogen by the Bureau of Indian Standards and approved by the Chief of Comptroller of Explosives. However, these standards do not take into account on-board high pressure gas cylinders mounted on moving vehicles. International standards have been specially set for on-board cylinders. There is a need for enforcement of these safety regulations as well. Need for more stringent emissions standards for future CNG vehicles a) MRTH may be asked to notify Euro IV equivalent standards for new CNG buses from 2005 and simultaneously provide fiscal incentives for achieving European Environmentally Enhanced Vehicles standards.

b) Test procedure for engines using gaseous fuels such as CNG be changed from a "steady state" test to a "transient" test as this type of test is more representative of actual driving on the road under various conditions. Safety Aspects in CNG Refilling Stations a) Ministry of Petroleum and Natural Gas may be asked to review the layout of the dispensing stations to ensure easy approachability to dispensers and protection of the installed pumps. b) Standardise all vehicle-refuelling receptacles or nozzles on the NGV-1 standard to reduce filling time, minimise safety risk posed by leakage of gas due to O-ring failure, and allow more efficient use of existing compression capacity. High-pressure Cylinders and Piping for Storage of CNG on Board Motorised Vehicles The Bureau of Indian Standards may be asked to lay down standards for high-pressure cylinders and piping for the on board storage of CNG as a fuel for automotive vehicles on the lines of prevailing international standards such as ISO 11439 Gas cylinders – "High-pressure Cylinders for the On-board Storage of Natural Gas as a Fuel for Automotive Vehicles".

5. A confined space means an enclosed or partially enclosed space that (a) is not designed or intended for human occupancy except for the purpose of performing work; (b) has restricted means of access and egress; and (c) may become hazardous to a person entering it as a result of (i) its design, construction, location or atmosphere, (ii) the materials or substances in it, or (iii) any other condition relating to it. Therefore, based upon this definition, if a space does not satisfy all three criteria then it is not considered a confined space and these regulations do not apply. • A worker is considered entering a confined space when the breathing zone of the worker breaks the plane of the opening to the confined space. Breathing zone is defined as the area within a 10 inch radius of the worker's nose and mouth.

   There are no prerequisites for confined space entry certification training, however, other training may be required by the Occupational Health and Safety (OHS) legislation, such as for a CSE vertical entry and in hazardous atmospheres, retrieval equipment is required.

   • The employer of the individual performing the work (entering the space) shall conduct the assessments to ensure the hazards are identified. In instances where the work is not being performed at the employer's place of work, the building owners/occupants shall be

consulted to ensure all applicable hazards are identified. The employer shall ensure the assessment is completed and covers the hazards of the specific space. • Each entrant shall complete confined space entry training with an approved CSE training provider prescribed by the Workplace Health, Safety and Compensation Commission (WHSCC). • At a minimum, CSE certification training is required for attendants as prescribed by WHSCC, keeping in mind that attendants are not permitted to enter a confined space according to OHS legislation. Knowledge and skills are required to fulfill the responsibilities of the work of an attendant as described in OHS Regulation. • Appropriate testing will be based upon potential atmospheric hazards associated with the space and the type of work being performed as identified in the risk assessment. The intervals will be determined based upon risk but as a minimum, where a hazard exists, testing should be performed prior to initial entry, after an interruption in work or any time conditions change

6. Chemical laboratory of engineering colleges are following the fundamental safety guidelines accumulated in their lab-testing environment. As per their safety requirements college laboratory focussing on the following aspects. • Providing the chemical safety manual pertaining the detailed information and explanation of each chemical which are making use throughout the academic course. The objective is to help those working in a laboratory environment keep chemical safety a top priority. Using the RAMP concept for scientific safety, RAMP stands for: R Recognize the hazards A Assess the risks of the hazards M Minimize the risks of the hazards P Prepare for emergencies from uncontrolled hazards. Recognize the Hazards Students should be able to recognize common laboratory hazards, to explain why these are hazards, and to have some familiarity with hazard rating systems. Assess the Risks of the Hazards Students should be able to assess the risks of specific hazards. Risk is the probability of suffering injury or harm from exposure to a hazard. Students should be able to determine the relative severity of a specific hazard and to give an estimate of the likelihood of exposure under certain circumstances. Minimize the Risks of the Hazard Students should be able to identify ways in which the risk can be lowered. This may involve using appropriate engineering controls (equipment such as hoods, ventilation systems, and safety interlocks), administrative controls (procedures, processes, and training), and personal protective equipment (PPE) to reduce or mitigate the hazard. Students should know common methods to minimize hazards and the limitations of those protective measures. Students must be aware that all laboratory research has risks and that careful planning and preparation can reduce those risks to acceptable levels. Prepare for Emergencies from Uncontrolled Hazards Students should prepare for emergencies by being able to explain how to respond to common emergencies that could occur in laboratories, such as fires, explosions, chemical exposures, injuries, and chemical spills. Students should be able to explain the selection and proper use of emergency equipment such as fire extinguishers, eyewash stations, safety showers, spill kits, first aid kits, fire alarms, and fire blankets. Students should know the importance of reporting laboratory incidents and the lessons that can be learned from the incidents. Training, walking to locations of all emergency

equipment, and considering what one would do should occur BEFORE an incident or emergency occurs. Use of these safety education guidelines should help foster a culture of safety, in which students apply the RAMP concept to their laboratory experiences and continue to keep safety a high priority throughout their education and their professional lives. Basic Terminology and Concepts 1 . Differentiate between hazard and risk . 2 . Define acute and chronic toxicity and cite some examples of each . 3 . State the general effects that corrosives have on the skin . 4 . State the general hazards associated with flammables commonly used in the laboratory . 5 . Correlate a compound's structure and properties with potential flammability . 6 . Explain the statement "The dose makes the poison ." 7 . Explain why reducing the scale reduces the risk . 8 . Describe the different classes of lasers . Labels, SDS, and PPE 9 . Explain the components of the GHS labeling system, including pictograms, signal words, hazard statements, hazard categories (ranking), and precautionary statements . 10 . Interpret information given on an NFPA diamond . 11 . Given an SDS, identify the substance, the hazards, and the appropriate PPE . Basic Laboratory Safety 12 . State the general rules for working safely in a chemical laboratory . 13 . Describe the possible routes of exposure for a hazardous material . 14 . Explain why food and drinks are not permitted in a chemical laboratory . 15 . List the general considerations for appropriate waste disposal . 16 . State the general hazards associated with mercury, mercury compounds, and pyrophoric compounds . 17 . Identify potential unusual situations or unplanned events in the laboratory (e .g ., chemical spills, odors) . 18 . Explain why long hair that is not tied back, neckties, jewelry, and loose articles of clothing are considered hazards . Regulatory Agencies and Regulations 19 . State the purpose of regulatory agencies (e .g ., OSHA, EPA) . 20 . State the purpose of the Chemical Hygiene Plan . 21 . Identify the components of a Chemical Hygiene Plan . Planning 22 . Prepare a safety checklist for experiments using the RAMP concept . 23 . Describe how to plan experiments in order to minimize the use and generation of hazardous materials . 24 . Prepare and lead a short safety meeting appropriate to the laboratory setting . PPE 25 . Describe the various types of eye protection and the specific protection that each provides 26 . Describe and discuss skin protection measures (e .g ., clothing, gloves, tools) . 27 . Describe the appropriate materials and construction for a laboratory coat . 28 .Explain why glove material and construction must be considered when selecting proper. . 29. Given a glove selection chart, select the proper glove material and construction for a laboratory operation or potential chemical exposure . 30 . Select and wear appropriate PPE while in the laboratory . 31 . Describe the proper care of PPE . Ventilation 32 . Differentiate between a chemical hood and a biological safety cabinet . 33 . Describe the proper use and operation of chemical hoods and ventilation systems . 34 . Describe the use of a "snorkel" exhaust system. Chemical Wastes and Disposal 35 . Describe the appropriate protocols for handling and disposing of chemical wastes . 36 . Describe the appropriate disposal methods for damaged glassware .