



**SUMMER-22 EXAMINATION**  
**Model Answer**

Subject Title: Industrial Safety & Maintenance

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**Important Instructions to examiners:**

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.
- 8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.



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Q No	Sub q.no	Answer	Marking scheme
<b>1</b>		<b>Answer any 5</b>	<b>10</b>
1	a	<b>Definition of Organization:</b> <b>Organization</b> is related with developing a frame work where the total work is divided into manageable components in order to facilitate the achievement of objectives or goals. Thus, organization is the structure or mechanism (machinery) that enables living things to work together. <b>Safety organization</b> is defined as a definite, planned and organized set up whose purpose is to enlist and maintain the combined efforts of organized personnel for the purpose of total loss control including accidents and environmental protection in an industry or establishment.	2
1	b	<b>Causes of accident in an industry :</b> <b>1. Technical causes.</b> a) Mechanical factors b) Environmental factors. <b>2. Human causes.</b> ( Any four points) These are due to unsafe acts by our weakness. This is due to some personal factors such as : i) Age. ii) Health iii) No. of dependents	1         1



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		<p>iv) Financial positions v) Home environment vi) Lack of skill and knowledge. vii) Improper attitude towards work viii) Carelessness ix) Inattentiveness.</p>	
1	c	<p><b>Important chapters under Factories Act 1948(Any four)</b> The main objectives of Indian Factories Act 1948 are to regulate the working conditions in factories, to regulate health, safety, welfare and annual leave and enact special provision in respect of young persons, women and children who work in factories. Important chapters are:</p> <ol style="list-style-type: none"><li>1. Working hours</li><li>2. Health</li><li>3. Safety</li><li>4. Welfare</li><li>5. Special provisions</li><li>6. Employment of young persons</li><li>7. Annual leave with wages</li><li>8. Penalties &amp; Procedures</li></ol>	<p>½ mark each</p>
1	d	<p><b>Accident investigation agencies: (Any two)</b></p> <ol style="list-style-type: none"><li>1. Factory inspectors(Government labour department)</li><li>2. Factory Management</li><li>3. Foreman or Supervisor</li><li>4. Safety Officer or Engineer</li></ol>	<p>1 mark each</p>



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		<b>5. Safety Committee or Expert group including consultants</b>	
1	e	<b>Different hazards in insecticide industry:</b> 1. Toxic hazard 2. Inhalation hazard 3. Ingestion hazard 4. Penetration of the body covering(contact poison)	½ mark each
1	f	<b>Types of maintenance:</b> 1. Corrective or breakdown maintenance 2. Scheduled maintenance 3. Preventive maintenance 4. Predictive maintenance	½ mark each
1	g	<b>Safety planning:</b> It is the first step of safety management where in a safety manager decides in advance safety objectives, policy, procedure, strategies, rules, programmes, method, budget, schedules and necessary means for achieving these objectives, considering facts and anticipating foreseeable events that may affect safety of plant, people and environment.	2
<b>2</b>		<b>Answer any 3</b>	<b>12</b>
2	a	<b>Safety policy components for Chemical Industry:</b> The various components considered for safety policy in Chemical Industry are: <ul style="list-style-type: none"><li>• Maintain an organized and orderly facility.</li><li>• Communicate hazards to everyone in the facility.</li><li>• Follow basic safety procedures.</li><li>• Use engineering controls.</li><li>• Use PPE as needed or required.</li><li>• Follow requirements for high hazard chemicals.</li><li>• Prepare for accidents and emergencies.</li></ul>	1/2 mark each for any eight



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		<ul style="list-style-type: none"><li>• Offer Training and Resources.</li><li>• Label Everything Clearly.</li><li>• Safety Check Emergency Equipment.</li><li>• Cleanliness is Next to Safety.</li><li>• Keep Safety Gear in Sight.</li><li>• Designate a Location for Food and Drink.</li><li>• Create a Chain of Responsibility.</li></ul>	
2	b	<p><b>Procedure of safety Auditing :</b></p> <p>Safety audit is carried out by a team whose members are not involved in the plant or activity being audited. The expertise of the team should be compatible with the type of audit. It is beneficial to include the managers of other plants or units in an audit team as well as one previous auditor of the same unit. Audits are carried out in a formal way using a carefully drawn up checklist of items and descriptive standards for each item. A line manager or supervisor of the plant under audit should be asked to accompany the auditor inspecting it. He should be informed of all corrections and improvements required by the auditors so that he can start taking the necessary steps before the audit report is submitted to management. The main object of inspection should be to determine whether the layout design and condition of equipment and protective features are upto standard and to ensure that the protective features will work in an emergency. The auditing should give a verbal report to the management on completion of audit followed by a clear and concise written report within two weeks.</p>	4
2	c	<p><b>Accident investigation:</b></p> <p>Philosophy of industrial accident investigation should be clear and well explained to workers. It should not be oriented towards fault-finding and blaming any individual. Its main objective is to find out the real cause of the accident and then based on it, to</p>	1 mar k for



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	<p>suggest appropriate remedial measures to prevent its recurrence.</p> <p><b>Steps involved in accident investigation:</b></p> <ol style="list-style-type: none"><li>1. Provide first aid and/or medical care to the injured persons and take action to prevent further injury or damage. This is the first priority.</li><li>2. Report the accident as required by your company's policies.</li><li>3. Investigate the accident as soon as possible after it occurs. This allows you to observe the conditions as they were at the time of the accident, prevents the disturbance of evidence, and allows you to identify witnesses. You will need to gather physical evidence, take photographs, and interview witnesses to understand the chain of events that led to the accident.</li><li>4. Identify the causes of the accident. Note that there are usually multiple causes.</li><li>5. Report your findings in a written report. in preparing the report, it is helpful to prepare step-by-step account or timeline working back from the moment of the accident, listing all possible causes at each step. This account can be helpful in preparing the final report, which should clearly explain the evidence for your conclusions.</li><li>6. Develop a plan for corrective action to prevent the accident from happening again. These actions should be specific, constructive, address root causes of the accident, and address the causes described in the report.</li><li>7. Implement your corrective action plan. It is helpful to set a deadline for implementation of corrective actions and there should be monitoring in place to ensure that they are completed.</li><li>8. Follow up to evaluate the effectiveness of the corrective actions taken.</li></ol>	<p>acci dent inve stiga tion and 3 mar ks for steps</p>
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		9. Make adjustments as needed to continue to improve.	
2	d	<b>Sampling technique for toxic and flammable gases in pharmaceutical industry:</b>  Both high performance liquid chromatography and radio- immunoassay procedures have been used to determine oestrogens and progestogens in environmental samples. Serum samples have been analyzed for the exogenous active compound, its metabolite, oestrogen-stimulated neurophysins or any of a number of other hormones considered appropriate for the specific process and hazard. Airborne monitoring usually includes breathing zone personal monitoring, but area sampling can be useful in detecting departures from expected values over time. Personal monitoring has the advantage of detecting breakdowns or problems with processing equipment; personal protective equipment or ventilation systems and can provide an earlier warning of exposure. Biological monitoring, on the other hand, can detect exposures which may be missed by environmental monitoring. Good practice combines both environmental and biological sampling to protect workers.	4
<b>3</b>		<b>Answer any 3</b>	<b>12</b>
3	a	<b>Failure Modes and Effective Analysis(FMEA):</b>  FMEA is a design tool used to systematically analyze component failure and identify the resultant effects on system operations. It is a systematic way of identifying and preventing potential failures in systems, processes, products and services before they occur. It has long been a way to predict the consequences of failures in complex systems. FMEA is a proactive tool to assist in new design or enhancement of existing processes. It doesn't require a prior accident or close call. It	4



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		<p>can be carried out manually or by using computer software, individually or team of experts.</p> <p>Characteristics:</p> <ul style="list-style-type: none"><li>• It is a time consuming, but very useful method</li></ul> <ol style="list-style-type: none"><li>1. Inductive technique(drawing of the general interference from a particular event</li><li>2. Non mathematical</li><li>3. Equipment oriented.</li><li>4. Human errors are not considered</li></ol> <ul style="list-style-type: none"><li>• It considers only one failure mode at a time.</li></ul>	
3	b	<p><b>Corrective or Breakdown Maintenance:</b></p> <p>Corrective or breakdown maintenance implies that repairs are made after the equipment is out of order and it cannot perform its normal function any longer, e.g., an electric motor will not start, a belt is broken, etc. Under such conditions, production department calls on the maintenance department to rectify the defect. The maintenance department checks into the difficulty and makes the necessary repairs. After removing the fault, maintenance engineers do not attend the equipment again until another failure or breakdown occurs.</p> <p>Breakdown maintenance practice is economical for those (non-critical) equipment whose down-time and repair costs are less this way than with any other type of maintenance.</p> <p>Typical Causes of Equipment Breakdown:</p> <ol style="list-style-type: none"><li>(i) Failure to replace worn out parts.</li><li>(ii) Lack of lubrication.</li></ol>	2





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- (iii) Neglected cooling system.
- (iv) Indifference towards minor faults.
- (v) External factors (such as too low or too high line voltage, wrong fuel, etc.)
- (vi) Indifference towards -equipment vibrations, unusual sounds coming out of the rotating machinery, equipment getting too much heated up, etc.

**Scheduled Maintenance:**

Scheduled maintenance is a stich-in-time procedure aimed at avoiding breakdowns. Breakdowns can be dangerous to life and as far as possible should be minimized. Scheduled maintenance practice incorporates (in it), inspection, lubrication, repair and overhaul of certain equipment which if neglected can result in breakdown.

Scheduled maintenance often occurs at repeating intervals, such as changing an air filter every March and September or conducting a performance inspection at the start of each year. This kind of maintenance may also be used to fulfill a work order.

Once a problem is discovered, a maintenance scheduler works with a maintenance planner to resolve the problem. A time is then scheduled to conduct necessary repairs. Inspection, lubrication, servicing, etc., of this equipment are included in the predetermined schedule. Scheduled maintenance practice is generally followed for overhauling of machines, cleaning of water and other tanks, white washing of buildings, etc. Although scheduled maintenance is a simplistic form of preventive maintenance, the practice is still valuable. It ensures equipment will continue working as designed to reduce downtime and maintain maximum value. Depending on the asset condition and manufacturer specifications, consistent maintenance schedules can add years to asset lifespans. Furthermore, minimum recommended maintenance instructions keep asset warranties active.



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3	c	<p>The <b>Bhopal disaster</b>, also referred to as the Bhopal gas tragedy, was a gas leak incident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India. It is considered to be the world's worst industrial disaster.</p> <p>The disaster happened because water entered a tank containing Methyl isocyanate. This caused a chemical reaction which resulted in the buildup of much Carbon dioxide, among other things. The resulting reaction increased the temperature inside the tank to reach over 200 °C (392 °F). As the cool morning breeze picked up pace, it carried the poisonous gas leaking from the Union Carbide factory to rest of the city and killing people - both awake and asleep. As per government's affidavit, about 3,000 people died of poisonous gas within a few hours of the incident.</p> <p>It is estimated that about 40 tonnes of methyl isocyanate (MIC) gas and other chemicals leaked from the Union Carbide factory. Methyl isocyanate is extremely toxic and if its concentration in air touches 21 ppm (parts per million), it can cause death within minutes of inhaling the gas. In Bhopal, the level was multiple times higher.</p> <p>The leakage of gas was reported from Plant Number C. As per official record, methyl isocyanate got mixed with water used for cooling the plant. The mixture led to generation of volumes of gases, which put tremendous pressure on Tank Number 610.</p> <p>The tank cover gave way to building gaseous pressure releasing tonnes of the poisonous gas, which diffused over large area. Approximately 5 lakh people were exposed to the leakage of methyl isocyanate gas.</p> <p>Tragedy did not strike Bhopal on the intervening night of 2-3 December 1984 but</p>	4
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		<p>thereafter. The massive leakage of Methyl Isocyanate (MIC) gas from the Union Carbide plant resulted in colossal loss of life and an estimated 8,000 died within two weeks and more than five lakh were affected. Breathing <b>Methyl Isocyanate</b> can irritate the nose and throat. * Breathing Methyl Isocyanate can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath. It reacts exothermically with water to produce carbon dioxide, methylamine, dimethylurea and/or trimethylbiuret. Heat of reaction causes evolution of the vapors of the <b>isocyanate</b>. ... Airborne vapors of methylisocyanate are explosive when exposed to heat, flame or sparks.</p> <p><b>Safety failures which caused Bhopal tragedy:</b></p> <p>During the leakage of methyl Isocyanate from the storage tanks of union carbide the water sprayers of the industry was not in working conditions.</p> <p>There was unavailability of safety officer who has the knowledge of handling such tragedy.</p> <p>Lack of safety management in workers</p> <p>Gas scrubbers were not in working condition.</p> <p>Absence of occupiers in industry at that situation.</p>	
3	d	<p><b>Different types of accidents:</b></p> <ol style="list-style-type: none"><li>1. Near accident: An accident with no damage or injury is called near accident.</li><li>2. Trivial accident: An accident with very less damage is called trivial .</li><li>3. Minor accident: It is an accident with damage and injury more than trivial.</li><li>4. Serious accident: An accident with heavy damage and lot of injury is called serious accident.</li></ol>	4



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		5. Fatal accident: It is an accident with very heavy damage. There may be loss of lives also.	
4		<b>Answer any 3</b>	<b>12</b>
4	a	<b>Objective of Strategic Planning</b> <ol style="list-style-type: none"><li>1. Helps in facing environmental or future challenges.</li><li>2. Provides direction.</li><li>3. Improved functioning.</li><li>4. Exploiting favourable opportunities.</li><li>5. Minimization of chances of mistakes or losses.</li><li>6. Effective/efficient utilization of resources like time, money, talent, equipment etc.</li><li>7. Facilities co-ordination and control.</li><li>8. Increase Competitive strength.</li></ol>	1 mar k each for any 4
4	b	<b>The Management Oversight and Risk Tree (MORT)</b> is an analytical procedure for determining causes and contributing factors. MORT arose from a project undertaken in the 1970s. The work aimed to provide the U.S. Nuclear industry with a risk management programme competent to achieve high standards of health and safety. Although the MORT chart (the logic diagram that accompanies this text) was just one aspect of the work, it proved to be popular as an evaluation tool and lent its name to the whole programme.  In MORT, accidents are defined as unplanned events that produce harm or damage, that is, losses. Losses occur when a harmful agent meets a person or asset. This contact can occur either because of a failure of prevention or, as an unfortunate but acceptable outcome of a risk that has been properly assessed and acted-on. MORT	4



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		<p>analysis always evaluates the "failure" route before considering the "assumed risk" hypothesis.</p> <p>In MORT analysis, most of the effort is directed at identifying problems in the control of a work/process and deficiencies in the protective barriers associated with it. These problems are then analysed for their origins in planning, design, policy, etc. To use MORT, you must first identify key episodes in the sequence of events. Each episode can be characterised as:</p> <ul style="list-style-type: none"><li>• a vulnerable target exposed to</li><li>• an agent of harm in the</li><li>• absence of adequate barriers.</li></ul>	
4	c	<p><b>Safety in Fertilizer industry</b></p> <p>Production of fertilizer products present challenges with respect to process safety due to the hazards inherent in the manufacturing processes. Hazards are occurred due to following reasons</p> <p><i>Fire/explosion hazard due to:</i></p> <ol style="list-style-type: none"><li>1. leaks from the hydrocarbon feed system.</li><li>2. leaks of synthesis gas in the CO/removal/synthesis gas compression areas (75% hydrogen)</li><li>3. the formation of a flammable gas mixture inside equipment, for example in the reformer or process airline.</li></ol> <p><i>Toxic hazards from:</i></p> <ol style="list-style-type: none"><li>1. the release of liquid ammonia from the synthesis loop.</li><li>2. accidental release during storage and handling.</li></ol>	4



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		<p>For prevention of fire hazard leak detectors should be employed and in emergency fire fighting systems should be ready. Regular mock drills need to be conducted. Flaring system or gas absorption system should be in place in case of release of gases. Apart from specialized requirement following general guidelines should be followed.</p> <ul style="list-style-type: none"> <li>• Maintain an organized and orderly facility.</li> <li>• Communicate hazards to everyone in the facility.</li> <li>• Follow basic safety procedures.</li> <li>• Use engineering controls.</li> <li>• Use PPE as needed or required.</li> <li>• Follow requirements for high hazard chemicals.</li> <li>• Prepare for accidents and emergencies</li> </ul>									
4	d	<p><b>Preventive Maintenance vs Predictive Maintenance</b></p> <table border="1"> <thead> <tr> <th>Preventive Maintenance</th> <th>Predictive Maintenance</th> </tr> </thead> <tbody> <tr> <td>Preventive maintenance is usually performed to prevent assets from unexpected failures</td> <td>Predictive maintenance is usually performed to predict failures that might occur so that it can be prevented from occurrence.</td> </tr> <tr> <td>This maintenance is performed on whether needed or not i.e. whether potential failure is identified or not. This is done on regular basis</td> <td>This maintenance is performed whenever needed i.e. whenever any potential failure is identified. This is not done on regular basis</td> </tr> <tr> <td>One needs to increase downtime of asset to carry out maintenance i.e. one need to stop primary functions of assets</td> <td>No downtime of machine is required i.e. one does not need to stop primary functions of assets as this maintenance</td> </tr> </tbody> </table>	Preventive Maintenance	Predictive Maintenance	Preventive maintenance is usually performed to prevent assets from unexpected failures	Predictive maintenance is usually performed to predict failures that might occur so that it can be prevented from occurrence.	This maintenance is performed on whether needed or not i.e. whether potential failure is identified or not. This is done on regular basis	This maintenance is performed whenever needed i.e. whenever any potential failure is identified. This is not done on regular basis	One needs to increase downtime of asset to carry out maintenance i.e. one need to stop primary functions of assets	No downtime of machine is required i.e. one does not need to stop primary functions of assets as this maintenance	1 mar k mea ch for any four
Preventive Maintenance	Predictive Maintenance										
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		to carry out maintenance action.	can be performed while assets are performing their regular functions	
		In this, maintenance occurs even if potential failures are not identified	In this, maintenance occurs only when potential failures are identified.	
		It is less complex process and simple than predictive maintenance	It is more complex and difficult than preventive maintenance.	
		This maintenance action is more costly than predictive maintenance as regular maintenance requires more investment	This maintenance action is less costly than preventive maintenance as one can simply reduce avoid maintenance that is not necessary and thus reduce maintenance costs.	
		It is more time consuming because in this type of maintenance, one need to perform inspection and maintenance on regular basis	It is less time consuming as in this type of maintenance, one need to perform inspection and maintenance only when required	
4	e	<b>Qualitative Vs Quantitative risk analysis</b>		1
		<b>Qualitative Risk Analysis</b>	<b>Quantitative Risk Analysis</b>	mar
		This is a subjective approach that primarily focuses on risk identification for measuring the possibility of the occurrence of the risk event during the entire project. Severity identification is the primary goal	This is an objective approach wherein the data verified are used to analyze the risk effect	k
		This helps in gauging the chances of risk and prioritize them to make it clear to the team as to take action	At the same time making numerical calculations to correct the risk also becomes important	each
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		on which issue first and hence this is the most important technique in risk analysis	which is done in this phase. Therefore a combined analysis of both qualitative and quantitative risk assessment helps to assess and minimize the risk	
		Qualitative risk analysis is complex because it does not involve straightforward math and hence one must know how to rank the risk for which expertise is required	Direct calculating methods and tools are available making the process simple but still one must know the right way to use these formulas and tools to complete the corrective action	
		Time-consuming to identify each risk, record and rank them	Tools are used to speed up the process	
		Can be used easily as there is no need for any tool	Reliability on tool sometimes makes it difficult for the team to use it	
		Used in all projects irrespective of the complexity of the project	Used only in complex projects	
		It deals with all risk and then ranks them in order of the impact	Deals only with the risks marked for further analysis by qualitative risk analysis	
		Risk is ranked between 0 to 1	Risk closer to 1 ranking are taken first and calculation is done to predict the project outcome based on the effects of risk	
<b>5</b>		<b>Answer any 2</b>		<b>12</b>
<b>5</b>	<b>a</b>	<b>Policy Formulation and Implementation of safety Plans</b> <b>Policy Formulation-</b> Policy Formulation is the process by which an organization chooses the most appropriate courses of action to achieve its defined goals. This process is essential to an organization success because it provides a frame work for		





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	<p>the actions that will lead to the anticipated results</p> <p><b>The process of policy formulation basically involves six main steps</b></p> <ol style="list-style-type: none"><li><b>1. Setting organization objectives-</b> The key component of any strategy statement is to set the long-term objectives of the organization. It is known that strategy is generally a medium for realization of organizational objectives</li><li><b>2. Evaluation the organizational environment-</b>The next step is to evaluate the general economic and industrial environment in which the organization operates. This includes a review of the organizations competitive position</li><li><b>3. Setting quantitative targets:-</b> In this step an organization must practically fix the quantitative target values for some of the organizational objectives.</li><li><b>4. Aiming in Content with the divisional plans-</b>In this step the contribution made by each department, division or product category with in organization .</li><li><b>5. Performance analysis –</b> Performance analysis includes discovering and analyzing the gap between the planned or desired performance.</li><li><b>6. Choice of strategy-</b>This is the ultimate step in strategy formulation. The best course of action is actually chosen after considering organizational goals, strengths, potential and limitations.</li></ol> <p><b>Policy Implementation-</b> Policy Implementation refer to the execution of the plans and strategies, so as to accomplish the long term goals of the organization. It convert the opted strategy into the moves and actions of the organization to achieve the objectives</p> <p><b>Steps In Policy Implementation</b></p> <ol style="list-style-type: none"><li><b>1. Evaluation and communication of the Strategic Plan-</b> The Strategic plan,</li></ol>	3
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		<p>which was developed during the strategy formulation stage, will be distributed for implementation. However there is still a need to evaluate the plan ,especially with respect to initiatives, budgets and performance .</p> <p><b>2. Development of an implementation structure-</b> This step is to create a vision or a structure, that will serve as a guide or framework for the implementation of strategies.</p> <p><b>3. Development of implementation–support Polices and programs</b> - Some call the “ strategy-encouraging polices” while others refer to them as “constant improvement programs”. Nonetheless these are policies and programs that will be employed in aid of Implementation.</p> <p><b>4. Budgeting and allocation of resources-</b> It is now time to equip the implementation with the tools and other capabilities to perform their tasks and functions.</p> <p><b>5. Discharge of functions and activities</b> – It is time to operationalize the tactics and put the strategies into action, aides by strategic leadership, utilizing participatory management and leadership styles.</p>	3
5	b	<p><b>Prepare Accident Report and explain elements of Report</b></p> <p>An accident is an unplanned event so laws require that certain work related accidents are reported to authority.</p> <p>The Accident Report form is in 2 parts .The first part is completed by the employee and second part is completed by the supervisor</p> <p>The supplied templates calls on the employee with the assistance of manager to fill in the first part details includes</p>	



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	<ul style="list-style-type: none"><li>• Employee details</li><li>• Injury details-including date, time and expected time of work</li><li>• Medical treatment required</li><li>• Event leading up to the injury-this is important to gain the employees perspective of what actually happened.</li></ul> <p>The Second Section of the form is to completed by Supervisor and requires manager to identify the following</p> <ul style="list-style-type: none"><li>• Witness details</li><li>• How the accident happened?</li><li>• How a recurrence can be prevented?</li></ul> <p><b>Elements of Accident Report</b></p> <p>The following elements will help you to create a through, factual report that will help you to minimize future liabilities and keep your employees safe</p> <ol style="list-style-type: none"><li>1. <b>Specific details and description:</b> - The more specific the accident report, the more use it will be when making corrective decisions. Ambiguity is the enemy in risk management.</li><li>2. <b>Facts Only:-</b> It can be tempting to include opinions in incident reports, especially if you feel that your opinion could be helpful to decision makers. Incident report should be an entirely factual document because opinions can be cloud accuracy and distract from the details.</li><li>3. <b>Objective Tone :-</b> At time workplace incidents can spark emotion, but there is no place form emotions in an incident report .Keep tone of document as objective as possible.</li><li>4. <b>Organization :-</b> In most cases, it is best to organize an incident report</li></ol>	<p>3</p>
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		<p>chronologically, although inspection incident report may be organized by enumerating details according to findings.</p> <p>5. <b>Witness Statements:-</b> If there were witness to the accident, it can be helpful to include their statements in your incident report. Remember to attribute these to specific peoples.</p> <p>6. <b>Confidential Concerns:-</b> It is possible tat your incident report could be used in court at some point, so avoid including confidential details that should not be made public. These may include the personal health history of some involved.</p> <p>7. <b>Accuracy :-</b> If you are unsure about the accuracy of a details related to the incident, verify it before you include it ,depend upon the nature of the event.</p> <p>8. <b>Good Grammar:-</b>Correct word choice, complete sentences and proper punctuation all help your incident report to be clear and accurate as possible.</p> <p>9. <b>Sketches,Diagrams,Photos :-</b> Not every incident report requires the inclusion of sketeches, diagrams and photos but in some cases these addition can be incredibly helpful.</p> <p>10. <b>Supervisor Signoff:-</b> Once the incident report is completed ensure that it is signed off by the supervisor who was on duty during the incident .The supervisor should recheck the accuracy of all details before signing .</p>	3
5	c	<p><b>Precautions and Prevention Methods of hazard in chemical process plant</b></p> <p>Following are some important precautions to be taken to prevent hazards in chemical industry are</p> <p><b>1. Control major hazard installations by sound engineering and</b></p>	



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	<p><b>management practices, for example by</b></p> <ul style="list-style-type: none"><li>a) Good plant design, fabrication and installation, including the use of high-standards</li><li>b) Regular plant maintenance</li><li>c) Good Plant operation</li><li>d) Good management of safety on site</li><li>e) Regular inspection of the installation, with repair and replacement of components.</li></ul>	3
	<p>2. <b>Some of the steps for preventing industrial accidents are as follows</b></p> <ul style="list-style-type: none"><li>a) <b>Proper safety measures:</b> The proper safety measures should be adopted to avoid accidents Government also provides guidelines for enacting measures for checking accidents, these should be properly followed.</li><li>b) <b>Proper selection :-</b> Any wrong selection of workers will create problems later on .Some time employees are accident prone, they may not be properly suitable fro the particular jobs.</li><li>c) <b>Safety Conscious :</b> The employees should be made conscious of various safety measures to be followed. There should be proper working slogans and advises to the worker for making them conscious.</li><li>d) <b>Enforcement of discipline:</b> Disciplinary action should be taken against those who flout safety measures. There may be negative punishment like warings, lay off, terminations of workers.</li><li>e) <b>Incentives :</b> Workers should be given various incentives for</li></ul>	3



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		<p>maintaining safety .These may also be safety contrasts among workers. Those who follow safety instruction properly should be given monetary and non-monetary incentives.</p> <p><b>f) Safety committees:</b> Safety measures are in the interest of both employers. There should be committees consisting of representatives of workers and employees for devising and enforcing safety programmes</p> <p><b>g) Proper maintenance of machines, equipment and infrastructural facilities :</b> Accident may occur on account of the fault in machine or equipments. There should be proper maintenance of machine.</p> <p><b>h) Safety Training:</b> The workers should be given training regarding safety measures. They should know the hazards of the machines, the areas of accident proneness and good working possible precautions in case of some accidents.</p>	
6		<b>Answer any 2</b>	<b>12</b>
6	a	<p><b>HAZOP (Hazard and Operability Study ) of any one process or Operation of Chemical Industry</b></p> <p>HAZOP is a technique for identifying and analyzing hazards and operational concerns of a system. It is a very organized, structured and methodical process for carrying out a hazard identification analysis of a system</p> <p><b>Stages at which HAZOP can be carried out :</b></p> <p>1. At an entry stage of development to decide the site and identify major hazards</p>	3



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		<ol style="list-style-type: none"><li>2. At design freeze stage</li><li>3. At pre-start-up stage</li><li>4. Studies on existing plants</li><li>5. Studies prior to plant modification</li><li>6. Studies prior to taking a plant ,out of services</li><li>7. Studies on research facilities</li></ol> <p><b>Procedure for HAZOP study follows the sequence</b></p> <ol style="list-style-type: none"><li>1. Define objective and scope</li><li>2. Select the team</li><li>3. Prepare for the study</li><li>4. Carry out the examination</li><li>5. Follow up and</li><li>6. Record the results.</li></ol>	3
6	b	<p><b>Procedure for shut down of a plant:</b></p> <p>A plant shutdown, or turnaround, is a temporary closure of a building to perform maintenance. The main activities should be preventative in nature with the focus on equipment inspections. This is the opportune time to replace worn-out or broken process materials and equipment at their useful end-of-life. An effective plant shutdown should result in reduced unplanned downtime, reduced overtime, and greater operational efficiencies. Five distinct phases of a plant shutdown are scoping, planning, scheduling, execution, and wrap up.</p> <p><b>Shutdown</b> operation needs sequential steps like cooling and de-pressuring,</p>	3 marks for shut down



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	<p>pumping out, removal of residual content e.g. hydrocarbons, corrosive or toxic chemicals, water, oil, pyrophoric catalyst, disposal of effluents and sludge, drainage and blinding and isolation activities.</p> <p>Heat source should be cut off, cooling may be continued till required, where vacuum is possible due to cooling, inert gas or air (if compatible) should be introduced to maintain atmospheric pressure, pumping out material after cooling and de-pressuring and pumped out hot oil should be cooled below its flash point. Residual hydrocarbons can be removed by purging with steam, water or water followed by steam. After purging, air should be allowed into the system. Residual water should be removed. Lastly running blinds should be removed and shutdown blinds should be installed.</p> <p style="padding-left: 40px;">If the shutdown is required due to any fault, the cause of the fault should be found, studied and removed before restarting the plant.</p> <p><b>Start up procedure of any Chemical Industry:</b></p> <p>Start up operation need special precautions after shut down ,</p> <p style="padding-left: 40px;">Starting sequence should be well defined, written and known to the worker involved in this work. Starting in sequence of utilities like water, air, power, purging, charging, slow and gradual heating , monitoring of pressure , Temperature, flow and reaction rate, cooling if necessary, starting of exhaust system, observing noise, vibration , speed, alignment are all important.</p> <p style="padding-left: 40px;">During start up if drains remain open, vent valves remain closed, wrong valves are operated , unwanted material enters over flame reaction, water where it is incompatible, air instead of steam or vice versa, less charging of material or catalyst, delayed cooling or heating not starting of any pump or instrument, no indication or</p>	3
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		<p>alarm.</p> <p>Correct identification of Pipelines, correct sequence of control operation , Counter check of other parameters and strict manual observation and satisfaction are requisite precautions for safe start up procedure.</p> <p>Attention should be paid on preparatory activity, verifying content, gradually reaching of working parameters and normal conditions.</p> <p>Verifying steam trap working for condensate discharge.</p>	
6	c	<p><b>Procedure for On-line maintenance of Stem Trap</b></p> <ol style="list-style-type: none"><li>1. In a chemical plant it is normal practice to do on line maintenance work</li><li>2. This avoids total shutdown of the equipment or plant</li><li>3. This is possible if proper pipe fittings are installed at the time of erection</li><li>4. If we provide a stand by pump in a process pipe ,it is possible to attend the faculty pump without stopping the production by using a stand by pump</li><li>5. When the pressure vessels like reactor ,distillation column, evaporator is leaking then it is difficult to do maintenances work without stopping the production</li><li>6. When the insulation get damaged due to any reason, it is possible to attend it without stopping production since insulation is fixed externally</li><li>7. Only precaution is to be taken if the pipe line or equipment is at high temperature ,suppose there is a steam trap in a pipe line .If we desired to replace a stem trap, we can close valve 1 and 2 and open 3 and divert the fluid through by-pass line</li><li>8. After replacement of the steam trap close valve 3 and open 1 and 2</li></ol>	4



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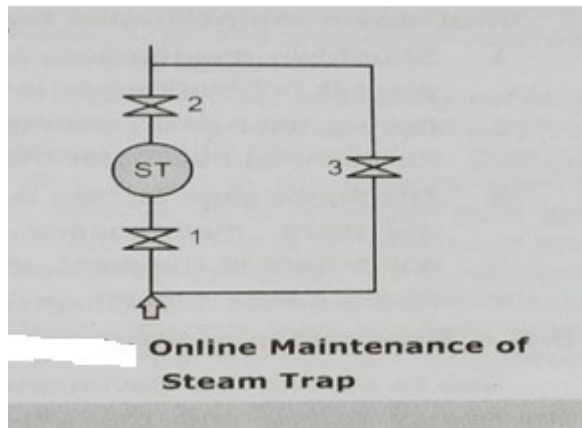
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Thus it is possible to attend maintenance job in the line without stopping the production



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