

i (b) What is ergonomics? Why is it important at a workplace

The term ergonomics is derived from two Greek words, 'ergon' meaning work and 'nomoi' meaning natural laws.

The importance of ergonomics lies in the fact that with the use of ergonomically - designed devices, stress-related issues can be brought down to a minimum. For instance, an ergonomically - designed keyboard can reduce repetitive stress injuries like Carpal Tunnel Syndrome, a disorder caused by repeating the same action (such as data entry) that can result in inflammation. Ergonomic keyboards are split down the middle, and have a design which allows you to comfortably rest your palms and wrists while typing.

Applying ergonomics to the Workplace:

- reduces the potential for accidents;
- reduces the potential for injury and ill health; and
- improves performance and productivity.

Ergonomics can reduce the likelihood of an accident.

For example, in the design of control panels.

Ergonomics can also reduce the potential for ill health at work, such as aches and pains of the wrists, shoulders and back. Consider the layout of controls and equipment; those used most often should be placed where they are easy to

- 2 -

Training for a specifically dangerous job must be supplemented with an adequate instructions by the master, char [unclear] hand or foreman.

Each industrial undertaking carries out a safety instruction programme for all the workers & other employees.

2(a) What is Job Hazard Analysis? Bring out the benefits of carrying out Job Hazard Analysis.

One way to increase the knowledge of hazards in the workplace is to conduct a job hazard analysis tasks. A Job Hazard Analysis (JHA) is a procedure which helps integrate accepted safety and health practices into a particular operation.

Four basic stages in conducting a JHA are:

- Selecting the job to be analyzed.
- breaking the job down into a sequence of steps.
- identifying Potential hazards.
- determining preventive measures to overcome these hazard

The benefits of doing a Job Hazard Analysis:-

Initial benefits from developing a JHA will become clear in the preparation stage. The analysis procedure previously undetected hazards and increase the Job Knowledge of those participating. Safety and he is raised, communication between workers and supervisors is improved, and acceptan of safe work is promoted.

The completed JHA, or better still, a written work procedure based on it, can form the basis for regulations between supervisors and workers on health and safety. It can serve as a teaching aid for initial job analysis. It can be used as a standard for health and safety inspections and it will assist in completing comprehensive accident investigations

reach without the need for stooping, stretching or hunching.
Failure to observe ergonomics principles may have serious
repercussions, not only for individuals, but whole organisations.
Many well-known accidents might have been prevented if ergonomics
had been considered in designing the jobs people did and the
systems within which they worked.

Q (b) Write briefly on task analysis with an example.

Task analysis or hierarchical task analysis (HTA), is a broad task analysis method, which describes the task in terms of a hierarchy of operations and plans based on structure chart notation. The hierarchical task analysis prompts the analyst to establish the conditions when various sub-tasks should be carried out in order to meet a system's goals. This method produces a hierarchy of three levels of task analysis : Goals (external task) : System state that the human wishes to achieve, Tasks : Structured set of activities in some sequence to achieve goals, Operations or actions : different things that a person must do within a system; Simple tasks having no control structure.

The main characteristics of the HTA :-

- 1) The goal decomposition is based on a person's verbalisation (interview, thinking aloud methods) and thus on his mental representation of the activity.
- 2) Each sub-goal and activity may be described by a verb and a name
- 3) Each sub-goal or activity has a number.
- 4) Each plan has a number.

Advantages

- This method is easy to learn & to use.
- The hierarchical structure of this task analysis approach

allows the analyst to concentrate on crucial aspects of the task within the context of the overall task. Also other specific techniques of task analysis may be applied.

- This method is best developed as a collaboration between the task analyst and user involved in operations. Thus the analyst should operate in accordance with the perceived needs of people who are users of the system. This method can form the basis of many other assessments, such as the communication analysis.
- The hierarchical task analysis is commonly used and widely accepted in cognitive task analysis.
- The HTA is very powerful because it can be applied to different types of physical and mental activities & different domains of applications.

3 (a) Explain human error analysis and fault tree analysis.

It is also called as human error theory. In this theory it is considered that the accidents are caused due to chain of events of human errors.

The (3) major factors that lead to human errors are :-

- (i) Over load
- (ii) In appropriate response
- (iii) In appropriate activities

Human Factors theory

Overload

- Environmental factors (Noise, Distractions)
- Internal factors (Personal problems, emotional stress)
- Situation Factors (Unclear instructions, risk level)

Inappropriate response

- Detecting a hazard but not correcting it
- Removing safe guards from machines & equipment
- Ignoring safety

Inappropriate activities

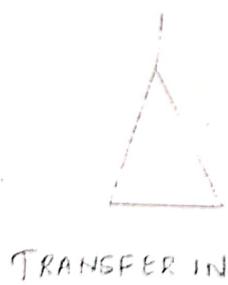
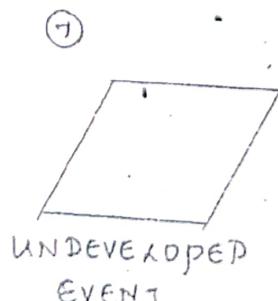
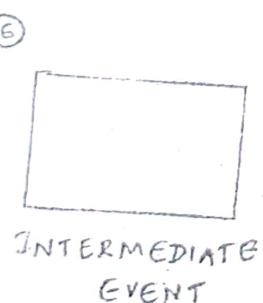
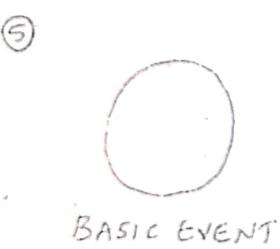
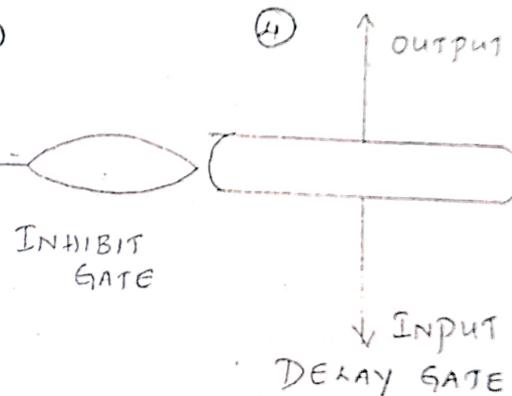
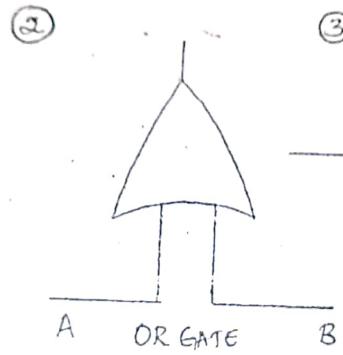
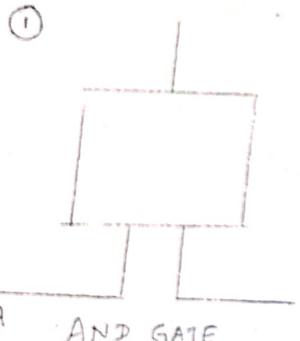
- Performing tasks without the requisite Training
- Misjudging the degree of risk involved with a given task

(i) Overload :- Overload amounts to excess loading beyond carrying capacity of a person.

A person's capacity depends upon his / her natural ability, training, state of mind, stress, fatigue & physical

FAULT TREE ANALYSIS:

Fault tree Analysis can be used to predict and prevent accidents or as an investigating tool. FTA is an analytical methodology that uses a graphic model to display the analysis process visually. A fault tree is built of special script symbols. Some derived from Boolean Algebra. Consequently the resultant model resembles a logic diagram or a flowchart. Some of the symbols used in constructing a fault tree are given below.



The figure shows how these symbols may be used for construct a fault tree. The PTA is developed using the following steps.

- (i) Decide an accident or incident to be placed at the top of the tree.
- (ii) Identify the highest level of failure or fault event that could contribute to the top event. Assign the appropriate symbols.
- (iii) move downwards through successively more specific levels until basic events are identified. Experience, deliberation and systematic analysis are very important in constructing a fault tree. Once a fault tree has been constructed. It is examined to determine the various combinations of failure or fault even that could lead to the top event.
- (iv) The final step involves marking recommendations for preventive measures.

4(a) What is Emergency response plan? What is the role played by the persons in emergency response plan?

Emergency Response Plan:- It is a network system which focus on the emergency control centre (Ecc), The Incident controller (IC) and the Incident Site (IS).

Personal of the emergency response team:

(i) Site main controller (smc) - The top executive incharge of the unit.

(ii) Incident controller (IC) - The shift-in-charge

(iii) Deputy incident controller (Dy IC) is a shift Person next to Incident controller.

(iv) Essential workmen (EW) - are the shift people from various departments.

(v) Other key persons - Key heads of various department

The above personal will be the people who monitor the emergency plan at the work place. In case of emergency or any incident takes place above personal will take care of the situation.

4(b) Requirements of emergency response plan

The requirements of emergency response plan includes:

- (i) emergency organisation
- (ii) scenario's vulnerability zones, consequences, 280 Risk Curves.
- (iii) Emergency control centres (main and alternate), their locations, sirens, assembly points, escape, evacuation & rescue, first aid, medical & transport.
- (iv) Declaration of emergency & communication system.
- (v) check list sequence of emergency shut down.
- (vi) Atmospheric stability class prevalences & wind velocity orientation & percent prevalences.
- (vii) sites & area maps.
- (viii) Roles & Responsibilities of essential persons.

5 Discuss briefly the problems related to safety & health and their prevention in the following industries.

a) pharmaceutical Industry

- The pharmaceutical Industry consists of
- Bulk drug manufacturing
 - Drugs manufacturing

Problems related to safety and health are :-

- 1) Chemical pollution
- 2) Toxic pollution
- 3) Toxic gases
- 4) Hazardous wastes
- 5) Noise pollution

The general safety measures including Personnel protective equipment must be followed such as gloves, protection to mouth and nose etc.

b) Textile Industry

The textile industry includes:-

- 1) Cotton textile mills.
- 2) Synthetic textile mills
- 3) Silk textile mills
- 4) Rayon/ fabric mills

Problems related to safety & health includes :

- (i) Air pollution
- (ii) Respirable dust pollution
- (iii) Noise pollution
- (iv) Chemical pollution - Toxic chemicals
- (v) Colour problem
- (vi) Odour problem

General safety measures include Personal Protection equipment (PPE) must be followed.

(c) Construction Industry

Problems associated with construction industry are

- i) Falling of materials from elevated places/floors
- ii) Dust and respiratory problems to the workers or labours.
- iii) Noise pollution of machines
- iv) Electrical accidents.
- v) Fire hazards or accidents
- vi) Large quantity of debris
- vii) Scaffolding i.e loose or less bolting of scaffold
- viii) Damage to foot by the materials such as cement, paints, chemicals etc.
- ix) Due to improper sign posts/danger/warn signs.
- x). odour nuisance.

Safety and preventive measures against specific hazards

- 1) All open sites of buildings should be covered or barricaded.
- 2) Standard safety signs should be used in the work site
- 3) For elevated places secure access and foot hold should be provided.

- A) All lifting equipments should be load tested before use, so that the materials will not overload the machinery or lifts.
- B) Fire fighting measures should be installed during the construction. Only stair cases should be used during fire hazard instead of lift.
- C) Workers should not be allowed under suspended loads.
- D) The enclosed places must be adequately ventilated. Proper lighting should be provided.
- E) Personnel protective equipment such as helmets, gloves, foot wear etc should be provided to the workers.
- F) Safety belts should be provided.
- G) Scaffolding should be constructed according to the standard engg. practice.
- H) Labour / workers should be insured.
- I) Safety regarding electrical accidents should be provided.

d) Iron and Steel Industry

This industry includes -

- 1) Manufacture of wrought iron
- 2) Manufacture of carbon steel

Problems

- 1) High Temperature (100-500°C)
- 2) Number of different substances
- 3) Noise pollution
- 4) Use of organic solvents
- 5) Air pollution

Foundries

- 1) Iron and Steel Foundries
- 2) Various processes induce injury to the skin
- 3) Hazard due to gases and vapours.
- 4) Use of phenols and phenolic compounds
- 5) High Temperature effect
- 6) Air pollution.

f) LPG bottling plants

The problems associated do safety and health are :

- 1) Huge storage tanks
- 2) Volatility problems
- 3) Fire hazards
- 4) Explosion hazards

The prevention measures to be taken in the LPG bottling plants are :

- 1) Fire fighting system must be in place.
- 2) Fire Retardents must be used.
- 3) Fire protection gears must be supplied.
- 4) Fire protection clothing must be used.