USN | | | | | | | | | | |

Internal Assessment Test II – March. 2018

Sub:	INDUSTRIAL SAFETY					Sub Code:	15ME662	Branch:	MECHANICAL
Date:	19/04/2018	Duration:	90 min's	Max Marks:	50	Sem/Sec:	6th Sem A &B		OBE

Answer any FIVE FULL Questions

		MARKS	CO	RBT
1.	What is electric shock? Explain effect of electric current on human body	[10]	CO1	L1
2.	Write the safety procedure in electrical plant.	[10]	CO1	L1
3.	Explain the prevention of electrical accidents.	[10]	CO1	L2
4. (a)	What is PPE? List out all the PPE's and their function.	[05]	CO1	L1
(b)	What is primary and secondary shock? Explain AC and DC current shock.	[05]	CO1	L1
5.	State safety precaution while working with welding machine and grinding machine.	[10]	CO1	L1
6.	Write safety precaution while working with corrosive material and compressed gas cylinder.	[10]	CO1	L1

USN | | | | | | | | | | |

Internal Assessment Test 1 – March. 2018

Sub:	INDUSTRIAL SAFETY					Sub Code:	15ME662	Branch:	MECHANICAL
Date:	13/03/2018	Duration:	90 min's	Max Marks:	50	Sem/Sec:	6th Sem A &B		OBE

Answer any FIVE FULL Questions

		MARKS	CO	RBT
1.	What is electric shock? Explain effect of electric current on human body	[10]	CO1	L1
2.	Write the safety procedure in electrical plant.	[10]	CO1	L1
3.	Explain the prevention of electrical accidents.	[10]	CO1	L2

4. (a)	What is PPE? List out all the PPE's and their function.	[05]	CO1	L1
(b)	What is primary and secondary shock? Explain AC and DC current shock.	[05]	CO1	L1
5.	State safety precaution while working with welding machine and grinding machine.	[10]	CO1	L1
6.	Write safety precaution while working with corrosive material and compressed gas cylinder.	[10]	CO1	L1

Solution of 1st IAT

1. Electric shock is a sudden stimulation of the nervous system of human body by the flow of electric current through a part of the body.

The effects of electric shock on the human body depend on several factors. The major factors are:

1. Current and Voltage
2. Resistance
3. Path through body
4. Duration of shock

The muscular structure of the body is also a factor in that people having less musculature and more fat typically show similar effects at lesser current values.

CURRENT AND VOLTAGE

Although high voltage often produces massive destruction of tissue at contact locations, it is generally believed that the detrimental effects of electric shock are due to the *current* actually flowing through the body. Even though Ohm's law (I=E/R) applies, it is often difficult to correlate voltage with damage to the body because of the large variations in contact resistance usually present in accidents. Any electrical device used on a house wiring circuit can, under certain conditions, transmit a fatal current. Although currents greater than 10 mA are capable of producing painful to severe shock, currents between 100 and 200 mA can be lethal. With increasing alternating current, the sensations of tingling give way to contractions of the muscles. The muscular contractions and accompanying sensations of heat increase as the current is increased. Sensations of pain develop, and voluntary control of the muscles that lie in the current pathway becomes increasingly difficult. As current approaches 15 mA, the victim cannot let go of the conductive surface being grasped. At this point, the individual is said to "freeze" to the circuit. This is frequently referred to as the "let-go" threshold. As current approaches 100 mA, ventricular fibrillation of the heart occurs. Ventricular fibrillation is defined as "very rapid uncoordinated contractions of the ventricles of the heart resulting in loss of synchronization between heartbeat and pulse beat." Once ventricular fibrillation occurs, it will continue and death will ensue within a few minutes. Use of a special device called a de-fibrillator is required to save the victim. Heavy current flow can result in severe burns and heart paralysis. If shock is of short duration, the heart stops during current passage and usually re-starts normally on current interruption, improving the victim's chances for survival.

RESISTANCE

Studies have shown that the electrical resistance of the human body varies with the amount of moisture on the skin, the pressure applied to the contact point, and the contact area. The outer layer of skin, the epidermis, has very high resistance when dry. Wet conditions, a cut or other break in the skin will drastically reduce resistance. Shock severity increases with an increase in pressure of contact. Also, the larger the contact area, the lower the resistance. Whatever protection is offered by skin resistance decreases rapidly with increase in voltage. Higher voltages have the capability of "breaking down" the outer layers of the skin, thereby reducing the resistance. If skin resistance is high, much energy may be dissipated at the surface as current passes through the skin, and large surface burns can result at the entry and exit points.

PATH THROUGH BODY The path the current takes through the body affects the degree of injury. A small current that passes from one extremity through the heart to the other extremity is

capable of causing severe injury or electrocution. There have been many cases where an arm or leg was almost burned off when the extremity came in contact with electrical current and the current only flowed through a portion of the limb before it went out into the other conductor without going through the trunk of the body. Had the current gone through the trunk of the body, the person would almost surely have been electrocuted. A large number of serious electrical accidents in industry involve current flow from hands to feet. Since such a path involves both the heart and the lungs, results can be fatal.

DURATION OF SHOCK

The duration of the shock has a great bearing on the final outcome. If the shock is of short duration, it may only be a painful experience for the person. If the level of current flow reaches the approximate ventricular fibrillation threshold of 100 mA, a shock duration of a few seconds could be fatal. This is not much current when you consider that a small light duty portable electric drill draws about 30 times as much. At relatively high currents, death is inevitable if the shock is of appreciable duration; however, if the shock is of short duration, and if the heart has not been damaged, interruption of the current may be followed by a spontaneous resumption of its normal rhythmic contractions

2. Safety procedure in electrical plant are

1. Isolation of the part from live parts during the period of installation, testing and maintenance. No switching on by mistake.
2. Danger notices and safety notices should be placed at work place.
3. The neighbouring switches should be locked open to avoid switching by a third person.
4. **Earthing.** The work equipment and conductors should be isolated and then earthed by means of earthing connections, from all ends/incomers/outgoers.
5. Proper tools, safety devices should be provided to the electricians.
6. The electricians should be well trained.
7. First aid should be available.
8. Switching on should be allowed only after completion of work, after cancellation of the permit by the authority.

   Death can be caused even on 400 V installations, because of negligence.
9. Follow the safety rules faithfully.
10. Take permission from authorised person for doing specific work. Fill up 'Work Permit' form, get signed. Work Permit form should be returned to issuing authority after completion of work.
11. Make sure to switch-off the supply from all the ends. The switching-off and switching-on should be as per safety rules and with prior permission of the authorised person.

    The repair/maintenance work of High Voltage Apparatus should not be undertaken unless the apparatus is made DEAD and Isolators are open and locked, Earthing Switches closed and Locked. HV conductor should be discharged and connected security to earth.
12. Place caution notice and danger notices near the work place and near the switching terminals.
13. Use safety shoes, safety belt, gloves hat.
14. Do not use wet clothes, wet shoes, metal tapes.

3. Prevention of electrical accidents

a. **Have only licensed electricians install, repair and dismantle jobsite wiring.** That way, everything will be completed according to electrical safety codes, ensuring greater protection for the workers who will be using the wiring to power tools and equipment. Bringing in a professional electrician also prevents the injuries that result when less-qualified individuals attempt electrical jobs that they aren't properly trained to do.

b. **Always plug into a GFCI.** Ground Fault Circuit Interrupter protection is required at every plug-in point associated with your jobsite's temporary electrical supply - right down to extension cords. Make sure that only GFCI receptacles are installed, and that portable GFCIs are kept on hand in case additional grounding needs arise.

c. **Check each extension cord before use.** Ensure that insulation is completely intact (free from cracks, tears, or abrasion) and that power extension cables haven't been knotted, which can cause conductor damage and increase the risko fire

d. **Do a thorough check for electrical wiring before cutting through any wall, floor or ceiling.** Any time that a tool inadvertently makes contact with an unseen electrical line, the person holding that tool is likely to be shocked or electrocuted. Always size up the situation before you get started to reduce your risk of injury.

e. **Inspect power tools on a regular basis.** Look over the tools' power cords and plugs for any sign of damage to the insulation, blades, or grounding pin. If you find signs of excessive wear and tear, take tools out of commission until they've been properly repaired. Maintain awareness during electrical tool use as well; if a tool starts to overheat, smoke, give off a burning smell, or shock you on contact, discontinue use immediately.

f. **Check insulated tools for damage before each use.** Once the insulation layer of an insulated hand tool becomes nicked, cracked or cut, the tool is no longer effectively insulated - it actually becomes more of an electrical conductor, and can increase your risk of injury. If a tool has damaged insulation, it is no longer safe to use - destroy and replace it right away.

g. **Never modify electrical plugs.** Under no circumstances should you ever file down the blades, remove the ground pin, or otherwise modify an electrical plug so that it will fit into a socket - doing so only increases the likelihood of shock, electrocution, and fire. Either have a certified electrician change the device's plug, or replace outdated two-prong receptacles with grounded outlets that can accommodate a ground pin.

h. **Keep extension cords in a safe place where they won't be stepped on or driven over.** The force of a vehicle - or even repeated treading by pedestrians - can cause an extension

cord's conductor to become misshapen or break, a problems that can lead to electrical fires. Because it occurs in the core of the cable, conductor damage isn't always obvious to the eye, so play it safe from the start by guarding jobsite extension cords with heavy-duty cord covers.

4. (a) Personal protective equipment (PPE) refers to protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection.

PPE for the Head

Employees must wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts

Protective helmets into two different types and three different classes.

Type 1 helmets incorporate a full brim (brim fully encircles the dome of the hat) helmets offer protection from blows to the top of the head

Type 2 helmets have no encircling brim, but may include a short bill on the front. Helmets offer protection from blows to both the top and sides of the head

- Class A Helmets reduce the force of impact of falling objects and also reduce the danger of contact with exposed low-voltage electrical conductors. Helmet shells are proof-tested at 2,200 volts of electrical charge.
- Class B Helmets reduce the force of impact of falling objects and also reduce the danger of contact with exposed high-voltage electrical conductors. Helmet shells are proof-tested at 20,000 volts.
- Class C Helmets reduce the force of impact of falling objects, but offer no electrical protection

PPE for the Eyes & Face

Employees shall wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion.

(b).

Primary: Injury or death can occur whenever electric current flows through the human body. Currents of less than 30 mA can result in death. A thorough coverage of the effects of electricity on the human body is contained in the section of this module entitled Effects

Secondary: Although the electric current through the human body may be well below the values required to cause noticeable injury, human reaction can result in falls from ladders or

scaffolds, or movement into operating machinery. Such reaction can result in serious injury or death.

The three basic factors that determine what kind of shock you experience are the amplitude of the current, the duration of the current passing through the body, and the frequency. Direct Currents actually have zero frequency, as the current is constant. However, there are physiological effects during electrocution no matter what type of current. The factor deciding the effects of the AC and DC current is the path the current takes through the body. If it is from the hand to the foot, it does not pass through the heart, and then the effects are not so lethal. However DC current will make a single continuous contraction of the muscles compared to AC current, which will make a series of contractions depending on the frequency it is supplied at. In terms of fatalities, both kill but more milliamps are required of DC current than AC current at the same voltage.

5. Welding machine

a. Wear PPE
b. Remove all flammable material, such as cotton, oil, gasoline, etc., from the vicinity of welding.
c. Keep a suitable fire extinguisher nearby at all times
d. Do not leave hot rejected electrode stubs, steel scrap, or tools on the floor or around the welding equipment
e. Do not permit unauthorized persons to use welding or cutting equipment.
f. Proper ventilation should be provided
g. Obey the instructions given by the instructor
h. Gain sufficient knowledge before using machine

Grinding machine

a. Wear PPE
b. Remove all flammable material, such as cotton, oil, gasoline, etc., from the vicinity of welding.
c. Keep a suitable fire extinguisher nearby at all times
d. Gain sufficient knowledge before using machine.
e. Proper ventilation should be provided
f. Obey the instructions given by the instructor
g. Machine must be maintained and serviced regularly
h. Proper safety guard must be provided

6.

Corrosive material

a. Always handle containers of corrosives carefully. Damaged containers may leak
b. Acid containers, such as drums and carboys, can cause particular problems if they are not handled and stored safely.

c. Dispense from only one container at a time. Finish all the dispensing of one material before starting to dispense another
d. Gain sufficient information about the material
e. Proper ventilation should be provided
f. Always store material at low temperature region

Compressed gas

a. Secure cylinders upright with a chain or strap in a proper cylinder cart.
b. Store cylinders at least 20 feet from combustible materials in a dry, ventilated place.
c. Keep oxygen cylinders at least 20 feet from fuel gas cylinders.
d. Ensure valves are completely closed and any protection devices are secured.
e. Avoid storing cylinders in lockers – a leak could result in a dangerous gas buildup.
f. Use proper warning signs in areas where cylinders are stored.
g. Keep cylinders in a location free from vehicle traffic, excessive heat and electrical circuits.
h. Keep empty cylinders away from full ones.