

# **LABORATORY SAFETY MANUAL**

## **Machine shop**



**BANGLADESH UNIVERSITY OF  
ENGINEERING  
AND TECHNOLOGY**

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**Disclaimer:**

The safety measures mention in this manual are applicable for general activities in the laboratory. Students and lab stuffs are asked to follow additional safety measures if it's necessary for any specific experiment.

## Table of Contents

1. Emergency.....	4
1.1 What is an Emergency? (Definitions).....	4
1.2 What to do in Case of an Emergency? .....	5
1.3 FIRE EXTINGUISHER INSTRUCTIONS (PASS) .....	6
1.4 What if you or people are trapped in a burning building? .....	6
2. General Conduct (All Laboratories).....	7
2.1 Behavior in the Laboratories:.....	7
2.2 Personal Habits .....	7
2.3 Housekeeping.....	7
2.4 Personal Protective Equipment .....	8
3. Heavy Equipment.....	8
3.1 When using heavy equipment, there are five basic guidelines that employees must always follow to ensure safety: .....	8
3.2 Ensure the following before leaving equipment unattended: .....	9
4. Welding safety rules.....	9
5. Physical safety symbols.....	10
.....	15
6. Reference .....	16

## Safety manual

This safety manual is applicable for Machine Shop. This will help both students and laboratory instructors to know about the safety features and safe work practices inside the laboratory.

### 1. Emergency

#### 1.1 What is an Emergency? (Definitions)

Sudden, unexpected, or impending situation that may cause injury, loss of life, damage to the property, and/or interference with the normal activities of a person or group and which, therefore, requires immediate attention and remedial action.

Following situations may be regarded as emergency:

- 1) A sudden, urgent, usually unexpected occurrence or occasion requiring immediate action
- 2) A state, especially of need for help or relief, created by some unexpected event

### Emergency Contact List

Designation	Phone No.	BUET Office
BUET telephone operator(PABX)	55167100	0

#### Medical Centre:

Emergency ambulance service/Medical officer	6666 (BUET Office)
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Designation	Name	Phone No.	BUET Office
Chief Medical officer	Dr. Md. A. K.Masud	01916740809	7344
Senior medical officer	Dr. Mohammad Mashuk Elahi	01552416578	7393
Medical officers	Dr. Md. Hasib iskandar	01720960997	7893
Medical officers	Dr. Md. Mubashwirul islam	01679222750	7817

#### Fire service and civil defense:

Fire Brigade Emergency/Enquiry	199
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Place	Mobile	Phone
Polashi	01716354370	02-8628688
Mirpur Road	01730002229	02-9001055
Mohammadpur	01712970093	02-9112078

#### Police & Security:

Designation	Number
Emergency Call	999
DMP Police Emergency	01713398311,9551188

**Directorate of Students' Welfare (DSW):**

Designation	Name	Phone No.	BUET Office
DSW	Dr. Md. Mizanur Rahman	01911346993	6135,7143
Assistant DSW	Dr. Md. Raquibul Hossain	01819557960	7224
Associate Directors	Dr. Mohammad Faisal	01794692601, 01926714764	7713, 6168

**Residential Halls: (Updated at 03/08/2019)**

Hall Name	Designation	Name	Phone No.	BUET Office
Ahsan Ullah Hall	Assistant Provosts	Dr. Md. Iqbal Hossain	01927885215	7430
Kazi Nazrul islam Hall	Assistant Provosts	Dr. Mahbub Hasan	01820291811	7833
Titumir Hall	Assistant Provosts	Dr. Md. Muktedir Billah	01840702279	7718
Sher-e-Bangla Hall	Assistant Provosts	Dr. Md. Shahinoor islam	01922544639	7933
Suhrawardy Hall	Assistant Provosts	Dr. Mohammad Khurshed Alam	01712526059	6390
Shahid Smrity Hall	Assistant Provosts	Dr. Rupak Mutsuddy	01839848062	7224
Chattri Hall	Assistant Provosts	Nishat Sultana	01757786310	7735
Dr.M.A.Rashid Hall	Assistant Provosts	Dr. Md. Shafiul Azam	01535495622	7470

**University security & others:**

Designation	BUET Office
Security Emergency Call	7777
Security officer	7482
Electricity & Plumbing	7323
Machine Room	7589
Shaheed Minar Gate(Main Gate)	7812
West Palashi ( Main Gate)	6592
Bakshi Bazar R/A Gate	7825
Dhakeswari R/A Gate	7759
Palashi R/A Gate	7692
Azad R/A Gate	7760
71,72 No. Building Gate	6330

**1.2 What to do in Case of an Emergency?*****In the event of an emergency,***

- Get out of immediate danger!
- Report situation to the instructor
- Explain the nature of the emergency.
- Provide your name and location.
- Provide the phone number from which you are calling.
- Answer all questions and do not hang up the phone until the operator is finished.

***If the emergency has cause injury to a person,***

- Provided it is safe for you, stay with the victim!
- If the victim is conscious, ask what the problem is.
- If the victim is unconscious, check for breathing and bleeding. Do not move the individual until trained personnel arrive or an immediate threat to life exists. Only trained individuals should administer first aid and CPR.
- Keep the victim still, comfortable, and ventilated.
- Protect the victim from any disturbances.
- Search for any emergency identification (i.e. ID)
- Wait for emergency help to arrive. Never leave the victim alone if possible.
- Once the emergency responders have arrived, stay out of the way of emergency personnel and emergency vehicles!

***What to do in case of a fire or smoke?***

All situations related to fire should be taken seriously. If you hear or see anything uncertain, evacuate the building!

***If fire or smoke is discovered anywhere on or about the campus:***

- Leave the area where the fire is located, isolating it as well as possible by closing doors and windows around it.
- Activate the fire alarm switch.
- Do not attempt to retrieve valuables.
- Do not use Elevators /lifts .
- Never attempt to fight a fire larger than wastebasket size. Even a small fire can generate enough smoke to cause serious injury. Never attempt to fight a fire by yourself. Call for help. Always stay between the fire and the exit.

***If you can't evacuate:***

- Find a safe location and call emergency.
- Crawl to the door on hands and knees, so you can breathe the fresher air near the floor.
- Seal your room against entering smoke.
- If it's still smoky in your room, breathe through a wet towel that covers your nose and mouth. Breathe only through your nose.
- Clear flammable debris from the window.

**1.3 FIRE EXTINGUISHER INSTRUCTIONS (PASS)**

- P \* PULL** safety pin from the handle
- A \* AIM** at the base of the fire
- S \* SQUEEZE** the trigger handle
- S \* SWEEP** foam side to side



**1.4 What if you or people are trapped in a burning building?**

- The universal sign for a person trapped in a burning building is to hang clothing or a sheet out of the window of the room where you are trapped. The firefighters then will know where you are trapped.
- If you are aware that someone is trapped in a burning structure, inform the firefighters immediately.
- Do not re-enter the building alone.
- If you are trapped, stay low to the ground as you try to exit. Do not open any doors that feel hot. Use wet towels or clothes to protect you from flames and smoke.
- If your clothes catch fire, STOP, DROP, AND ROLL!!!

## 2. General Conduct (All Laboratories)

### 2.1 Behavior in the Laboratories:

- Act in a professional manner at all times.
- Visitors must be escorted.
- Contact information is to be posted on all laboratory doors. If an experiment is being run unattended, the experiment contact information must be displayed.
- Students must be aware of the location and proper operation of laboratory safety equipment, i.e. fire extinguishers, flammable cabinets and fume hoods, eye-wash stations, and personal protective equipment.

### 2.2 Personal Habits

- Be alert to unsafe conditions. It is the responsibility of each individual to assure a safe working environment for themselves and other workers in the laboratories.
- No eating, drinking, gum chewing or cosmetic application in the labs.
- Closed toed shoes must be worn at all times in active laboratory areas. No sandals!
- Long hair and loose clothing shall be confined. Appropriate clothing must be worn at all times. No shorts, capris, skirts, or sleeveless shirts where chemicals or machines are present.
- Proper Personal Protective Equipment (PPE) must be worn (see Section 4.4). Users of the Lab must be familiar with the hazards of the materials with which they are working. Consult the MSDS sheets, before working with any hazardous chemicals.
- No glassware or utensils that are used for laboratory operations shall be used for storage, handling, or consumption of food or beverages.
- Hands should be washed before using the restrooms and before eating. Areas of exposed skin, i.e. forearms, should be washed frequently if there is potential of contact with chemicals.
- Do not conduct any unauthorized experiments.
- Personnel must have pre-approval by his/her direct supervisor in order to perform work alone.
- Work should not be conducted if the researcher is feeling tired or otherwise impaired.

### 2.3 Housekeeping

- Lab areas are to be kept clean and uncluttered. This will help prevent spillage, breakage, personal injuries and unnecessary contact with chemicals.
- Contaminated glassware should be cleaned daily.

- Small spills shall be cleaned up immediately from work areas and floors. (Contact Safety & Risk Management for large hazardous spills.)
- Doorways and walkways within the lab shall not be blocked or used for storage.
- Access to exits, hallways, emergency equipment, and utility controls shall remain accessible at all times.
- All tools and equipment shall be returned to their proper storage location after use.
- Chemical containers shall be properly emptied and cleaned prior to disposal. Glass bottles will be uncapped, washed out with an appropriate solvent, triple rinsed with water and placed in the glass container for disposal.
- All non-empty, non-cleaned containers must be labeled with a description of their content!

## **2.4 Personal Protective Equipment**

- Proper eye protection must be worn at all times in laboratories. Proper protection includes, but is not limited to, chemical splash safety goggles, face shields, and safety glasses.
- Students wearing contact lenses must be informed of the special hazards associated with their use, (i.e., absorption of chemicals from the air) and must inform their supervisors so that appropriate measures can be taken in an emergency.
- Chemical resistant gloves shall be worn whenever the potential for hazardous skin contact exists.
- Heat resistant gloves shall be used for handling hot objects.
- Abrasion resistant gloves (e.g. leather) should be worn for handling broken glass and other similar materials, but should not be used to handle chemicals.
- Before each use, gloves are to be inspected for damage and contamination, i.e., tears, punctures, discoloration. If deficiencies are noted, the gloves should be cleaned, repaired, or replaced before use.
- Contaminated gloves shall be removed before touching surfaces outside the work area (i.e., doorknobs, faucet handles).
- Shoes that cover the entire foot must be worn in active laboratory areas at all times. No sandals or open-toed shoes shall be worn in active laboratory areas.
- Laboratory coats shall be worn by laboratory employees whenever a reasonable risk of chemical exposure to skin or street clothing exists or when specified by standard operating procedures. They should be kept in an appropriate clean storage area.
- Disposable laboratory coats are recommended when working with highly toxic materials such as select carcinogens, mutagens or teratogens.
- Chemical protective clothing must be removed before leaving the work area.
- Hearing protection (noise attenuating ear muffs or plugs) are required whenever employees are exposed to 85 dB A or greater as an eight hour time weighted average.

## **3. Heavy Equipment**

### **3.1 When using heavy equipment, there are five basic guidelines that employees must always follow to ensure safety:**

Know how to properly operate the equipment you are using.

Do not use heavy machinery when you are drowsy, intoxicated, or taking prescription medication that may affect your performance.



Use only equipment that is appropriate for the work to be done. Inspect your equipment to ensure that it is in good working condition before beginning a job. In addition, ensure that regular inspections and maintenance are conducted as appropriate. Do not stress or overload your equipment. Accidents do not just happen, they are caused. Therefore, employees should also follow these guidelines.





### **3.2 Ensure the following before leaving equipment unattended:**







- All buckets, blades, etc. are on the ground.
- Transmission is in neutral.
- Engine is off.
- Equipment is secure against movement.
- Never get on or off moving equipment.
- Do not attempt to lubricate or adjust a running engine.
- Turn the engine off before refueling.
- Keep all shields and safety guards in place.
- Avoid underground utilities and overhead power lines.
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### **4. Welding safety rules**

- Proper clothing must be worn in the shop at all times.
- Students will keep long hair tied up, in the front and the back, bangs will not hang in front of eyes while in the lab.
- Shirts must be tucked in.
- Ties, rings, necklaces, and other jewelry must be removed prior to working in the shop.
- Work boots must be worn – no exceptions
- Safety glasses must be worn at all times – no exceptions.
- Guards and protective devices must not be removed from any machine and must be used at all times.
- Unattended machines must not be left running.
- Lab areas must be cleaned daily. (Welding –cutting areas).
- Any machine or equipment not working properly must be reported to the instructor at once.
- Students will not operate machines or equipment until they have received safety and operational instructions.
- Fire extinguishers are to be used only for extinguishing fires.
- Report all accidents to the instructor at once, no matter how serious.
- No horseplay in the shop will be tolerated.
- Do not weld on tables. No exceptions.
- Welding rods and stubs will be placed in the proper receptacle each day.
- Students will not remove any parts from machinery and/or equipment without instructor permission.
- No food or drink allowed in the lab area.
- Students will not abuse machinery and/or equipment at any time.
- Students will not talk to or distract other students that are using equipment and/or machinery.
- Ear plugs must be used when grinding.
- All tools will be returned to the tool room at the end of each period.

5. Physical safety symbols

	<p><b>Symbol for Gloves</b> Gloves must be worn while working in the laboratory. It is important to choose the appropriate type of glove.</p>
	<p><b>Symbol for Boots</b> Closed toe shoe that cover the entire feet must be worn all time while working in the laboratory.</p>
	<p><b>Symbol for Protective Clothing</b> Apron must be worn while working in the laboratory.</p>
	<p><b>Symbol for Safety Glasses</b> Safety glass must be worn while working with chemicals.</p>
	<p><b>Symbol for Breathing Masks</b> Use breathing mask while working in an area with potentially contaminated air.</p>
	<p><b>Symbol for Face shields</b> Face shields must be worn when executing experiments that carry the potential of causing an explosion inside of the hood.</p>
	<p><b>Symbol for Hearing Protection</b> There is a wide variety of hearing protection devices available. Use one according to your need in the laboratory</p>
	<p><b>Symbol for Wash Hands</b> Hand washing is a primary safeguard against inadvertent exposure to toxic chemicals or biological agents. The wash hands safety sign lets lab personnel know to wash their hands.</p>
	<p><b>Symbol for Food &amp; Drink Prohibited</b> No food and drink is allowed inside the laboratory. Especially during class hours.</p>

	<p><b>Symbol for Fire Extinguisher</b> it's important that every lab be prepared with the correct fire extinguisher, inspection requirements, and training.</p>
	<p><b>Symbol for No Open Flames</b> Open flame devices carry with them the risk of unintentional fire and serious consequences when not used appropriately. So be careful about open flame.</p>
	<p><b>Symbol for Poison/Toxic Material</b> The toxic material symbol indicates the presence of substances that may harm an individual if they enter the body.</p>
	<p><b>Symbol for Explosive Hazard</b> The exploding bomb symbol will appear on chemicals in the lab that have explosive properties</p>
	<p><b>Symbol for Flammable &amp; Combustible Substances</b> The flammable and combustible symbol signifies substances that will ignite and continue to burn in air.</p>
	<p><b>Symbol for recycling storage</b> The recycling sign is used in labs to indicate where recyclable items are gathered and sorted.</p>

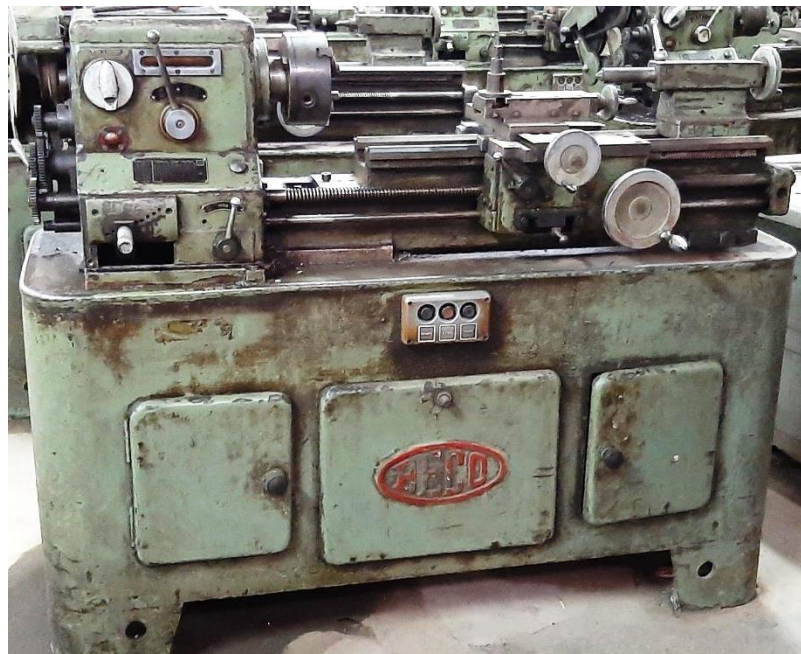
## Some tools and machines:



### Bench and Hand tools with vise

A workbench is a sturdy table at which manual work is done. They range from simple flat surfaces to very complex designs that may be considered tools in themselves.

Vise, also spelled Vice, device consisting of two parallel jaws for holding a workpiece; one of the jaws is fixed and the other movable by a screw, a lever, or a cam. When used for holding a work piece during hand operations, such as filing, hammering, or sawing, the vise may be permanently bolted to a bench.



### Lathe Machine

Commonly known uses of lathe machines are metalworking, metal spinning, wood turning, and glass working. Lathe machines have many uses in industrial area like sanding cutting, knurling, drilling, and deforming of tools that are employed in creating objects which have symmetry about the axis of rotation.

Safety requirements:

1. Boots required
2. Protective clothing required
3. Safety glasses required
4. Hand gloves required
5. Helmet Required



**Gemco shaper machine**



**Shaper Machine**

A shaper is a type of machine tool that uses linear relative motion between the work piece and a single-point cutting tool to machine a linear tool path. Its cut is analogous to that of a lathe, except that it is (archetypally) linear instead of helical.

A metalworking shaper is somewhat analogous to a metalworking planer, with the cutter riding a ram that moves relative to a stationary work piece, rather than the work piece moving beneath the cutter. The ram is typically actuated by a mechanical crank inside the column, though hydraulically actuated shapers are increasingly used. Adding axes of motion to a shaper can yield helical tool paths, as also done in helical planing.

Safety requirements:

1. Boots required
2. Protective clothing required
3. Safety glasses required
4. Hand gloves required
5. Helmet Required

Swarf, also known as chips or by other process-specific names (such as turnings, filings, or shavings), are pieces of metal, wood, or plastic that are the debris or waste resulting from machining, woodworking, or similar subtractive (material-removing) manufacturing processes.

Every time students come in contact of swarf they should be careful and use their safety boots . The iron chips should be kept far from the work place .



**Iron chips (Swarf)**



**Radial drill**

drill head that is mounted on an arm assembly that can be moved around to the extent of its arm reach. The most important components are the arm, column, and the drill head.



**Milling machine**

Grinding is an abrasive machining process that uses a grinding wheel as the cutting tool. A wide variety of machines are used for grinding and circular grinder is one of them.

Milling is a process performed with a machine in which the cutters rotate to remove the material from the work piece present in the direction of the angle with the tool axis. With the help of the milling machines one can perform many operations and functions starting from small objects to large ones.

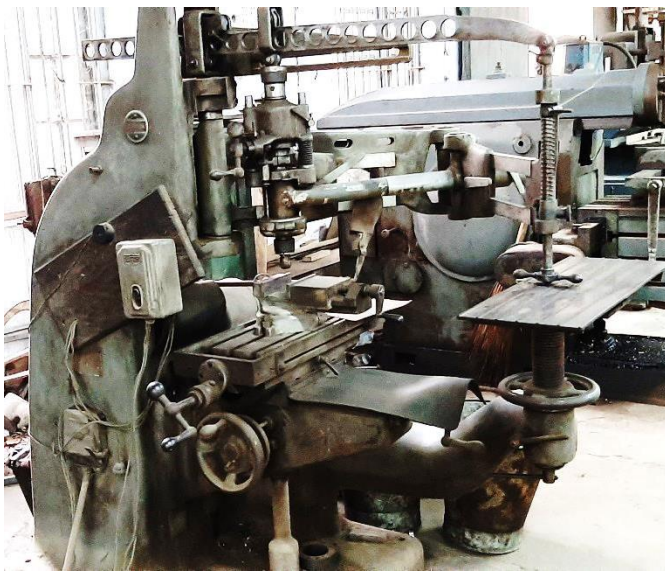
Safety requirements:

1. Boots required
2. Protective clothing required
3. Safety glasses required
4. Hand gloves required
5. Helmet Required

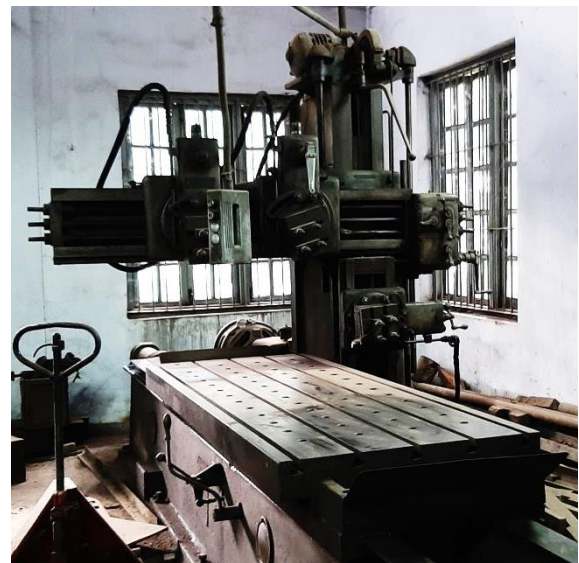


**Cranes inside the laboratory**

Inside the concrete laboratory different types of cranes are used to move heavy machineries and objects from one place to another place. Students should not use them without the permission of an instructor.



**Pantograph**



**Planer**

A pantograph is a mechanical linkage connected in a manner based on parallelograms so that the movement of one pen, in tracing an image, produces identical movements in a second pen.

A planer is a type of metalworking machine tool that uses linear relative motion between the work piece and a single-point cutting tool to cut the work piece. A planer is similar to a shaper, but larger, and with work piece moving, whereas in a shaper the cutting tool moves.

Safety requirements:

1. Boots required
2. Protective clothing required
3. Safety glasses required
4. Hand gloves required
5. Helmet Required

## 6. Reference

1. <https://www.labmanager.com/lab-health-and-safety/2017/09/science-laboratory-safety-and-hazard-signs-meanings>
2. <http://www.healthcareinspirations.com>
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4. <https://www.wikipedia.org>
5. <https://www.thesprucecrafts.com/safety-rules-every-woodworker-should-know-3536833>
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7. <https://emergency.vt.edu/ready/guides/building-fire/building-fire-during.html>