Hashemite University
Faculty of Engineering
Civil Engineering Department

# Geotechnical Engineering Lab

## List of Expirements

1. Determination of Water Content
2. Specific Gravity of sand
3. Grain Size Distribution Sieve Analysis
4. Grain Size Distribution Hydrometer Analysis
5. Atterberg Limit Liquid and Plastic Limit
6. Standard Proctor Compaction Test
7. Determination of Field Unit Weight of Compaction by Sand Cone Method
8. Constant Head Permeability Test
9. Direct Shear Test on Sand
10. Consolidation Test
11. Unconfined Compression Test

# Geotechnical Engineering Lab

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|---|
| Device Name: Can |
| Used For:  to determine water content |
| Experiment associated with it: water content test |
| Courses associated with it: Geotechnical engineering |

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|---|
| Device Name: Oven |
| Used For:  Oven Dry Soil |
| Experiment associated with it: for most experiment |
| Courses associated with it: Geotechnical engineering |

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## Machine Identification Card

### Name

OVEN:- FORCED VENTILATION

### Manufacturer

MATEST-ITALY

### Model No.

A020

### Machine Description

Oven,720 Liters Stainless/Steel, Digital

### Safety Instruction

• This apparatus is a Safety Class I instrument.

• Use thermal gloves or tongs to remove workpiece from the oven.

•Do not heat any flammable or combustible liquid in the oven. A fire and/or explosion may result.

• This apparatus has electrical connection ( Working with electricity)

### Maintenance Record

**Running**

### The experiments conducted on this machine

Most experiments

### The experiments summary

Get oven dry weight

## Water Content Determination procedure:

1. Record the moisture can and lid number. Determine and record the mass of empty, clean,and dry moisture can with its lid (MC)

2. Place the moist soil in the moisture can and secure the lid. Determine and record the massof the moisture can (now containing the moist soil) with the lid (MCMS).

3. Remove the lid and place the moisture can (containing the moist soil) in the drying oventhat is set at 105 °C. Leave it in the oven overnight.

4. Remove the moisture can. Carefully but securely, replace the lid on the moisture canusing gloves, and allow it to cool to room temperature. Determine and record the mass ofthe moisture can and lid (containing the dry soil) (MCDS).

5. Empty the moisture can and cleans the can and lid.

# Geotechnical Engineering Lab

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|---|
| Used For: to remove air voids in the soil and water |
| Experiment associated with it: specific gravity |
| Courses associated with it: Geotechnical engineering |

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## Machine Identification Card

### Name

VACUUM PUMP

### Manufacturer

MATEST-ITALY

### Model No.

V204

### Machine Description

Vacuum Pump, lubrified, paddle rotatory type.
Supplied complete with:
- Thermal protection with automatic resetting, assembled inside the motor.
- On/Off luminous switch, cable, carrying handle, base, bottle of special oil.
- CE labelled with certificate of conformity.

Ideal for laboratory and site use to produce vacuum.

Rotation speed: 2800 rpm.
Power supply: 230V 1ph 50/60Hz.

### Safety Instruction

- This apparatus is a Safety Class I instrument.
- This apparatus has need electrical connection ( Working with electricity)

### Maintenance Record

**Running**

### The experiments conducted on this machine

Specific Gravity

### The experiments summary

To remove air voids in the soil and water

## Specific Gravity procedure:

1. Determine and record the weight of the pycnometer plus water (to the mark).

2. Place 100g of a dry soil sample (passed through the sieve No. 10) in the pycnometer. Determineand record the weight of dry soil.

3. Add distilled water to fill about half to three-fourth of the pycnometer. Soak the sample for 10minutes.

4. Apply a partial vacuum to the contents for 10 minutes, to remove the entrapped air.

5. Stop the vacuum and carefully remove the vacuum line from pycnometer.

6. Fill the pycnometer with distilled (water to the mark), clean the exterior surface of the pycnometer with a clean, dry cloth. Determine the weight of the pycnometer, soil, and water.

7. Empty the pycnometer and clean it

8. Empty the pycnometer and clean it

# Geotechnical Engineering Lab

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|---|
| Device Name: sieve |
| Used For: Grain Size Distribution |
| Experiment associated with it: sieve analysis test |
| Courses associated with it: Geotechnical engineering |

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|---|
| Device Name: Sieve Shaker |
| Used For: to determine the grain size distribution of soil particle retained on sieve #200 |
| Experiment associated with it: sieve analysis test |
| Courses associated with it: Geotechnical engineering |

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## Machine Identification Card

### Name

MOTORIZED SIEVE SHAKER

### Manufacturer

MATEST-ITALY

### Model No.

A060-01

### Machine Description

Motorized Sieve shaker uses an electric motor and can hold up to 8 sieves ø200mm or 7 sieves ø300mm plus lid and pan.
Provided of timer 0 - 60 minutes ,Power supply: 230V 1ph 50Hz 110W،

.Dimensions: 350x400x950 mm,Weight: 24 kg approx

### Safety Instruction

•This machine operates on electric current. Improper operation could result in electric shock, electrocution, or an explosion!

•Keep all parts of your body away from moving parts of the machine while it is operating.

•Be careful that any dangerous situations won't happen during the working; stop immediately the machine in the event that it will not work properly.

•Don't operate the machine without having all covers and case in place.

### Maintenance Record

**Running**

### The experiments conducted on this machine

Grain size distribution of soil particle retained on sieve #200

### The experiments summary

Sieve analysis helps to determine the particle size distribution of the coarse and fine aggregates. This is done by sieving the aggregates using sieves with suitable openings depending on the material to be tested, then pass aggregates through them and thus collect different sized particles left over different sieves.

## Sieve Analysis Procedure:

1. Write down the weight of each sieve as well as the bottom pan to be used in the analysis.

2. Record the weight of the given dry soil sample.

3. Make sure that all the sieves are clean, and assemble them in the ascending order of sieve numbers (#4 sieves at top and #200 sieves at bottom). Place the pan below #200 sieves.Carefully pour the soil sample into the top sieve and place the cap over it.

4. Place the sieve stack in the mechanical shaker and shake for 10 minutes.

5. Remove the stack from the shaker and carefully weigh and record the weight of each sieve with its retained soil. In addition, remember to weigh and record the weight of the bottom pan with its retained fine soil.

# Geotechnical Engineering Lab

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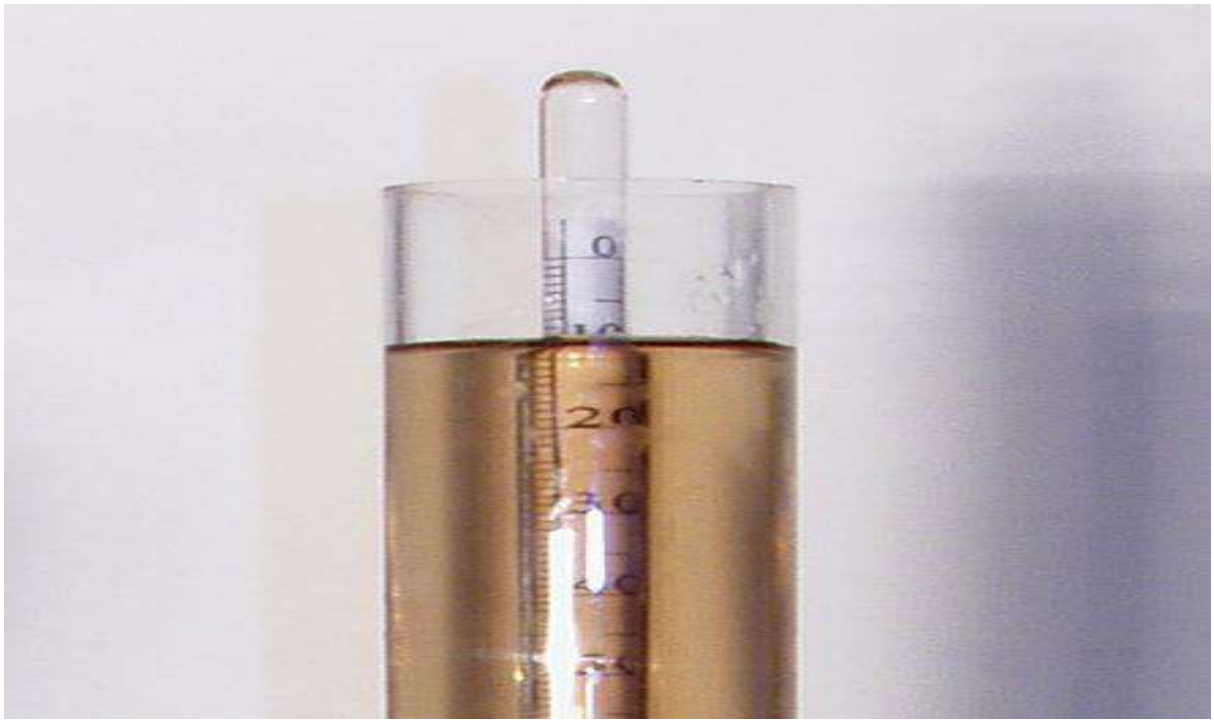
| Device Name: Hydrometer Apparatus |
| Used For: to determine the grain size distribution of soil particle pass on sieve #200 |
| Experiment associated with it: Hydrometer test |
| Courses associated with it: Geotechnical engineering |



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## Machine Identification Card

### Name

HYDROMETER

### Manufacturer

MATEST-ITALY

### Model No.

V172-03

### Machine Description

Glass hydrometers of various scale graduation systems.

### Safety Instruction

- This apparatus is a Safety Class I instrument.
- This apparatus has no electrical connection ( Working without electricity)

### Maintenance Record

**Running**

### The experiments conducted on this machine

Grain size distribution of soil particle pass on sieve #200

### The experiments summary

A hydrometer analysis gives results from which the percent of soil finer than 0.075 mm in diameter can be estimated. It is generally accepted that the percent finer than 0.002 mm in size is clay or clay-size fractions. Most clay particles are smaller than 0.001 mm, and 0.002 mm is the upper limit. The .presence of clay in a soil contributes to its plasticity.

## Hydrometer Analysis Procedure:

1. Take the fine soil from the bottom pan of the sieve set, place it into a beaker, and add 125mL of the dispersing agent (sodium hexametaphosphate (40 g/L)) solution. Stir the mixtureuntil the soil is thoroughly wet. Let the soil soak for at least ten minutes.

2. While the soil is soaking, add 125mL of dispersing agent into the control cylinder and fill itwith distilled water to the mark. Take the reading at the top of the meniscus formed by the hydrometer stem and the control solution.

3. Immediately transfer the soil slurry into the empty sedimentation cylinder. Add distilledwater up to the mark.

4. Cover the open end of the cylinder with a stopper and secure it with the palm of your hand.Then turn the cylinder upside down and back upright for a period of one minute. (Thecylinder should be inverted approximately 30 times during the minute.)

5. Set the cylinder down and record the time. Remove the stopper from the cylinder. After anelapsed time of one minute and forty seconds, very slowly and carefully insert thehydrometer for the first reading. (Note: It should take about ten seconds to insert or remove the hydrometer to minimize any disturbance, and the release of the hydrometer should be made as close to the reading depth as possible to avoid excessive bobbing).

6. The reading is taken by observing the top of the meniscus formed by the suspension and the hydrometer stem. The hydrometer is removed slowly and placed back into the controlcylinder. Very gently spin it in control cylinder to remove any particles that may haveadhered.

7. Take hydrometer readings after elapsed time of 2 and 5, 8, 15, 30, 60 minutes and 24 hours.

# Geotechnical Engineering Lab

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|---|
| Device Name: Atterberg limit casagrande |
| Used For: to determine the liquid limit and plastic limit of the soil |
| Experiment associated with it: Atterberg limit |
| Courses associated with it: Geotechnical engineering |

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## Machine Identification Card

### Name

LIQUID AND PLASTIC LIMITS

### Manufacturer

MATEST-ITALY

### Model No.

S171, S173-04, S178

### Machine Description

-The liquid limit device consists of a brass cup held on an adjustable bracket.
-The cup can be adjusted for a height of 1 cm and can be lifted and dropped one rubber base of standard hardness by cam action.
-Complete device consists of one casagrande grooving tool, one ASTM grooving tool and a height gauge block.

The plastic limit the complete set consists of one each:- 1. Glass plate 20cm x 115cm having ground ends and one side frosted. 2. Brass of stainless steel rod 3mm dia. x 150mm long., 3. Flexible spatula. 4. Set of 6 moisture containers. , 5. Porcelain basin 150mm dia., 6. Plastic wash bottle 500ml

### Safety Instruction

- This apparatus is a Safety Class I instrument.
- This apparatus has no electrical connection ( Working without electricity)

### Maintenance Record

**Running**

### The experiments conducted on this machine

Atterberg Limit

### The experiments summary

The liquid limit of a soil is the moisture content, expressed as a percentage of the weight of the oven-dried soil, at the boundary between the liquid and plastic states of consistency. The moisture content at this boundary is arbitrarily defined as the water content at which two halves of a soil cake will flow together, for a distance of ½ in. (12.7 mm) along the bottom of a groove of standard dimensions separating the two halves, when the cup of a standard liquid limit apparatus is dropped 25 times from a height of 0.3937 in. (10 mm) at the rate of two drops/second.

The plastic limit of a soil is the moisture content, expressed as a percentage of the weight of the oven-dry soil, at the boundary between the plastic and semisolid states of consistency. It is the moisture content at which a soil will just begin to crumble when rolled into a thread ⅛ in. (3 mm) in diameter using a ground glass plate or other acceptable surface.

## Liquid Limit Procedure:

1. Take roughly 3/4 of the soil and place it into the porcelain dish. Assume that the soil was previously passed through a No. 40 sieve, air-dried, and then pulverized. Thoroughly mix the soil with a small amount of distilled water until it appears as a smooth uniform paste.

2. Weigh four of the empty moisture cans with their lids, and record the respective weights and can numbers on the data sheet.

3. Adjust the liquid limit apparatus by checking the height of drop of the cup. The point on the cup that comes in contact with the base should rise to a height of 10 mm. The block on the end of the grooving tool is 10 mm high and should be used as a gage. Practice using the cup and determine the correct rate to rotate the crank so that the cup drops approximately two times per second.

4. Place a portion of the previously mixed soil into the cup of the liquid limit apparatus at the point where the cup rests on the base. Squeeze the soil down to eliminate air pockets and spread it into the cup to a depth of about 10 mm at its deepest point. The soil pat should forman approximately horizontal surface.

5. Use the grooving tool carefully cut a clean straight groove down the center of the cup. The tool should remain perpendicular to the surface of the cup as groove is being made. Useextreme care to prevent sliding the soil relative to the surface of the cup

6. Make sure that the base of the apparatus below the cup and the underside of the cup is cleanof soil. Turn the crank of the apparatus at a rate of approximately two drops per second andcount the number of drops, N, it takes to make the two halves of the soil pat come into contact at the bottom of the groove along a distance of 13 mm (1/2 in.).

7. If the number of drops exceeds 40, then go directly to step eight and do not record the number of drops, otherwise, record the number of drops.

8. Take a sample, using the spatula, from edge to edge of the soil pat. The sample should include the soil on both sides of where the groove came into contact. Place the soil into amoisture can cover it. Immediately weigh the moisture can containing the soil, record its mass, remove the lid, and place the can into the oven. Leave the moisture can in the oven forat least 16 hours. Place the soil remaining in the cup into the porcelain dish. Clean and dry the cup on the apparatus and the grooving tool.9.

9. Remix the entire soil specimen in the porcelain dish. Add a small amount of distilled water to increase the water content so that the number of drops required closing the groove decrease.

10. One of the trials shall be for a closure requiring 25 to 35 drops, one for closure between 20and 30 drops, and one trial for a closure requiring 15 to 25 drops. Determine the watercontent from each trial. Remember to use the same balance for all weighing

# Geotechnical Engineering Lab

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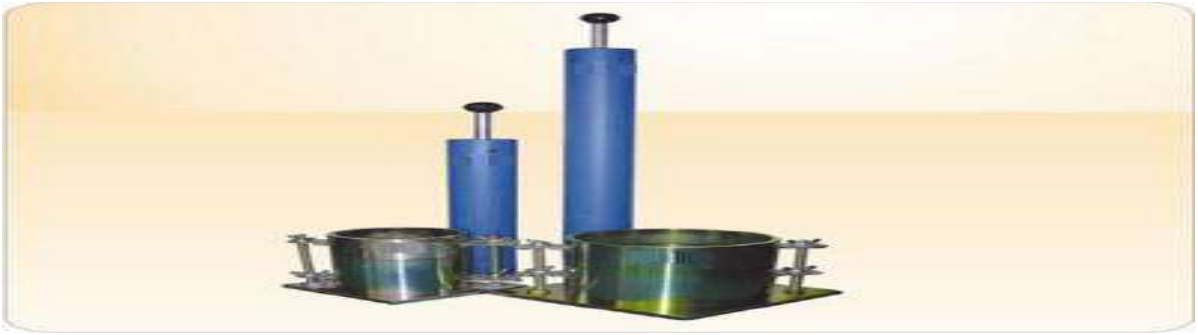
| Device Name: Mold and Rammar<br>Experiment name: compaction |
| Used For: soil compaction |
| Experiment associated with it: compaction |
| Courses associated with it: Geotechnical engineering |



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|---|
| Device Name: Automatic CBR/Proctor Compact |
| Used For: soil compaction |
| Experiment associated with it: compaction |
| Courses associated with it: Geotechnical engineering |

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## Machine Identification Card

### Name

AUTOMATIC CBR/PROCTOR COMPACT

### Manufacturer

MATEST - ITALY

### Model No.

S198

### Machine Description

Designed to compact Proctor and CBR specimens, it ensures an extremely uniform compaction degree, granting reliable and repeatable test results.
The blows are automatically distributed as requested by the selected Standard, with turntable rotation and rammer displacement through microprocessor. Top quality components and high accuracy mechanical workings grant very long life also under intensive utilisations.

### Safety Instruction

• This equipment generates moderate levels of audible noise when in use. Ensure that it is installed in a location where operating noise will not cause disturbance. Ear protection is required while in use.

• Indicates a potentially hazardous situation that may result in minor or moderate injury

• This apparatus has need electrical connection ( Working with electricity)

### Maintenance Record

**Running**

### The experiments conducted on this machine

Compaction the soil

### The experiments summary

The Automatic Soil Compactor is made to provide a fully automatic uniform compaction of Standard / Modified and CBR specimens assuring test conformity with the reference standard.

## Standard Compaction Procedure:

1. Depending on the type of mold you are using obtain a sufficient quantity of air-dried soil inlarge mixing pan. Determine the weight of the soil sample as well as the weight of the compaction mold with its base (without the collar) by using the balance and record the weights
2. Compute the amount of initial water to add by the following method:Assume water content for the first test to be 8 percent.
3. Where “water to add” and the “soil mass” are in grams. Remember that a gram of water is equalto approximately one milliliter of water.
4. Measure out the water, add it to the soil, and then mix it thoroughly into the soil using the trowel until the soil gets a uniform homogeneous. Assemble the compaction mold to the base, place some soil in the mold and compact the soilin the number of equal layers specified by 3 layers.
5. The number of drops of the rammer per layer 25 drops. The drops should be applied at a uniform rate not exceeding around 1.5seconds per drop, and the rammer should provide uniform coverage of the specimen surface. Try to avoid rebound of the rammer from the top of the guide sleeve. The soil should completely fill the cylinder and the last compacted layer must extend slightlyabove the collar joint. If the soil is below the collar joint at the completion of the drops, the test point must be repeated. (Note: For the last layer, watch carefully, and add more soil after about10 drops if it appears that the soil will be compacted below the collar joint.)
6. Carefully remove the collar and trim off the compacted soil so that it is completely even with the top of the mold using the trowel. Replace small bits of soil that may fall out during thet rimming process
7. Weigh the compacted soil while it’s in the mold and to the base, and record the mass.
8. Determine the wet mass of the soil by subtracting the weight of the mold and base
9. Remove the soil from the mold using a haydraulic extruder and take soil moisture content samples.
10. Fill the moisture cans with soil and determine the water content.

# Geotechnical Engineering Lab

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| Device Name: Sand cone |
| Used For: Field dry densities |
| Experiment associated with it: Field dry densities |
| Courses associated with it: Geotechnical engineering |

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## Machine Identification Card

### Name

Field Unit Weight of Compaction by Sand Cone Method

### Manufacturer

MATEST-ITALY

### Model No.

S234

### Machine Description

The test consists in digging a hole into the ground and then collect, dry and weight the sampled soil. The hole is then filled with dry sand from the cone container and the volume of sand recorded.
The apparatus consists of:
- S234-05 Metal double cone assembly with valve, galvanized for rust protection
- S234-06 Metal base with rimmed center hole for cone housing, galvanized
- V121 N° 2 Plastic jar, 5 liter capacity

### Safety Instruction

- This apparatus is a Safety Class I instrument.
- This apparatus has no electrical connection ( Working without electricity)

•Use only accessories that are recommended.

•Always wear sturdy clothing with long sleeves and long pants

### Maintenance Record

**Running**

### The experiments conducted on this machine

Field density in-place of compacted or firmly bonded soil

### The experiments summary

This test method describes the procedure for determining the in-place density and moisture of earthwork through the use of a sand cone or volumeter apparatus.

## Measurement of Field Density by Sand Cone Method procedure:

Select a location/elevation that is representative of the area to be tested, and determine the density of the soil in-place as follows:

1. Fill the sand cone device with the same type of sand used for the calibration. Obtain the mass of the filled sand cone, $\boldsymbol{W\ 1}$ .

2. Prepare the surface of the location to be tested, so that it is a level plane. Place the base plate on the surface.

3. Excavate a test hole through the center of the base plate. The shape of the test hole should approximate the shape of the calibration chamber. The base plate should not overhang the test hole, and the bottom of the test hole should be flat. Place all the excavated soil in a sealed plastic bag to be used for water content measurement.

4. Clean the flange of the base plate hole, invert the filled sand cone device over the excavated test hole. Open the valve and fill the test hole, base plate, and funnel with sand. Do not perform the test if there are significant ambient vibrations (e.g., heavy equipment operation), and take care not to move or shake the device during filling. When the sand stops flowing, close the valve.

5. Determine the mass of the sand cone with the remaining sand, $\boldsymbol{W\ 2}$ .

6. Determine and record the mass of the moist soil material that was removed from the test hole, $\boldsymbol{W\ s\ h}$ .

7. Mix the soil material thoroughly, and either obtain a representative specimen for water content determination $\boldsymbol{w}$ , or use the entire sample.

# Geotechnical Engineering Lab

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| Device Name: Constant Head |
| Used For: to determine the coefficient of permeability for granular soil |
| Experiment associated with it: permeability test |
| Courses associated with it: Geotechnical engineering |

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## Machine Identification Card

### Name

Constant Head Permeability

### Manufacturer

Not available

### Model No.

2001/46

### Machine Description

The constant head permeability test involves flow of water through a column of cylindrical soil sample under the constant pressure difference. The test is carried out in the permeability cell, or permeameter, which can vary in size depending on the grain size of the tested material. The soil sample has a cylindrical form with its diameter being large enough in order to be representative of the tested soil. As a rule of thumb, the ratio of the cell diameter to the largest grain size diameter should be higher than 12). The usual size of the cell often used for testing common sands is 75 mm diameter and 260 mm height between perforated plates. The testing apparatus is equipped with a adjustable constant head reservoir and an outlet reservoir which allows maintaining a constant head during the test. Water used for testing is de-aired water at constant temperature. The permeability cell is also equipped with a loading piston that can be used to apply constant axial stress to the sample during the test. Before starting the flow measurements, however, the soil sample is saturated. During the test, the amount of water flowing through the soil column is measured for given time intervals.

Knowing the height of the soil sample column L, the sample cross section A, and the constant pressure difference Δh, the volume of passing water Q, and the time interval ΔT

### Safety Instruction

- This apparatus is a Safety Class I instrument.
- This apparatus has no electrical connection ( Working without electricity)

### Maintenance Record

**Running**

### The experiments conducted on this machine

Coefficient of permeability for granular soil

### The experiments summary

The rate of flow of water through a soil specimen of gross cross-sectional area, *A,* can be expressed

## Constant head of pressure permeability test in sand procedure:

1. Measure the initial mass of the plastice specimen tube.
2. Measure the inside diameter of upper and lower chambers. Calculate theaverage inside diameter of the permeameter (D)
3. Place one porous stone on the inner support ring in the base of the chamber then place a filter paper on top of the porous stone
4. Mix the soil with a sufficient quantity of distilled water to prevent the segregation of particle sizesduring placement into the permeameter. Enough water should be added so that the
5. Using a scoop, pour the prepared soil into the lower chamber using a circular motion to fill it. A uniform layer should be formed
6. Use the tamping device to compact the layer of soil. Use approximately ten rams of the tamper per layer and provide uniform coverage of the soil surface.
7. Replace the upper chamber section,
8. Top surface of the soil and place a filter paper and then the upper porous stone on it
9. Place the compression spring on the porous.
10. Measure the sample length at four locations around the circumference of the permeameter and compute the average length. Record it as the sample length.
11. Adjust the level of the funnel to allow the constant water level in it to remain a few inches abovethe top of the soil
12. Connect the flexible tube from the tail of the funnel to the bottom outlet of the permeameter and keep the valves on the top of the permeameter open.
13. Place tubing from the top outlet to the sink to collect any water that may come out
14. Open the bottom valve and allow the water to flow into the permeameter
15. As soon as the water begins to flow funnel to a convenient height to get a reasonable steady flow of water
16. Allow adequate time for the flow pattern to stabilize
17. Measure the time it takes to fill using the graduated cylinder, and then measure the temperature of the water. Repeat this process three times and compute the averagetime, average volume, and average temperature. Record the values as t, Q, and T, respectively
18. Measure the vertical distance between the funnel head level and the chamber outflow level, andrecord the distance as h.

# Geotechnical Engineering Lab

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| Device Name: Consolidation Apparatus |
| Used For: to evaluate the settlement, swell of cohesive soil. |
| Experiment associated with it: Consolidation test |
| Courses associated with it: Geotechnical engineering |

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# Machine Identification Card

## Name

**CONSOLIDATION APPARATUS**

## Manufacturer

**MATEST-ITALY**

## Model No.

**S260**

## Machine Description

The consolidation test unit consists of a consolidometer and a loading device. The consolidometer can be either (1) a floating ring consolidometer or (ii) a fixed ring consolidometer
The floating ring consolidometer usually consists of a brass ring in which the soil specimen is placed. One porous stone is placed at the top of the specimen and another porous tone at the bottom. The soil specimen in the ring with the two porous Stones are placed on a base plate. A plastic ring surrounding the specimen fits into a groove
on the base plate. Load is applied through a loading head that is placed on the top porous stone.
In the floating ring consolidometer, compression of the soil specimen occurs from the top and bottom towards the center. The fixed ring consolidometer essentially consists of the
same components

## Safety Instruction

- This apparatus is a Safety Class I instrument.
- This apparatus has no electrical connection ( Working without electricity)

## Maintenance Record

**Running**

## The experiments conducted on this machine

Consolidation

## The experiments summary

Consolidation is the process of time-dependent settlement of saturated clayey soil when subjected to an increased loading, the procedure of a one-dimensional laboratory consolidation test, and the methods of calculation to obtain the void ratio pressure curve *(e* vs.logp), the preconsolidation pressure *(Pc),* and the coefficient of consolidation *($c_v$)* will be outlined

## Consolidation Device Procedure:

1. Weigh the empty consolidation ring.

2. Measure the height (h) of the ring and it's inside diameter (d).
3. Extrude the soil sample from the sampler, generally thin-walled Shelby tube. Determine the initialmoisture content and the specific gravity of the soil, respectively.
4. Place the sample on the consolidation ring and cut the sides of the sample to be approximately the same as the outside diameter of the ring. Rotate the ring and pare off the excess soil by means of the cutting tool so that the sample is reduced to the same inside diameter of the ring. It is important to keep the cutting tool in the correct horizontal positionduring this process.

5. Press the sample gently into the ring and continue until the sample protrudes a short distance through the bottom of the ring. Be careful throughout the trimming processto insure that there is no void space between the sample and the ring.
6. Turn the ring over carefully
7. Weigh the specimen plus ring
8. Add water to the consolidometer to submerge the soil
9. Being careful to prevent movement of the ring and porous stones, place the load plate centrallyon the upper porous stone and adjust the loading device
10. Attach the vertical deflection dial gauge to measure the compression of soil
11. Adjust the dial gauge to a zero reading.
12. Apply loads on the load plate.First start by 5kg then after 1 day 10kg and follow loadings according to data sheet.
13. Record the consolidation dial readings at the elapsed times given on the data sheet
14. At the last elapsed time reading, record the final consolidation dial reading and time, release the load, and quickly disassemble the consolidation device and remove the specimen.
15. Carefully remove the specimen from the consolidation ring, being sure not to lose too much soil,and place the specimen in the previously weighed moisture can. Place the moisture can containing the specimen in the oven and let it dry for 24 hours.
16. Weigh the dry specimen in the moisture can.

# Geotechnical Engineering Lab

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| Device Name: Direct Shear |
| Used For: to determine the shear resistance of all types of soil |
| Experiment associated with it: Direct Shear test |
| Courses associated with it: Geotechnical engineering |

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## Machine Identification Card

### Name

DIRECT SHEAR TEST APPARATUS

### Manufacturer

TECHNOTEST-ITALY

### Model No.

T665/010

### Machine Description

Direct shear test is simple and faster to operate. As thinner specimens are used in shear box, direct shear machine consists of shear box, soil container, loading unit, proving ring, dial gauge to measure shear, deformation and volume changes.

A two piece square shear box is one type of soil container used A proving ring is used to indicate the shear load taken by the soil initiated in the shearing plane.

### Safety Instruction

•Do not attempt to operate the equipment with covers removed.

•Only connect to the correct electrical supply.

•Equipment voltage setting is stated on the fuse cover of the appliance inlet module.

Do not operate machine with wet hands.

### Maintenance Record

**Running**

### The experiments conducted on this machine

Direct Shear

### The experiments summary

Direct shear test (DS) on alluvial fine-grained soils. The effect of laboratory variability of geotechnical parameters(cohesion c’ and friction angle )

## Direct Shear Device Procedure:

1. A metallic box with dimention 6*6*6cm which supports the shear box and provides either a reaction against which one half of the shear box is restrained, or a solid base with provisionsfor aligning one half of the shear box, which is free to movecoincident with applied shear force along a plane
2. Fill the shear box with sand in small layers; level the surface of sand specimen.

3. But the shear box assemply in place in the direct shear machine.
4. Remove the two vertical pines.
5. Connect and adjust the position of the shear force loading system so that no force is imposed on the shear load measuring device. Record the zero value of the shear load measuring device
6. Apply the desired normal laod N on the specimen
7. Attach the horizental and vertical dial gauges (.01 division) to the shear box to measure displacement during the test ,and shear force dial gage (.001 division)
8. Apply a small seating normal load to the specimen.Verify that the components of the normal loading system areseated and aligned. The top porous insert and load transferplate must be aligned so that the movement of the load transferplate into the shear box is not inhibited. The specimen shouldnot undergo significant compression under this seating load.
9. Reseat the device after appling the first normal load Position and adjust the shear displacement measurement device. set the measurement dial gauge to indicate zero,then start the test by record the data .The horizental reading is the reference to take reading at vertical deformation and shear force the test end at failure of shear force were give constant reading.

10. Repeat the test three specimens can be prepared from similar material. While ( this standard test) method applies to the measurements on one specimen.

# Geotechnical Engineering Lab

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| Device Name: Unconfined shear machine |
| Used For: to determine  unconfined compression and shear strength |
| Experiment associated with it: Unconfined shear test |
| Courses associated with it: Geotechnical engineering |

**The Hashemite University**
**Engineering College**
**Department of Civil Engineering**

**الجامعة الهاشمية**
**كلية الهندسة**
**قسم الهندسة المدنية**

## Machine Identification Card

### Name

Unconfined compression Machine

### Manufacturer

MATEST-ITALY

### Model No.

S212

### Machine Description

This motorized machine with electronic digital "touch-screen" controlled by microprocessor is suitable to perform all the tests when the requested speed rate is within: "0.05 to 63 mm/min" with max. load of 40 Kn.
It can therefore perform:

- Unconfined, CBR, Quick Triaxial tests.

### Safety Instruction

•Only connect to the correct electrical supply.

•Equipment voltage setting is stated on the fuse cover of the appliance inlet module.

Do not operate machine with wet hands.

### Maintenance Record

**Running**

### The experiments conducted on this machine

Unconfined Compression test

### The experiments summary

Determine unconfined compression and shear strength parameters.

## Compression Device Procedure:

1. Remolded specimens are prepared in the laboratory and are dependent upon the Proctor data pertaining to the required molding water content.

2. The cylindrical soil specimen should have aheight to diameter (L/D) ratio of between two. Specimen with diameter of 38mm and height of 76mm are used.

3. Place the specimen in the loading device so that it is centered on the bottom platen. Adjust the loading device carefully so that the upper platen just makes contact with thes pecimen. Zero the deformation indicator dial gage, And Zero the load indicator dial gage Apply the load so as to produce an axial strain at a rate of 1mm/min. Record load, deformation with, sufficient intervals of deformation to define the shape of the stress-strain curve. The rate of strain should be chosen.Continue loading until the load values decrease with increasing strain, or until 15 % strain is reached. The rate of strain used for testing sealed specimens may be decreased if deemed desirablefor better test results.

Make a sketch, or take a photo, of the test specimen at failure showing the slope angle of the failure surface if the angle is measurable.