



SRI SHANMUGHA COLLEGE OF ENGINEERING AND TECHNOLOGY

(Approved By AICTE, Accredited by NAAC, Affiliated to Anna University)

Tiruchengode – Sankari Mani Rd, Pullipalayam, Morur (PO), Sankari (Tk), Salem 637304.

AI8411- SOIL SCIENCE LABORATORY



DEPARTMENT OF AGRICULTURE ENGINEERING

Anna University - Regulation: 2017

B.E AGRICULTURE ENGINEERING – IV SEMESTER

AI8411- SOIL SCIENCE LABORATORY



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RECORD NOTE BOOK

REGNO. _____

Certified that this is a bonafide observation of Practical work done by
Mr/Ms/Mrs.....of the.....
Semester..... Branch during the Academic
year.....in the.....laboratory.

Staff-in-Charge

Head of the Department

Internal Examiner

External Examiner

GENERAL INSTRUCTIONS

- ❖ All the students are instructed to wear protective uniform and shoes before entering into the laboratory.
- ❖ Before starting the exercise, students should have a clear idea about the principles of that exercise
- ❖ All the students are advised to come with completed recorded and corrected observation book of previous experiments, defaulters will not allowed to do their experiment.
- ❖ Don't operate any instrument without getting concerned staff member's prior permission.
- ❖ All the instruments are costly. Hence handle them carefully, to avoid fine for any breakage.
- ❖ Almost care must be taken to avert any possible injury while on laboratory work.
In case, anything occurs immediately report to the staff members.
- ❖ One student from each batch should put his/her signature during receiving the instrument in instrument issue register.

LIST OF EXPERIMENTS

Ex. No: 1

Date:

DETERMINATION OF SPECIFIC GRAVITY OF SOIL SOLIDS

AIM

To determine the specific gravity of soil solids.

THEORY AND APPLICATION

Specific gravity of soil solids is the ratio of weight, in air of a given volume; of dry soil solids to the weight of equal volume of water at 4°C. Specific gravity of soil grains gives the property of the formation of soil mass and is independent of particle size. Specific gravity of soil grains is used in calculating void ratio, porosity and degree of saturation, by knowing moisture content and density. The value of specific gravity helps in identifying and classifying the soil type.

APPARATUS

1. Pycnometer
2. 450 mm sieve
3. Weighing balance
4. Oven
5. Glass rod
6. Distilled water

PROCEDURE

1. Dry the pycnometer and weigh it with its cap. (W_1)
2. Take about 200g of oven dried soil passing through 4.75mm sieve into the pycnometer and weigh again (W_2).
3. Add sufficient de-aired water to cover the soil and screw on the cap.
4. Shake the pycnometer well and remove entrapped air if any.
5. After the air has been removed, fill the pycnometer with water completely.
6. Thoroughly dry the pycnometer from outside and weigh it (W_3).
7. Clean the pycnometer by washing thoroughly.
8. Fill the cleaned pycnometer completely with water up to its top with cap screw on.
9. Weigh the pycnometer after drying it on the outside thoroughly (W_4).
10. Repeat the procedure for three samples and obtain the average value of specific gravity.

OBSERVATIONS AND CALCULATIONS

Determine the specific gravity of soil grains (G) using the following equation

$$G = \frac{(W_2 - W_1)}{(W_2 - W_1) - (W_3 - W_4)}$$

Where

W_1 = Empty weight of pycnometer.

W_2 = Weight of pycnometer + oven dry soil

W_3 = Weight of pycnometer + oven dry soil+ water

W_4 = Weight of pycnometer + water

OBSERVATION FOR SPECIFIC GRAVITY DETERMINATION

| Sample Number | W_1 in gms | W_2 in gms | W_3 in gms | W_4 in gms | Specific Gravity G |
|----------------|--------------|--------------|--------------|--------------|--------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| Average | | | | | |

RESULT

Average specific gravity of soil solids G =

Ex. No: 2

Date:

DETERMINATION OF FIELD DENSITY (UNIT WEIGHT) OF SOIL BY CORE CUTTER METHOD

AIM

To determine the fields density of soil by core cutter method.

THEORY AND APPLICATIONS

Unit weight is designed as the weight per unit volume. Here the weight and volume of soil comprise the whole soil mass. The voids in the soil may be filled with both water and air or only air or only water consequently the soil may be wet, dry or saturated. In soils the weight of air is considered negligible and therefore the saturated unit weight is maximum, dry unit weight is minimum and wet unit weight is in between the two. If soils are below water table, submerged unit weight is also estimated.

Unit weight of soil reflects the strength of soil against compression and shear. Unit weight of soil is used in calculating the stresses in the soil due to its overburden pressure. It is useful in estimating the bearing capacity and settlement of foundations. Earth pressure behind the retaining walls and in cuts is checked with the help of unit weight of the associated soils. It is the unit weight of the soil which controls the field compaction and it helps in the design of embankment slopes. Permeability of soil depends on its unit weight .It may be noted here that , in the field the unit weight refers to dry unit weight only because the wet unit weight of soil at location varies from season to season and based on the fluctuations of the local water table level and surface water.

APPARATUS

1. Cylindrical core cutter
2. Steel rammer
3. Steel dolly
4. Balance
5. Moisture content cups

PROCEDURE

1. Measure the height (h) and internal diameter (d) of the core cutter and apply grease to the inside of the core cutter.
2. Weigh the empty core cutter (W_1).
3. Clean and level the place where density is to be determined.
4. Drive the core cutter, with a steel dolly on its top in to the soil to its full depth with the help of a steel rammer.
5. Excavate the soil around the cutter with a crow bar and gently lift the cutter without disturbing the soil in it.
6. Trim the top and bottom surfaces of the sample and clean the outside surface of the cutter.
7. Weigh the core cutter with soil (W_2).
8. Remove the soil from the core cutter, using a sample ejector and take a representative soil sample from it to determine the moisture content (w).

OBSERVATIONS AND CALCULATIONS

Internal diameter of the core cutter (d) =

Height of the core cutter (h) =

Volume of the core cutter (V) =

Specific gravity of solids (G) =

1. Calculate the wet unit weight of the soil using the following relationship.
2. Calculate dry unit weight.
3. Calculate void ratio (e) porosity (n) and degree of saturation.

RESULT

- 1. Dry unit weight of the soil** =
- 2. Wet unit weight of the soil** =
- 3. Void ratio of the soil** =
- 4. Porosity of the soil** =
- 5. Degree of saturation** =

Ex. No: 3

Date:

DETERMINATION OF FIELD DENSITY (UNIT WEIGHT) OF SOIL BY SAND REPLACEMENT METHOD

AIM

To determine the field density of soil at a given location by sand replacement method.

APPARATUS

1. Sand pouring Cylinder
2. Calibrating can
3. Metal tray with a central hole
4. Dry sand (Passing through 600 micron sieve)
5. Balance
6. Metal tray
7. Scraper tool
8. Glass plate

THEORY AND APPLICATIONS

In core cutter method the unit weight of soil obtained from direct measurement of weight and volume of soil obtained from field. Particularly for sandy soils the core cutter method is not possible. In such situations the sand replacement method is employed to determine the unit weight. In sand replacement method a small cylindrical pit is excavated and the weight of the soil excavated from the pit is measured. Sand, whose density is known, is filled into the pit. By measuring the weight of sand required to fill the pit and knowing the density of soil, volume of the pit is calculated .Knowing the weight of soil excavated from the pit and the volume of pit the density of soil is calculated. Therefore in this experiment there are two stages (1) Calibration of sand density and (2) Measurement of soil density.

PROCEDURE

CALIBRATION OF SAND DENSITY

1. Measure the internal dimensions diameter (d) and height (h) of the calibrating can and compute its internal volume V.
2. Fill the sand pouring cylinder (SPC) with sand with 1 cm top clearance to avoid any spillover during operation and find its weight (W_1)
3. Place the SPC on a glass plate, open the slit above the cone by operating the valve and allow the sand to run down. The sand will freely run down till it fills the conical portion. When there is no further downward movement of sand in the SPC, close the slit.
4. Find the weight of the SPC along with the sand remaining after filling the cone (W_2)
5. Place the SPC concentrically on top of the calibrating can. Open the lit to allow the sand to rundown until the sand flow stops by itself. This operation will fill the calibrating can and the conical portion of the SOC. Now close the lit and find the weight of the SPC with the remaining sand(W_3)

MEASUREMENT OF SOIL DENSITY

1. Clean and level the ground surface where the field density is to be determined.
2. Place the tray with a central hole over the portion of the soil to be tested.
3. Excavate a pit into the ground, through the hole in the plate, approximately 12cm deep (Close the height of the calibrating can) the hole in the tray will guide the diameter of the pit to be made in the ground.
4. Collect the excavated soil into the tray and weigh the soil (W)
5. Determine the moisture content of the excavated soil.
6. Place the SPC, with sand having the latest weight of W_3 , over the pit so that the base of the cylinder covers the pit concentrically.
7. Open the slit of the SPC and allow the sand to run into the pit freely, till there is no downward movement of sand level in the SPC and then close the slit.
8. Find the weight of the SPC with the remaining sand W_4 .

OBSERVATIONS AND CALCULATIONS

TABLE
CALIBRATION OF UNIT WEIGHT OF SAND

| Sl.No | Description | Trial No 1 |
|-------|---|------------|
| 1 | Volume of the calibrating container, V | |
| 2 | Weight of SPC + sand W_1 | |
| 3 | Weight of SPC + sand W_2 After filling conical portion on a flat surface | |
| 4 | Weight of SPC + sand W_3 After filling calibrating can | |
| 5 | Weight of sand required to fill cone $W_c = W_1 - W_2$ | |
| 6 | Weight of sand required to fill cone and can $W_{cc} = W_2 - W_3$ | |
| 7 | Weight of sand in calibrating can $W_{cc} - W_c$ | |
| 8 | Unit weight of sand $W_{cc} - W_c / V$ | |

DETERMINATION OF UNIT WEIGHT OF SOIL

| Sl.No | Description | Trial No 1 |
|-------|---|------------|
| 1 | Weight of SPC after filling the hole and Conical portion W_4 | |
| 2 | Weight of sand in the hole and cone $W_3 - W_4$ | |
| 3 | Weight of sand in the pit $W_p = (W_3 - W_4) - W_c$ | |
| 4 | Volume of sand required to fill the pit $V_p = W_p$ | |
| 5 | Weight of the soil excavated from the pit (W) | |
| 6 | Wet unit weight of the soil | |
| 7 | Dry unit weight of the soil | |
| 8 | Void ratio of the soil | |
| 9 | Degree of saturation | |

RESULT

- 1. Dry unit weight of the soil**
- 2. Wet unit weight of the soil**
- 3. Void ratio of the soil**
- 4. Porosity of the soil**
- 5. Degree of saturation**

Ex. No:

Date:

DETERMINATION OF GRAIN SIZE DISTRIBUTION OF SOIL BY SIEVE ANALYSIS

AIM

To conduct sieve analysis of soil to classify the given coarse grained soil.

APPARATUS

1. A set of Sieves 4.75 mm, 2.36 mm ,1.18 mm ,0.60mm, 0.30 mm 0.15 mm 0.075mm including lid and pan
2. Tray
3. Weighing Balance
4. Oven
5. Sieve Shaker
6. Brush

PROCEDURE

1. Weigh 500gms of oven dry soil sample, of which grain size distribution has to be studied.
2. Take the soil sample into 75μ sieve.
3. Wash the soil sample keeping it in the sieve. Washing of soil sample means: place the soil in the sieve and gently pour water over the soil so that it wets the soil and remove the fine particles in the form of mud, leaving only the sand and gravel size particles in the sieve.
4. Transfer the soil retained in the sieve after washing into a tray. Invert the sieve into the tray and pour water gently so that all the soil particles retained in the sieve are transferred it to the tray.
5. Keep the tray in the oven for 24 hours at 105°C to dry it completely.
6. Weigh the oven dry soil in the tray (W)
7. The weight of the fine grained soil is equal to $500 - W$
8. Clean the sieve set so that no soil particles were struck in them.

9. Arrange the sieves in order such that coarse sieve is kept at the top and the fine sieve is at the bottom. Place the closed pan below the finest sieve.
10. Take the oven dried soil obtained after washing into the top sieve and keep the lid to close the top sieve.
11. Position the sieve set in the sieve shaker and sieves the sample for a period of 10 minutes.
12. Separate the sieves and weigh carefully the amount of soil retained on each sieve, This is usually done by transferring the soil retained on each sieve on a separate sieve of paper and weighing the soil with the paper.
13. Enter the observations in the table and calculate the cumulative percentage of soil retained on each sieve.
14. Draw the grain size distribution curve between grain size on log scale on the abscissa and the percentage finer on the ordinate.

OBSERVATIONS & CALCULATIONS

Weight of the soil taken for testing (W) =

| S.No | IS Sieves | Aperture size of sieve in mm | Weight of soil retained (gm) | % Weight Retained | Cumulative Percentage Retained | Percentage Finer |
|------|-------------|------------------------------|------------------------------|-------------------|--------------------------------|------------------|
| 1 | 4.75 mm | 4.75mm | | | | |
| 2 | 2.36 mm | 2.36mm | | | | |
| 3 | 1.18 mm | 1.18mm | | | | |
| 4 | 600 microns | 0.600mm | | | | |
| 5 | 300 microns | 0.300mm | | | | |
| 6 | 150 microns | 0.150mm | | | | |
| 7 | 75 microns | 0.75mm | | | | |
| 8 | pan | - | | | | |

Plot the graph between percentage finer and logarithmic grain size (mm).From the graph, obtain the percentage of coarse, medium and fine sands.

$$\text{Uniformity coefficient } C_u = D_{60} / D_{10} > 1$$

$$\text{Coefficient of Curvature } C_c = (D_{30})^2 / D_{60} \times D_{10} < 6$$

RESULT

Gradation of soil particles =

Uniformity Coefficient C_u =

Coefficient of Curvature C_c =

Ex. No:

Date:

STUDY OF SOIL SAMPLING TOOLS COLLECTIONS OF REPRESENTATIVE SOIL SAMPLE AND IT'S PROCESSING

Aim:

To study the soil sampling tools collections of representative soil sample and it's processing.

Apparatus Required:

1. Spade
2. Cone Samples
3. Auger
4. Plastic basin (or) bucket
5. Khurpe
6. Soil testing tube (for wet soil)
7. Sampling bags.

Collection of soil samples from the field:

- Normally each field may be created as a sampling unit. But two or more fields which are similar in appendence production and part-management practices may be grouped together into a single sampling unit samples should be collected separately from areas which differ in soil colour or part management practices, such as liming, fertilization, cropping pattern, etc. During collection of soil, avoid dead furrows, old manure or time pites, compass pits and irrigation channels the sampling person is one who collects samples in the presence of the land owner who is the best judge in deciding which area of his farm should be sampled separately.
- Scalp away the surface littler and insert the sampling auger to ploughs depth (15 cm). Take atleast 15 samples randomly distributed over each area and place them in a clean bucket. If a sampling auger is not available make a 'V' shaped out to a depth of 1.5 cm thick size of soil from top to bottom of the expressed face of the 'V' shaped out and placed in a clean bucket or basin.

- Thoroughly mix soil samples taken from 15 or more aspects of each area remove foreign bodies such as plant roots, stipples, pettles, stores or gravels. By quartering, discard all but $\frac{1}{2}$ to 1Kg soil. Quartering is done by dividing the thoroughly mixed soil into four equal parts and discarding two opposite quarters repeat this procedure until about $\frac{1}{2}$ to 1 Kg of soil is left. Instead of quartering compartment 1° zution method can be followed. For this spread the soil on a clean hard surface and mark lines from both the side and create number of compartments repeat the process of collection until the required quantity is collected to store the soil in a clean cloth bag or contains with proper lattering for further analysis.

Collection of soil samples from a profile:

- After the profile is posed, clean one face of the pit carefully with Khurpe and note the succession and depth of each horizon. Price the surface with a Khurpe to show up structure, colour and compactness. Describe the profile as per the soil terminologies are the munsell colour and find out the texture by fed method. Collect samples from each horizon starting from lower horizon by holding while the soil above the loosened by a khurpi the sample in mixed and transferred to a bag after levelling.

Collection of soil sample:

- The soil sample received at the laboratory is air dried in shade and spread on a sheet of paper after breaking large tumps if present, with a wooden mallet. If it is further grouped by pounding with wooden mallet in such as a very that the aggregate particles the soil they prepared is sieved through a sieve, with round holes. 2 mm is fine enough to pass through and only stones and organic residues on the sieve.

Another inside the container:

- For the determination of organic carbon sieve the powdered soil through 0.5mm sieve, for the soil samples mean for micronutrient analysis of iron, brass, copper and zinc containers must be avoided for collection of nitrate, nitrogen, ammonia

nitrogen, bacteria want and moisture determination, soil samples should not be air dried and fresh soil samples are to be used.

Sampling for Analysis:

- The soil in the bottle is emptied on a clean thick sheet of paper and evenly spread with a sampling knife. It is heaped into a cone by raising the four ends of the paper. It is again mixed well and evenly spread on the paper again. Now it is divided into four equal quarters and small quantity of soil is taken from various points in each quarter to get a representative sample for analysis.

Depth of soil sampling

| S.No. | Crop | Soil sampling depth (cm) |
|-------|--|--------------------------|
| 1. | Grasses and Grass land | |
| 2. | Rice, finger millet, ground nut, pearl millet, small millets etc. (shallow rooted crops) | |
| 3. | Cotton, sugarcane, banana, topico, vegetable, etc. (Deep rooted crops) | |
| 4. | Perennial crops, Plantations and orchard crops | |

Steps in soil sample collection:

Diagram:

Result:

Thus the study has been soil sampling tools collection of representative soil sample and its processing.

Ex. No:

Date:

DETERMINATION OF ELECTRICAL CONTINUITY

Aim:

To determine electrical continuity in the given water sample.

Principle:

As the amount of soluble salts in a solution increase, the electrical continuity also increase. This electrical continuity is measured in terms of the resistance offered to the flow of current using a continuity meter. Higher the salt content, lesser the resistance to the flow of current is defined by the ohm's law as the ratio of electrical potential in volts and strength of the current in amperes.

- ❖ Resistance on ohm's (R) = Volts (V) / Current (I)
- ❖ Conductance in reciprocal of resistance conductance = $\frac{1}{R} = \frac{1}{\text{Ohm}}$
- ❖ The Electrical conductivity (E_c) measurement is expressed as million ohms/cm or dsm^{-1} .

Materials Required:

1. Conductivity meter
2. 100 ml beaker
3. Glass rod
4. 0.01 N KCl Solution
5. Saturated CaSO_4 Solution

Procedure:

- Switch on the conductivity meter and wait for 10 minutes.
- Check the instrument with saturated CaSO_4 solution and 0.01 N KCl Solution. The E_c of saturates CaSO_4 and 0.01 N KCl solution should be 2.2 dsm^{-1} and 1.41 dsm^{-1} respectively.
- Dip the electrode into the water sample and record the conductivity value.
- Multiply this by the cell constant (not on the cell itself) to get specific conductivity.

Result:

The E_c of the given water sample = dsm^{-1}

Ex. No:

Date:

DETERMINATION OF ORGANIC CARBON

Aim:

To determine the analysis of organic matter for the given sample.

Apparatus Required:

1. 1 N $K_2Cr_2O_7$
2. Conc. H_2SO_4
3. 0.5 N ferrous sulphate (or) ferrous ammonium sulphate
4. Phosphoric acid
5. Diphenylamine indicator

Procedure:

- Take 1 gram of soil in a 500 ml conical flask
- Add 10 mL of $K_2Cr_2O_7$ and shock to mix it
- Then add some of the concentrated sulphuric acid in the flask two (or) three times.
- Allow the flask to stand for 30 minutes on an acceptors sheet for the reaction to complete.
- Add 200 mL of H_2O to the flask to dilute the suspension filter it is expected that the end point of the titration is not be cleared.
- Add 10 mL of 85 % of diphenylamine indicator in (mL) and back titrate the solution with 0.5 N ferrous ammonium sulphate (FeS), till the colour flashes violet through blue to bright green.
- By making the colour change distinct through a flocculating effect.
- Note the volume of ferrous ammonium sulphate.

Calculation:

% of organic carbon in soil (R)

$$R = \frac{(V_1 - V_2) \times N \times 0.03}{W}$$

Where, W – Weight of sample

V_1 – Blank Titrate value (Initial)

V_2 – Titrate value of the sample (Final)

N – Normality of $K_2Cr_2O_7$

C – Correlation factor [1.334, 1.734]

Observation:

0.5 N FAS Vs 1N $K_2Cr_2O_7$

| S.No. | Volume of 1 N $K_2Cr_2O_7$ taken (mL) | Burette Reading | | Indicators | End Point |
|-------|---|-----------------|---------------|------------|-----------|
| | | Initial (ml) | Final (ml) | | |
| 1. | Blank | | | | |
| 2. | Sample | | | | |

Calculation:

Result:

The organic carbon content of the given soil

- i. Surface Soil =
- ii. Sub Surface Soil =

Ex. No:

Date:

STUDY OF SOIL FORMING ROCKS AND MINERALS

Aim:

- ❖ To study the soil forming rocks and minerals.
- ❖ Rocks are the materials that form the essential part of the earth's crust and are generally hard mass of mineral matters compressing one or more rock forming minerals. The study of rocks is called **Petrology** which is a Greek word which means rock science petrology deals with the description of rocks while petrology is the study of genesis of rocks.

Formation of rocks:

- **Primary or Igneous rocks:** cooling and consolidation of molten magma within or on the surface of Earth.
- **Metamorphic rocks:** Alteration of the existing Primary and Secondary rocks.
- **Sedimentary or Secondary rocks:** Transportation and cementation of weathered materials of the pre-existing rocks.

A. Igneous Rocks:

| Rocks | Texture | Essential minerals | Mass common accessory minerals | Average specific gravity (G) | Remarks |
|--------------|---|---|--------------------------------|------------------------------|------------------------------------|
| Granites | Plutonic Halocrystalline | Predominant Quartz 20-35% Orthoclase | Homblende, Mica, Magnetite | 2.64 | White or reddish or blackish |
| Syenite | - | Predominance Quartz 10 % Plus Orthoclase Nepheline & Albite | Homblende, Biotie Magnetite | 2.80 | - |
| Granodiarite | - | Intermediate Quartz Plagioclase exceeds orthoclase | - | 2.70 | Medium Colourized reddish |
| Diorite | - | Intermediate Plagioclase | - | 2.85 | Darker |
| Gabbre | - | Labradorite Augite+Olivine | Homblende Zlmenite | 3.00 | Blackish |
| Dolerite | Hypabyssal Ophitic texture | Labradorite Augite+Olivine | - | 3.00 | - |
| Basalt | Volcanic Monocrystalline with Glassy mass | - | - | 3.00 | - |

B. Sedimentary Rocks

| Name | Mineral Composition | Colour & Structure |
|--------------|--|---|
| Sand stone | Mainly Quartz with cementing agents such as CaCO_3 , Iron oxides and clays | Light – red usually granular & Porous structure |
| Shale | Clay Minerals, quartz & some organic matter | Light to dark Thickly Laminated structure |
| Limestone | Mainly Calcite or calcite dolomite with iron oxides, clay, phosphate & organic matter. | Usually grey to yellow fine grained & compact |
| Conglomerate | Composition of this rock consists of a rock structure known as the clasts and contains minerals particles like quartz and igneous sedimentary and metamorphic rock fragments. The binding matrix is a mixture of sand, mud and chemical ambushing agent. | Extremely variable due to mixture of fragments. |

Non Metallic Luster Light Colored

| HARDER THAN GLASS | |
|---|--|
| Cleavage Prominent | |
| Good Cleavage in a directions at about 90° nearly to vitreous lustre ; H=6 specific gravity = 2.4 | FELDSPAR GROUP Orthoclase, Microcline $\text{K}(\text{AlSi}_3\text{O}_8)$ (White, Pink, blue green), Plagioclase $(\text{Na}, \text{Ca})(\text{Al Si})(\text{Al}_2\text{Si}_8\text{O})$ White to dark blue grey with striations on cleavage faces |
| Cleavage Absent | |
| Concoidal fracture, transparent to transparent ; vitreous lustre ; crystal are long & 6 sided, terminated by a 6 sided pyramid H=7, S.G = 2.6 | Quartz SiO_2 , Varieties include, clear,, milky, smoky, Rust amethyst, citrine |
| Blue to green in colour ; H=6, S.G = 2.7 | TURQUOISE $\text{CuAl}_6(\text{PO}_4)_4(\text{OH})_8 \cdot 4\text{H}_2\text{O}$ |
| Green, yellow, pink, etc. glassy Lustre, crystals are strated in a long direction triangular cross section. | TURMALINE B, Al, Fe, Mg, Na, Ca, Li Silicates. |

Non Metallic Luster Dark Colored

| HARDER THAN GLASS | |
|---|--|
| Cleavage Prominent | |
| Cleavage in 2 directions of nearly 90° ; colour dark green – black; H=6 specific gravity = 2.4 | PYROXENE GROUP Complex Ca, Mg, Fe, Al Silicate. |
| Cleavage in 2 direction at approx. 60° & 120° ; dark green – black or brown in colour ; H=6, S.G = 3.35 | AMPHIBOLE GROUP Na, Ca, Mg, Fe, Al, Silicates |
| Cleavage Absent | |
| Alive green, commonly in aggregates of small glassy grains ; coneoidal fracture, transparent to translucent glassy Lustre H=6.5-7, S.G = 3.5-4.5 | OLIVINE $(Fe, Mg, Mn, Ni)_2SiO_4$ |
| Yellowish Brown streak yellowish brown to dark brown in colour; earthly Lustre. H=5-5.5, S.G = 3.5-4 | LIMONITE $Fe_2O_3 \cdot H_2O$ |

Result:

Thus the study has been made of soil forming rocks and minerals identify the rocks and minerals based on colour, structure & specific gravity, etc.

Ex. No:

Date:

DETERMINATION OF pH

Aim:

To determine the pH of the given water sample.

Principle:

- ❖ A glass surface (glass electrodes) in contact with hydrogen ions of the solution acquires an electric potential which depends on the concentration of H^+ ions. This is measured potentiometrically against some reference electrode which is usually a calomel electrode and expressed in pH units.

Materials Required:

- pH meter
- 100 ml beaker
- Glass rod
- Buffer solution (pH 4.0, 7.0, 9.2)

Procedure:

- Keep the range switch (pH selector switch) in zero position.
- Set the temperature compensation control to reach with the solution temperature.
- Connect the instrument to 230 volts A.C Supply and turn the power switch of the instrument to “Start” position and allow atleast one minute to warm up. Then turn the switch to “Operate” position as the electric are immersed in distilled water.
- **Zero Adjustment:** Adjust the zero adjustment known so that the pointer in the meter reads exactly zero
- Allow atleast 15 minutes for the instrument to warm up before proceeding with measurements. If the pointer deviates from zero, the adjustment is to be made with zero adjustment knob.
- Lift the electrodes from the distilled water and wipe it any using the fitter paper bits and dip in a standard buffer solution of known pH prepared from the buffer tablets.
- **Standardization:** Lift the Electrodes from the distilled water and wipe it dry using the filter paper bits and dip them in standard buffer solution of pH 4.0, 7.0, 9.2

- Measurement of pH change the range switch to zero position. Take out the electrodes from the buffer solution, wash and dip them into water sample and read the pH values directly on the water.
- Range switch should be kept at zero when the electrodes are immersed into and removed from as the sample to prevent the possible polarization of the glass electrode.

Result:

The pH of the given water sample =

Ex. No:

Date:

DETERMINATION OF SOIL MOISTURE

Aim:

To determine the soil moisture by using gravimetric method.

Principle:

Soil Moisture content is determined by drying a known quantity of soil sample in an electric oven at 105°C and finding out the loss in weight

Materials Required:

- ❖ Moisture Bottle
- ❖ Chemical Bottle
- ❖ Top Pan
- ❖ Desiccator

Procedure:

- Weigh an aluminum tin, and record this weight (tare).
- Place a soil sample of about 10g in the tin and record this weight as (wet soil + tare).
- Place the sample in the oven 105°C , and dry for 24 hours or overnight.
- Weigh the sample, and record this weight as weight of (dry soil + tare).
- Return the sample to the oven and dry for several hours, and determine the weight of (dry soil +tare).
- Repeat step 5 until there is no difference between any two consecutive measurements of the weight of (dry soil+tare).

Calculation:

Result:

Percentage of Moisture in the given Soil Sample =%
.....%