GEOLOGY

LAB MANUAL

B. Tech III Year - I Semester

NAME: ______________________________________

ROLL NO: ___________________________________

DEPARTMENT OF

CIVIL ENGINEERING

Parvathapur, Uppal, Hyderabad-98

CONTENTS

Evaluation of Laboratory Marks for III Year (Internal Exams)

1. The internal lab examination schedules will be given by the Examination Branch.

2. During a year there will be three lab exams each exam will be evaluated for 25 marks.

3. Average of three lab exams will be the final internal lab exam marks.

4. First laboratory exam will be conducted on First 1/3 of the total number of experiments, Second Laboratory Exam will be conducted on the Second 1/3 of experiments the Third Laboratory Exam will be conducted on the last 1/3 of experiments.

The evaluation is as follows

I. Continuous evaluation - 15 marks
II. Internal Laboratory Exam - 10 marks

I. Continuous Evaluation

a) Day to day evaluation - 10 marks

Each experiment / program will be evaluated for 10 marks.

The splitting of marks is as follows

i) Attendance - 2 marks

The student should attend the lab regularly; if he/she is absent he/she will be losing 2 marks.

ii) Experiments / program observation

The student should complete the program / experiment within the assigned time otherwise he / she will be losing 2 marks.

iii) Experiment result will carry 4 marks.

iv) Record 2 marks

Student must submit the record in the next lab session.

v) Average marks of the Half of the experiments will be considered for day to day evaluation for 10 marks separately for lab examination one two.

b) Lab knowledge Test (Quiz) - 5 marks

A quiz will be conducted along with the internal lab exam schedule will be given separately.

The quiz will be conducted for 20 minutes. The quiz contains 20 questions of type multiple choice. Each question carrying 0.25 marks.

II.	Internal laboratory examination	-	10 marks
a)	Exam	-	7 marks
	The Splitting of marks as follows		
	i) Experiments / Program write up	-	4 marks
	ii) Result Graphs	-	3 marks
b)	Viva Voce	-	3 marks

§ The internal lab examination duration - 2 hours

§ Every student will be given programs / experiments in the internal lab exam. In case the student wishes to change the programs / experiments 1 mark will be deducted. A time slot of 45 minutes is given for write up of programs / experiments.

§ The student is expected to complete the assigned program / experiment within 1 hour the remaining 15 minutes will be utilized for viva voce examination.

5. There shall be no supplementary exams in case the student fails to attend internal lab quiz exam as per schedule.

Evaluation of Laboratory Marks (End exams)

1. The external lab examination schedules will be given by the Examination Branch.

2. Duration of External lab examinations - 3 Hours

3. Exam will be evaluated for 50 Marks

The Splitting of marks is as follows

I.	Experiment write-up / Program with algorithm-	10 marks
II.	Experiment Setup / Program execution -	10 marks
III.	Result -	10 marks
IV.	Viva -Voce -	20 marks
	a) Written Viva -	10 marks
	b) Oral Viva -	10 marks

Written Viva-Voce Exam will be consisting of 10 questions of short answer type fill in the blanks. Each question will carry equal marks allotted time is 15 minutes.

LAB CODE

1. Students should report to the labs concerned as per the timetable.
2. Students who turn up late to the labs will in no case be permitted to perform the experiment scheduled for the day.
3. After completion of the experiment, certification of the staff in-charge concerned in the observation book is necessary.
4. Students should bring a notebook of about 100 pages should enter the readings/observations/results into the notebook while performing the experiment.
5. The record of observations along with the detailed experimental procedure of the experiment performed in the immediate previous session should be submitted certified by the staff member in-charge.
6. Not more than three students in a group are permitted to perform the experiment on a set up.
7. The group-wise division made in the beginning should be adhered to, no mix up of student among different groups will be permitted later.
8. The components required pertaining to the experiment should be collected from Lab- in-charge after duly filling in the requisition form.
9. When the experiment is completed, students should disconnect the setup made by them, should return all the components/instruments taken for the purpose.
10. Any damage of the equipment or burnout of components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year.

11. Students should be present in the labs for the total scheduled duration.

12. Students are expected to prepare thoroughly to perform the experiment before coming to Laboratory.

13. Procedure sheets/data sheets provided to the students' groups should be maintained neatly are to be returned after the experiment.

14. DRESS CODE:

    Boys - Formal white shirt neatly tucked in, white trousers, white / black / brown / tan shoes belt, I-cards worn round neck

    Girls - Formal white Salwar Kameez, white / black / brown / tan shoes, I-cards worn round neck

IDENTIFICATION OF MINERAL

DEFINITION OF MINERAL:

A Mineral may be defined as a natural inorganic homogenous, solid substance having a definite chemical composition regular atomic structure.

To call any substance as a Mineral, The requirements to be filled are:

1. It must have been formed by natural process i.e., artificial or synthetic or manmade substance are not eligible to be called as mineral
2. It must be an inorganic substance i.e., substance of wood or any other organic materials cannot be called as mineral
3. It must be homogeneous i.e., all parts of the mineral should possess the same physical, chemical characters
4. It must be solid i.e., gaseous, liquid or semi solid substances are not minerals.
5. It must have a definite chemical composition i.e., particular kind of mineral always has the same chemical composition irrespective of its size, shape, origin, occurrence, association etc.
6. It must have a definite atomic structure i.e., chemical composition atomic structure are specific for every mineral no two minerals can possess the same chemical composition atomic structure.

MODE OF FORMATION OF MINERALS:

Basically there are 3 kinds of formation of minerals in naturel. They are formed from magma or out of secondary process or under metamorphism.

MINERALS ARE FORMED FROM MAGMA:

Most of the minerals formed directly or indirectly out of magma during different of its solidification. Important built of rock forming minerals such as feldspar, quartz, pyroxene, amphiboles, mica olivine some precious minerals ore minerals like gemstones, topaz, magnetite, native beryl, apatite, muscovite, lead zinc ores tourmaline are also formed from magmatic sources.

SECONDARY PROCESS:

In nature some minerals are formed when secondary processes like weathering, precipitation deposition minerals like calcite, dolomite, bauxite - limonite, salts coal petroleum, chlorite, phosphates, clays, agate, opal zeolites are examples of this group.

UNDER METAMORPHISM:

These minerals are formed under the influence of high temperature pressure with or without the active involvement of chemically active solution.

Example:

Minerals like Andalusite, Sillimanite, Kyanite, Staurolite, Garnets, Chlorite, Graphite, Talc, Cordierite Etc.,

DIFFERENT METHODS OF STUDY OF MINERALS:

Common methods of study identification of minerals are based on

i. Their physical properties
ii. Their chemical composition
iii. Their optical properties
iv. Their x-rays analysis

STUDY OF PHYSICAL PROPERTIES:

Physical properties of minerals like colour, lustre, streak, clearage etc., can be studied with their observations feeling of small mineral specimens. So these properties are dependent on chemical composition atomic structure i.e., if atomic structure chemical composition remain same. The resulting physical properties also should be similar. Since every mineral invariably possess its own specific chemical composition atomic structure. Every minerals should possess its own set of physical properties.

STUDY OF CHEMICAL COMPOSITION:

According to definition every mineral has its own definite chemical composition which is not to be found in any other mineral therefore by chemical analysis if the composition is known it should be possible to identify the mineral.

Example:

If unknown mineral is found to have lead sulphide then the mineral is galena because galena always has the chemical composition of lead sulphide no other mineral has this composition.

STUDY OF OPTICAL PROPERTIES:

In this method of study the minerals are ground very fine fixed over glass slides by means of Canada balsam.

The principal which makes this method useful for study identification of minerals is that when polarized light passes through thin section of minerals it is influenced in a characteristic way depending on the chemical composition atomic structure of the mineral since every mineral has its own chemical composition regular atomic structure the optical properties of every mineral are also definite hence helpful in the identification of the mineral.

X-RAYS ANALYSIS:

X-rays Analysis make use of the definite atomic structure found in every mineral X-rays are similar to light waves but have a much shorter wavelength, comparable to the distance between atoms in a crystalline mineral. When a beam of X-rays falls on a crystal it is diffracted by the layers of atoms with in the crystal.

In making an X-rays Analysis of the atomic structure of the crystal, the diffracted X-rays are allowed to fall on a photographic plate, the resulting photograph shows a series as sports or lines which form more or less symmetrical pattern form measurement made on the photograph the arrangement of the atoms in the crystal can be deduced also the distances between them. In short results of X-rays Analysis of minerals reveal their actual atomic structures which is definite for each mineral this enables the accurate identification of minerals.

ADVANTAGES OF DIFFERENT METHODS OF STUDY:

1. The unique advantages is that it makes possible the study of minerals or rocks in the filed itself.
2. It does not requires equipment worth mentioning.
3. It does not involve the use of chemicals it does not need additional facilities.
4. It involves no loss or wastage of material this enables the minerals to be studied, any number of times.
5. It is quickest method of identifying the minerals, because with the help of previous knowledge it requires very little time for identification. But in other methods immediate inference is not possible for obvious reasons.
6. It is the cheapest simplest least method for identification of minerals i.e., money, energy time are spent to the minimum extent.

DISADVANTAGES OF DIFFERENT METHODS OF STUDY:

1. In some cases even slight variation in chemical composition result in considerable change in color.
2. Weathering the universal phenomenon, alters many physical properties significantly make identification difficult. Therefore only fresh minerals are easily identified in this way.
3. Further, some minerals when formed under different conditions show slight variation in physical properties.

Study of Physical properties identification of minerals referred under theory:

Rock forming Minerals: Quartz, Feldspar, Muscovite, Biotite, Augite, Hornblende, Olivine, Garnet, Kyanite, Talc, Chlorite, Flit, Jasper, Asbestos, Calcite etc.

Economic Minerals: Bauxite, Magnetite, Hematite, Pyrite Chromite.

Galena, Graphite, Pyrolusite, Magnesite

Identification based on the various physical properties of minerals are as follows

1. Form
2. Colour
3. Streak
4. Luster
5. Fracture
6. Clearage

7. Hardness
8. Specific Gravity (Density)
9. Degree of Transparency
10. Special Properties

FORM:
This is one of the first observation made when a mineral is examined in a h specimen. The form represent the common mode of occurrence of a mineral in nature it is also called habit or structure of the mineral.
The following is the list of some common forms the minerals which characteristically exhibit them, i.e., appearance of the particular form is indicative of a certain mineral.

Sl.No.	Name of the Form	Description	Mineral Example
1	Lamellar Form	Mineral appear as thin separate layers	Different varieties of Mica
2	Tabular Form	Mineral appear as slabs of uniform thickness	Feldspar
3	Fibrous Form	Mineral appear to be made up of fine threads fibers may or may not be separable	Parallel Fibers Asbestos type Satinspar. Radiating Fibers Stibnite, Pyrite Zeolites
4	Pisolitic Form	Mineral appear to be made up of small spherical grains (pea-size)	
5	Oolitic Form	Similar to Pisolitie but grains are of still smaller size (like fish egg)	Some Limestone
6	Rhombic Form	Rhombic Shape	Calcite, Dolomite
7	Bladed Form	Mineral appear as cluster or as independent lath shaped (i.e., rectangular grains)	Kyanite
8	Granular Form	Mineral appear to be made	Chromite, Magnetite,

		up of innumerable equidimensional grains of coarse or medium or fine size	Pyrite
9	Reni From	Kidney shaped mineral appear with number of over lapping smooth somewhat large curved surfaces	Hematite
10	Botryoidal Form	Similar to Reni form but with smaller curved faces like bunch of grapes	Chalcedony Psilomclane hematite
11	Mammillary	Mineral appear with large mutually interfering spheroidal surface - similar to Reni form	Malachite
12	Acicular Form	Mineral appear to be made up of thin needles	Natrolitc, Actinolite
13	Columnar Form	Mineral appear as long slender prism	Tourmaline precious Topaz
14	Prismatic Form	As elongated indepent crystals	Staucdite, Beryl, Apatite, Quartz
15	Spongy Form	Porous	Pyrolusite, Bauxite
16	Crystal Form	Polyhedral, Geometrical Shapes	Garnet, some Zeolites, Quartz, Amethyst, Pyrite, Galena
17	Interpenetrating Twin Form		Starurolitc
18	Massive Form	No definite shape for mineral	Fluorite, Pyrite Calcite, Graphite, Olivine,

			Quartz, Jasper
19	Concretionary Form	Porous appear due to accretion of small irregularly shaped masses	Laterite
20	Nodular Form	Irregularly shaped impact bodies with curved surface	Flit, Limestone

COLOUR:

It depends upon the absorption of some the reflection of others of coloured ray of white light. Colour of an object depends upon the colour of the reflected rays when all other colour rays are observed the colour of a mineral is often its most striking property.

1. Absorbed light represents energy that has been used to move electrons from energy level to the other.
2. Factors affecting colour of a mineral type of element valence, state, type of bonding type of neighboring atoms, feature of local symmetry.

For Example:

Chemical composition of olivine of 2-end members

1. Fosterite: - Mg_2sio_4; White Colour
2. Fayalite: - Fl_2sio_4; Dark Bottle Green
   This is caused by eh Fe_2 ion observing the more of the reddish the violet parts of the spectrum. Therefore, olivine is more or less green according to its iron content. Sometimes impurities cause colour.

Diagnostic colours of some minerals:

1. Galena - Dark Leady Grey
2. Hematite - Dark Leady Grey
3. Graphite - Shining Black
4. Pyrite - Black
5. Olivine - Yellow
6. Muscovite in book form - Silver White Colour
7. Muscovite in thin layers - Colorless
8. Magnesite - Spotless White
9. Opal - Milky white
10. Chromite, Magnetite - Black

Commonly Exhibited Colour of some Minerals:

Hornblende à Dark Green	Calcite à White
Augite à Greenish Black	Quartz à White / Colorless
Orthoclase à White or Shades of Red	Asbestos à White, Green, Grey, Yellow
Plagioclase à Grey or White	Jasper à Red
Microcline à White, Pink or Green	Flint à Yellowish Brown
Kyanite à Blue	Limonite à Yellow or Brownish
Garnet à Red	Baryets à White / Pale Grey
Talc à White / Pale Yellow	Gypsum à Colorless or White

Minerals which show different colours:

1. Quartz à Colourless, White, Green, Violet, Grey, Yellow, Pink etc.,
2. Feldspar à White, Grey, Shades of Red, Green, Dirty, White etc.,
3. Calcite à Colourless, White, Shades of Red Grey, Yellow etc.,

STREAK:

The colour of mineral powder is called streak of a mineral, may be quite different from that of the mineral mass. An unglazed white porcelain plate called a streak plate is used in the lab for testing the streak of a mineral. It is conveniently obtained for observation purpose by rubbing a mineral against by harder surface.

1. It is a reliable property than colour during specific investigation of sulphides some oxides.
2. Magnetite chromite, though look alike (inform, colour luster) can be distinguished from streak. Magnetite gives black streak, whereas chromite gives brown streak.

LUSTRE:

Lustre is the nature of shining on the surface of the mineral.

Based on the Quality of Shining Lustre are grouped as:

Sl.No.	Name of the Lustre	Description of Lustre	Mineral Examples
1	Metallic Lustre	Metallic Lustre is the type of shinning that appears on the surface of a metal	Galena, Pyrite, Gold, Bernie

2	Submetallic Lustre	Similar to Metallic Lustre but the amount of Shining is less	Hematite, Chromite, Magnetite, Ilmenite, Psiolmelane
3	Vitreous Lustre	Shining like a Glass Sheet	Quartz, Calcite, Dolomite, Feldspar barytes etc.,
4	Sub vitreous	Sub vitreous Lustre is similar to vitreous but with less shining	Pyroxenes amphiboles
5	Pearly Lustre	Shining like a Pearl	Tale, Selenite (Gypsum) Mica Muscovite
6	Silkey Lustre	Shining like a Silk	Fibrous Minerals kike asbestos satinspar
7	Resinous Lustre	Shining like a Resin	Opal agate chalcedony
8	Greasy Lustre	Shining like a Grease	Graphite, Serpentine
9	Adamantine Lustre	Shining like a Diamond	Garnet, Sphene, Zircon Diamond
10	Earthy or Dull Lustre	Shining like a Earth or Chalk	Magnesite, Kaolin, Chalk Bauxite

The Lustre of mineral may be of different degrees of intensity, according to the amount of light reflected form their surfaces: Splendent, Shinning, Glistening Glimmering Dull

FRACTURE:
Fracture is the randomly broken surface a mineral. It is important to note the characters of the fracture displayed in the broken or chipped surfaces. Fracture

with irregular surfaces are independent different from smooth flat surfaces of cleavages

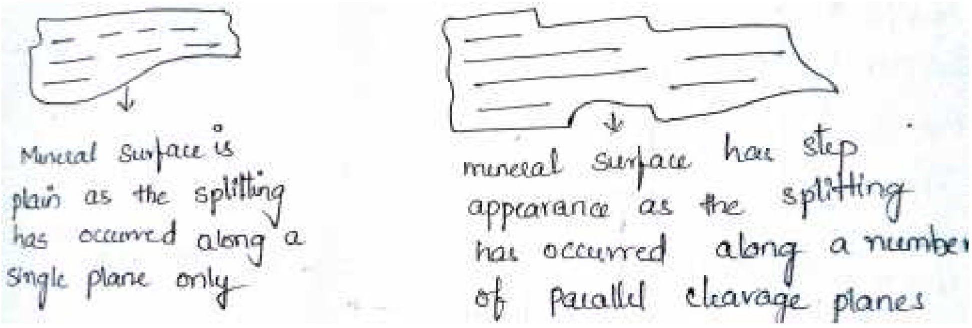
Fracture is described as:

Sl.No.	Name of the Fracture	Description of the Mineral	Mineral Examples
1	Even Fracture	If the broken surface of a mineral is plain an smooth, it is called Even Fracture	Magnetite, Chalk
2	Uneven Fracture	If the broken surface is rough or irregular it is called Uneven Fracture	Most of the Minerals
3	Hackly Fracture	If the broken surface is very irregular like the end of a broken stick	Asbestos, Tremolite, Kyanite
4	Conchoidal Fracture	If the broken surface is smooth curved it is called Conchoidal Fracture	Opal, Volcanic Glass
5	Sub-Conchoidal Fracture	If the curved nature is less prominent it is called Sub-Conchoidal Fracture	Agate, Flint, Japer etc.,

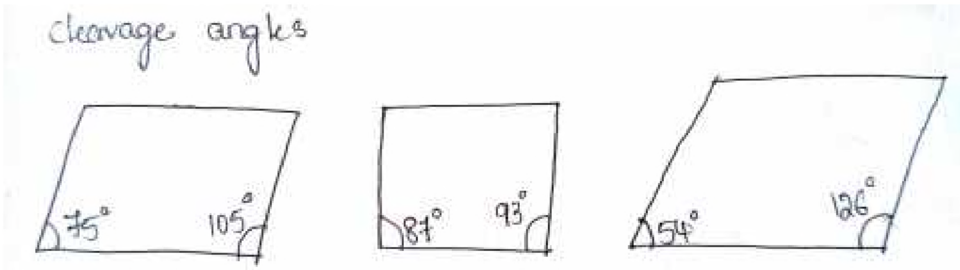
Like streak it is also less useful in mineral identification because a majority of the minerals shows the same kind of Fracture.

CLEAVAGE:
The definite direction or plane along which mineral tends to break easily is called the cleavage that mineral. Cleavage pane represents he planes of weakness in the atomic structure of a mineral. Cleavage if present occurs as innumerable parallel planes along which the mineral is equally weak. Hence all such parallel planes of weakness are referred to as a se. depending on their atomic structure. Crystalline mineral will have one set of cleavage, two sets of cleavage, three sets of

cleavage, four sets of cleavage, six sets of cleavage. The atomic structure of a mineral is definite. The cleavage, character of the mineral will also be definite. In any mineral the occurrence of cleavage can be detected easily by fitting or turning the specimen in different directions. Depending or the atomic structure development of cleavage character may differ in different minerals or in the same mineral.



Depending on the degree of perfection cleavage may be described as perfect or eminent or Excellent, Good, Imperfect, Poor or Indistinct. This is measurable by a Goniometer.



Changes Angles in a) Calcite b) Pyroxene Amphibole:

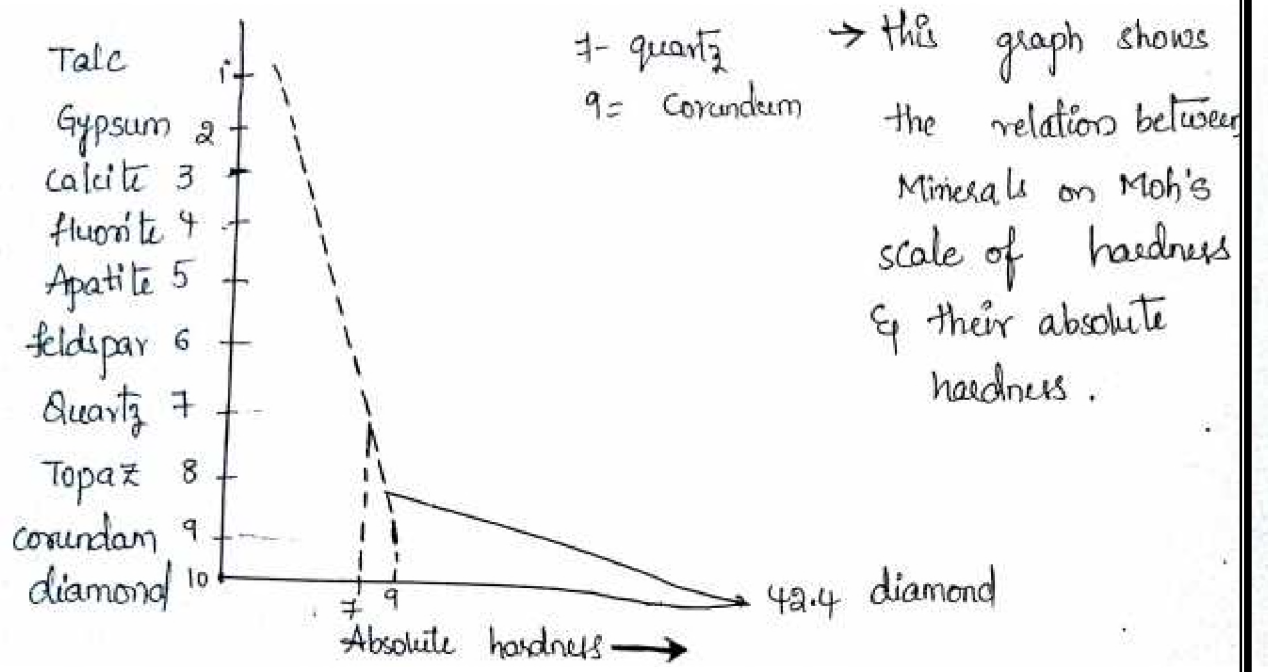
Sl.No.	Cleavage Sets	Mineral Example
1	1 Set	Mica, Chlorite Etc.,
2	2 Sets	Feldspar, Pyroxenes, Amphiboles
3	3 Sets	Calcite, Dolomite Galena
4	4 Sets	Fluorite
5	7 Sets	Sphalerite
6	No Cleavage	Quartz, Divine, Garnet

HARDNESS:

Hardness may be defined as the resistance offered by mineral to abrasion or scratching. Hardness may be tested by rubbing or scratching the specimen over a file or knife. The amount powder the degree of noise produced is a test of the hardness of the mineral. When a softer mineral is scratched by a harder mineral, a definite scratch is observed on the softer mineral.

A standard set of 10 reference mineral is used to determine the hardness of a mineral. This is called Moh Scale of hardness.

Talc	= 1
Gypsum	= 2
Calcite	= 3
Fluorite	= 4
Apatite	= 5
Feldspar	= 6
Quartz	= 7
Topaz	= 8
Corundum	= 9
Diamond	= 10



Hardness may be tested by means of Penknife (H=6), Window Glass (H=5) Fingernail (H=2.5).

SPECIFIC GRAVITY OR DENSITY:

Measure of Minerals Density

1. Density = Mass per unit volume Grams / cm^3.
2. Density depends on the type of atoms composing the mineral how densely they have packed by the crystal lattice.

General Range of Density:

1. Density around 2.7 common for light coloured rock forming minerals such as Felds par.
2. Density around 6 common pyrite other are forming minerals.

Note:
Some important rock forming minerals such as pyroxenes Amphiboles have densities around 3.3.

Specific Gravity is the ratio between its weight the weight of an equal volume of water at 40^0C. Based on the Specific Gravity of Minerals, the Density of Minerals may be described as High, Medium Low.

Sl.No.	Density	Mineral Example
1	Low Density	GYPSUM (2.3), Graphite (2-2.3) Coal (1-1.8)
2	Medium Density (Sp.Gravity 2.5-3.5)	Quartz (2.7), Feldspar (2.56-3.00), Pyroxene (3.1-3.5), Amphiboles (2.9-3.47), Mica (2.7-3.1)
3	High Density (Sp.Gravity 2.5-3.5)	Magnesite (5.18), Hematite (4.9-5.3), Galena (7.5), Hematite (3.5-5.5), Pyrolusite (4.8), Chromite (4.5-4.8) tin stone (8.71)

DEGREE OF TRANSPARENCY:

Depending upon the resistance offered by the mineral to the passage of light through them, they may be classified as transparent, translucent opaque.

1. Transparent:-Passage of light through the mineral.
2. Translucent:-Allows the passage of light but reflects back the light by mineral.
3. Opaque:-Does not allow does not reflect back the light.

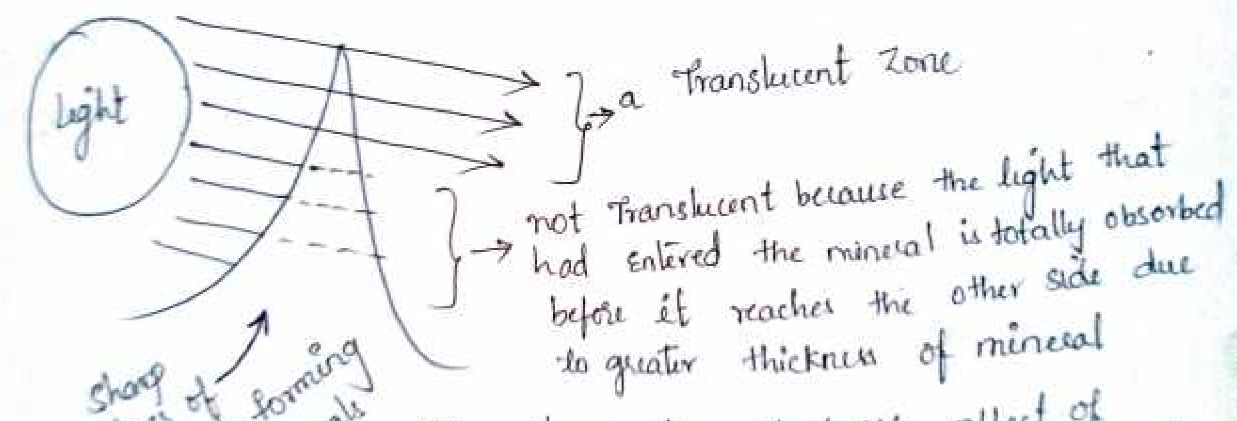


fig :- shows the thickness effect of transparency of rock forming Minerals.

SPECIAL PROPERTIES:

Some minerals exhibit peculiar characters which enable them to be identified easily. In some cases they are the consequences of the physical properties of the mineral itself. They are as follows.

1. Tale by virtue of its Soft Nature (H-1) exhibits smooth touch or soapy feel.
2. Graphiteà its low hardness (H-1 to 2) black color marks on paper due to their softness black colour soil the fingers.

IDENTIFICATION OF MINERALS

AIM:
Identification of the given mineral by using physical properties.

PROCEDURE:
The following prospectus are to be observed for the identification of the given minerals.

1. Colour :
2. Streak :
3. Lustre :
4. Form :
5. Hardness :
6. Cleavage :
7. Fracture :
8. Density / Specific Gravity :
9. Degree of Transparency :
10. Special Properties :

CONCLUSION
Based on the above physical prospectus the given specimen is identified as.

11. Uses :
12. Chemical Composition :
13. Mode of Occurrence :
14. Crystal System :

II. Megascopic description identification of rocks referred under theory:

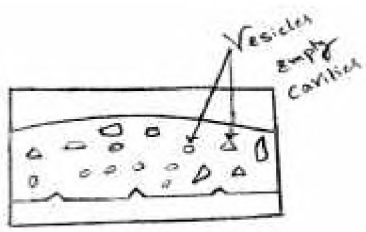
a. MEGASCOPIC IDENTIFICATION DESCRIPTION OF IGNEOUS ROCKS:

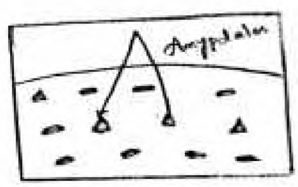
AIM:
Megascopic identification description of the Igneous Rock.

PROCEDURE:
The following prospectus are to be observed for the identification of the given minerals.

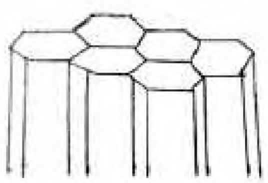
1. COLOUR: The body colours of the Igneous Rock.

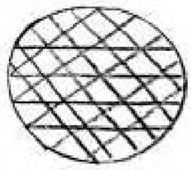
2. STRUCTURE: The common structures of igneous rock are.
   a. Vesicular Structure: The rock contains empty cavities of various sizes shapes also called porous structure the cavities are called vesicles.
   b. Amygdaloidal Structure: The vesicles which are empty are filled with hydrothermal solutions such fillings are called amygdales.



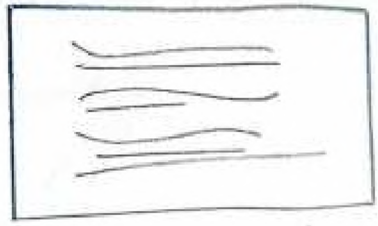


   c. Columnar Structure: The Igneous rock appear to be made up numerous parallel polygonal prismatic columns bundled together.

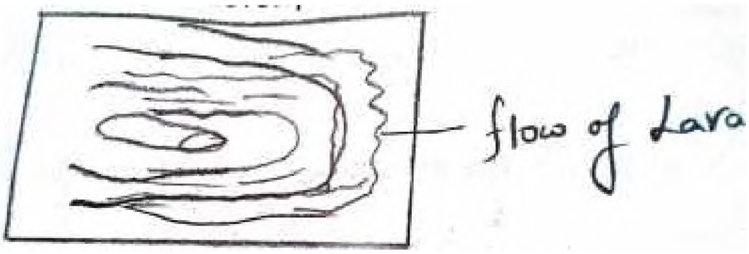




   d. Sheet Structure: The rock appear to be made up of a No.of Sheets.



e. Flow Structure: This structure refer to be linear nearly parallel features occurring in volcanic rock which develop as a consequence of the flow of lava.



f. Pillow Structure: The rock appear as a pile of numerous overlapping pillows

v Common Texture of Igneous Rocks: The texture based on the degree of crystallinity.

- Holo Crystalline: (Holo = Complete) or completely crystalline i.e., completely made up of minerals without glory matter.
- Holohyaline: (Hyaline = Glassy) composed of only glass without any minerals.
- Hemi Crystalline: (Hemi = half) partly crystalline partly glassy it means some part composed of minerals rest being glass.

v Textures based on Granularity:

1. Phaneric Texture: If the mineral grain size in rock are big enough to be seen by the naked eye.

- If the mineral grain size is > 5 mm the texture of the rock is called Phaneric Coarse.
- If the mineral grain size is between 1 mm to 5 mm the texture of the rock is called Phaneric Medium.
- If the mineral grain size is < 1 mm the texture of the rock is called Phaneric Fine.

2. Aphanitic Texture: If the mineral grain sizes are too fine to be seen separately by the naked eye.

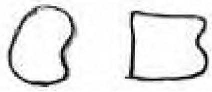
- Aphanitic Glassy à Minerals grains are of glassy material.
- Aphanitic Crystalline à Minerals grains are of mineral mater.

Micro Crystalline	Crypto Crystalline
↓	↓
Seen under Microscope	Seen by the Polarized Light

v Textures based on the Shapes of Crystals:

1. Euhedral: When the mineral is completely bounded the crystal faces.

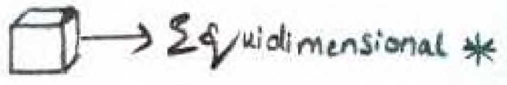
2. Anhedral: When crystal faces are absent.



3. Subhedral: When only a part of the mineral is bounded by the crystal.

v Texture Shapes of the Crystal based on growth Pattern:

1. Equidimensional à The Minerals grows equally in all directions.



2. Platy à The growth is possible only in 2 directions.

3. Prismatic à Similar to equidimensional but elongated.

4. Irregular à No definite shape

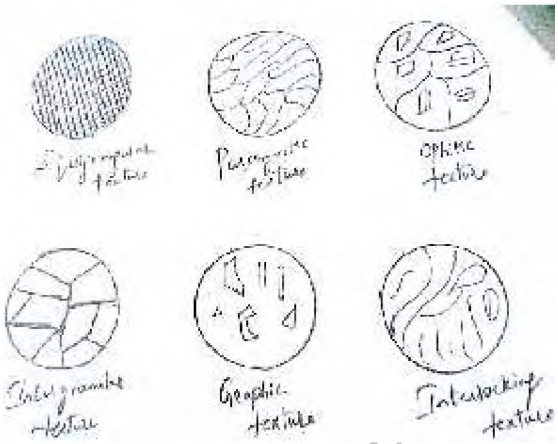
v Texture Shapes of the mutual relationships of constituent minerals of rock:

1. Equidimensional Texture à The Minerals grains present are approximately of the same size depending on the grain size this may be described as either phaneric or aphetic.
2. Phaneric Coarse grained equiangular.
3. Phaneric Medium grained equiangular.
4. Phaneric Fine grained equiangular.
5. Aphanitic equiangular (observed under microscope).
6. In equiangular texture different sizes of the mineral grains occur in the rock surface.

v Porphyritic Textures: Mineral grains of two different sizes occur i.e., larger smaller. Larger mineral grains is called phenocryshs smaller mineral grains is called ground mars.

1. Poilitic Texture: In this the smaller mineral grains are enclosed in between larger ones.

2. Ophitic Texture: In this mineral grains enclose small rectangular grains in larger ones.
3. Seriate Texture: In this the grain size of minerals are gradually from the smallest to the largest.
4. Enter Granular Texture: In this rectangular shaped grains forms a networks.
5. Graphic Texture: This is an intergrowth texture by the two minerals that are formed simultaneously.
6. Inter Locking Texture: The different minerals are closely inter linked or mutually locked with one another.



3. MINERALOGY: It presents of No.of Minerals in the rock. The composition of group of minerals in the rock.
   - Essential Minerals: The highest composition / high percentage of the minerals.
   - Accessory Mineral: Low mineral composition in rock.

4. CONCLUSION:

5. PETROGENISIS: Which type of rock.

6. E-PROPERTIES:

IDENTIFICATION OF IGNEOUS ROCKS

SPECIMEN NO:

AIM : Megascopic identification geotechnical description of the Igneous Rocks.

PROCEDURE

1. COLOUR :
2. STRUCTURE :

   Texture :

   a. Crystallinity :
   b. Granularity :
   c. Shape of the Crystal :
   d. Mutual relations of Constituent mineral of rock :
   e. Others :

3. MINERALOGY :

   a. Essential Minerals :
   b. Accessory Minerals :
   c. Cementing Material :

4. CONCLUSION : Based on the texture mineralogy, the given rock sample is identified as ______________________.
5. PETROGENISIS :
6. E-PROPERITES :

b. MEGASCOPIC IDENTIFICATION DESCRIPTION OF SEDIMENTARY ROCKS

SEDIMENTARY ROCKS:

Sedimentary Rocks: Sedimentary Rocks are formed due to the weathering erosion of the pre-existing rocks. Sedimentary Rocks are classified on the basic of the character of the mineral process which leads to its deposition. In additional, the depositional environments plays a major role in the formation of Sedimentary Rocks i.e., deposited the material by wind action or water action

Example: SStone, Lime Stone, Dolomite, Shale, Conglomerate etc.,

IDENTIFICATION OF SEDIMENTARY ROCKS:

AIM:

Megascopic identification description of the Sedimentary Rock.

PROCEDURE:

The following prospectus are to be observed for the identification of the given minerals.

1. Texture: Sedimentary Rocks are formed out of Sedimentary deposits in basin (LOWLYING ARE) like fragments of the rocks which are the products of weathering. So, these sediments vary in sizes like Clay, Sand, Pebbles Boulders due to attraction abrasion suffered during to their place of deposition. So the grains of sediments change its shape for example angular to rounded shape the loose sediments change to sedimentary rocks due to process called lith; faction. Loose mineral grains are held together by cementing materials.
   a) Grainsize: During formation of Sedimentary physical breakdown of rocks takes place. Based on the range of grainsize sediments are classified on to certain grades.

Sl.No.	Grade	Range of Grainsize of Sediments
1	Boulders	> 200mm
2	Cobbles	50-200 mm
3	Pebbles	10-50 mm
4	Gravel	2-10 mm
5 a	Very Coarse S	1-2 mm
b	Coarse S	0.5-1 mm
c	Medium S	0.25-0.5 mm
d	Fine Sane	0.1-0.25 mm

6	Silt	0.01-0.1 mm
7	Clay	0.01 mm

b) Shape of the Grain:
1. Angular: Very Angular, Angular, Sub-Angular
2. Rounded: Very Rounded, Rounded, Sub- Rounded
   - Heavier fragments becomes more Rounded than the small ones.
   - The softer mineral become more rounded than the border minerals.

c) Orientation of Grains: Based on the arrangements of grains they are Randomly Oriented, Horizontally Oriented, Vertically Oriented, Inclined Oriented or Incliendly Oriented.

d) Packing of Grains: Loosely Packing of Grains, Closely Packing of Grains, Densely Packing of Grains.

e) Sorting of the Grains: Poorly Sorted, Well Sorted Medium Sorted.

2. Mineralogy:

a. Minerals: Types of Minerals presented in a given rock sample.
   Eg: Quartz, Clay Minerals, Calcite, Feldspar etc.,
b. Matrix: The arrangements attachment. Packing sorting of the goods.
   Eg: Conglomerates brelias rocks the fine grains surrounding large pebble consists of matrix. Matrix means finer materials acts as matrix between the grains of the Sedimentary Rocks.
c. Cementation or Cementing Material: The material which bonds the individual grains such materials is called cementing. Generally finer material acts as a binding material depending on various finer materials kike calcareous, argillaceous, ferruginous or siliceous.

3. Classification: The Sedimentary Rocks are broadly classified into Detrail Non Detrail Rocks, Residual Rocks, Chemical Deposits Organic Deposits.

a. Detrail Rocks: are popularly called elastic rocks are formed of physically broken transported rock fragments.
b. Non-Detrail Rocks or Non Clastic Rocks: These rocks are formed due to precipitation evaporation etc.,
c. Residual Rocks: Sedimentary Rocks formed insitu due to weathering of rocks, compositionally they are made up of unaltered minerals insoluble products of decomposition of other mineral of original rocks. Unaltered minerals may be garnets, iron oxide, tourmaline, insoluble products are clay minerals.
   Eg: Laterite or combination of different sizes of the grain or sediments.
d. Detrail Rocks: These Rocks are formed or made up of grains fragments coarser than gravel which had undergone transport physically due to geological agencies like wind, river glaciers. These types of rocks also depends on the size shape of the fragments.
e. Chemically Formed Rocks: During weathering of rocks some of the soluble constituents are leached carried away in the form of solution such

dissolved matter come out as solid material subsequently either due to precipitation or evaporation. Which are physical chemical deposits.
Eg: Lime Stone.

f. Organically Formed Rock: The Sedimentary deposits which are formed with the active involvements of plants animals if these are mainly due to plants they are called phytogenic if they mainly due to animals called zoogenic.

1. Calcareous Type
2. Phosphatic Type
3. Ferrorgeneous Type
4. Siliceous Type
5. Carbonaceous Type

4. Conclusion: Based on the texture mineralogy the given rock sample is identified as _______________

5. Petrogenesis: Based on the above description he origin of the rock is identified as sedimentary rock indicates the depth of formation distance travelled etc.,

6. Engineering Properties: Based on the type of sedimentary rocks it possess certain properties like Strength, Density, Specific Gravity, Hardness etc., which are to be used for the certain engineering purpose.

IDENTIFICATION OF SEDIMENTARY ROCKS

SPECIMEN NO:

AIM : Megascopic identification geotechnical description of the Sedimentary Rocks.

PROCEDURE :

1. TEXTURE :
   a. Grainsize :
   b. Shape of the Grains :
   c. Orientation of the Grains :
   d. Packing of the Grains :
   e. Sorting of the Grains :

2. MINERALOGY :
   a. Minerals :
   b. Matrix :
   c. Cementing Material :

3. CLASSIFICATION:

4. CONCLUSION : Based on the texture mineralogy, the given rock sample is identified as ______________________.

5. PETROGENISIS :

6. E-PROPERITES :

c. MEGASCOPIC IDENTIFICATION DESCRIPTION OF METAMORPHIC ROCKS:

Metamorphic Rocks: Metamorphic Rocks are formed through the transformation of the pre-existing rocks under increased temperature pressure conditions. This process of transformation is known as Metamorphism.
Formation of Metamorphism rock from a pre-existing is controlled by the following parameters Temperature, Pressure, Chemically active fluid these there are known as Metamorphism agents. Generally all these three acts together cause Metamorphism. But sometimes, any one or two of them any dominate play together cause Metamorphism. But sometimes any one or two of them may dominate play on active role.

Temperature: Changes take place in the temp 350-380 ^{0}C.

Pressure: Uniform pressure increase with depth direct pressure due to tectonic forces.

Chemicals: Liquids which acts as carrier of chemical components, volatiles of magma hydrothermal solutions.

IDENTIFICATION OF METAMORPHIC ROCKS:

AIM:
Megascopic identification geotechnical description of the Metamorphism Rock.

PROCEDURE:
The following prospectus are to be observed for the identification of the given minerals.

1. Colour: Body Colour
2. Grain Size: Depends on the Size of the Sediments

Sl.No.	Grade	Range of Grainsize of Sediments
1	Boulders	> 200mm
2	Cobbles	50-200 mm
3	Pebbles	10-50 mm
4	Gravel	2-10 mm
5 a	Very Coarse S	1-2 mm
b	Coarse S	0.5-1 mm
c	Medium S	0.25-0.5 mm

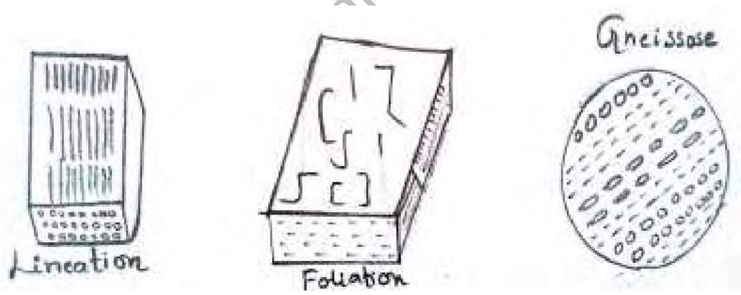
d	Fine Sane	0.1-0.25 mm
6	Silt	0.01-0.1 mm
7	Clay	0.01 mm

3. Texture: In Metamorphism rock textures are form due to recrystallization occur or both may be together.

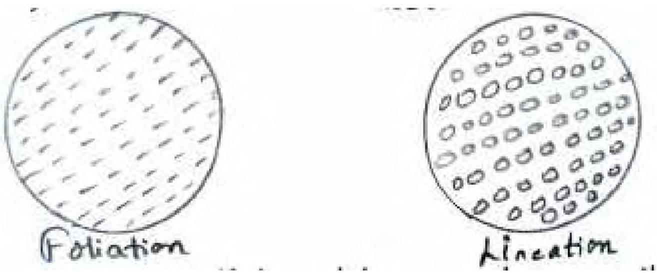
- Crystalloblastic Palimpsest Texture: The texture which have developed newly during the process Metamorphism are called crystalloblastic texture.
- Palimpsest Texture: The texture which bond parent rock but still retained in Metamorphic Rocks are called Palimpsest texture (refer all textures of Igneous Sedimentary).
- Xenoblastic Idioblastic Texture: The Crystalloblastic Idioblastic Texture. In the Xenoblastic Texture, the constituent minerals of the rock have no well-developed crystal faces. If eh minerals have well developed crystal faces forms the texture is known as idioblastics.
- Others: If the porphyritic texture appear as a result of Metamorphism it is called Balstoporphyritic.

4. Structure:

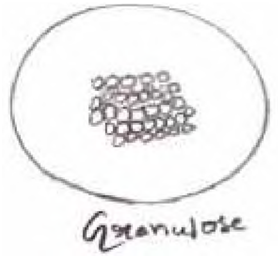
- Gneissose Structure: If the rock consists of equidimensional minerals along with other first segregation of minerals occurs alternating bands are formed (i.e., equidimensional other minerals occurs (alternating bands)) then foliation of platy prismatic minerals take place such a texture or arrangement of minerals is Gneissose Structure.



- Schistose Structure: If the rock consists of only prismatic or platy minerals. Then no segregation takes place (because of the absences of equidimensional minerals) but only foliation or lineation is called Schistose Structure.



- Granulose Structure: If the rock is composed permanently of equidimensional minerals then neither segregation nor foliation takes place (segregation does not occur because of the absence of platy or prismatic minerals. Foliation or alignment does not appear because of equidimensional character of minerals) such a texture is called Granulose Structure.



- Cataclastic Structure: If the rock contains soft rocks hard rock is called Cataclastic Structure.

Cataclastic { Relatively Stronger, Harder Tougher

5. Mineralogy: Types of Minerals present in the Metamorphism Rocks or in a given sample.

6. Conclusion: Based on the texture structures mineralogy the given rock sample is identified as ____________

7. Petrogenesis: Based on the mineral composition of the Rock the kind of Metamorphic Rock are diagnosed.

8. Engineering Properties: Every Rock possess particular engineering property which is used for Civil Engineers Purpose.

IDENTIFICATION OF METAMORPHIC ROCKS

c. Identification of Metamorphic Rocks

SPECIMEN NO:

AIM: Megascopic Identification geotechnical description of the Metamorphic Rocks.

PROCEDURE:

1. Colour:
2. Grain size:
3. Texture:
4. Structure:
5. Mineralogy:
6. Conclusion:

   Based on the texture, structure mineralogy, the given rock sample is identified as .

7. Petrogenesis:
8. Engineering properties:

III. Interpretation drawing of sections for geological maps showing tilted beds, faults, unconformities etc.

Construction of geological profiles interpretation of geological history from geological maps.

IV. Simple structural geology problems:

<u>THICKNESS OF BEDS:</u>

1. A coal bed dips at an angle of 40°W. If the exposed thickness of the coal bed at its surface is 200 m, find the true thickness vertical thickness of the bed.

2. A ground is sloping towards West at an angle of 15°. A coal bed is dipping at an angle 50° towards East. If the exposed thickness of coal bed is 300 m what are its true vertical thicknesses?

3. A sstone bed is dipping at 45 ° W. If its vertical thickness under a river bed sloping towards west at a gradient of 1 in 5 is 75 m, find the true thickness exposed thickness.

4. If the top of the coal bed is met a depth of 100 m bottom at a depth of 700 m, its true thickness is 450 m find the exposed thickness when the ground is (a) horizontal (b) inclined at 20°W.

STRIKE DIP:

1. A bed dips at 1 in 8 along N 30° W 1 in 10 along N 45 °
   (a) Find its True dip
   (b) Find the dip along N 60° E
   (c) Find the direction along which the Dip is 1 in 12
2. A coal bed dips at the rate of 1 in 8 along S 35° E. Find the apparent dip in a direction S 10° W.
3. A sbed dips at the rate of 1 in 5 in a direction S 30 °E. Determine the direction in which the strata dips at 1 in 10
4. A coal bed dips 50° along S 30° W. Find the direction along which the dip ids 28°
5. A sstone bed dips at 40 ° along N 60° E. Determine the amount of dip along S 80° E.
6. A coal bed dips at 30° along S 50° E 25 ° along N 70° E. Find the amount of true dip the direction along which it acts.

FAULTS:

1. A limestone bed is found dipping 40° W occur at two places separated by a distance of 180 m. A fault is found at the midpoint of the beds dipping at 45 °E. Find out Throw, Hade, Net slip the type of fault.
2. A Sandstone that strikes N 45° W dips 60 ° SW is broken by a strike fault that dips 35° SW. The sandstone outcrops 250m north east of the fault 150m south west of the fault. Assuming the movement to have been directly down the dip of the fault plane, calculate the (a) net slip (b) dip slip (c) strike slip (d) throw (e) heave (f) horizontal separation in a vertical plane perpendicular to the strike of the fault. (g) Vertical separation in the same plane (h) stratigraphic throw.