ENGINEERING GEOLOGY LABORATORY MANUAL

DEPARTMENT OF CIVIL ENGINEERING

MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

2022-2023

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CERTIFICATE

This is to certify that this manual is a bonafide record of practical work in the **Engineering Geology Laboratory** in **ThirdYear, First Semester** of**B.Tech (Civil Engineering) programme**during the academic year **2022-23**. The book is prepared by **Ms. Ch. Rajeshwari,**Assistant Professor, Department of Civil Engineering of **MLRITM.**

Signature of HOD Signature of Dean Academics Signature of Principal

CivilEngineeringDepartment -Laboratorydetails

The followinglaboratories aeavailableinthe CivilEngineeringdepartmentofthecollege.

1. Surveyinglab-I
2. StrengthofMaterialslab
3. Computer AidedDraftingofBuildingsLab
4. Surveyinglab-II
5. FluidMechanics&HydraulicMachineryLab
6. Engineering GeologyLab
7. GeotechnicalEngineeringLab
8. AdvancedCommunicationsSkillsLab
9. Concrete&HighwayMaterials lab
10. EnvironmentalEngineeringlab

EngineeringGeologyLab:(MV-401)

Objectives:

- Itenablesacivilengineer tounderstandengineeringapplicationofcertainconditionsrelatedtotheareaofconstructio n,whicharemostlygeological.
- Itenablesageologisttounderstandthenatureofthegeologicalinformationthatisessentia l forthe safe designand constructionofa civilengineeringproject.

Scope:

- Thescopeofengineeringgeologybeststudiedconcerningsignificant activitiesoftheprofession of civil engineer which are: Construction, water resource development,townandregionalplanning.

NameoftheFacultyInchargeforthelaboratory:
MsCh. Rajeshwari

Location:
Thelaboratoryislocatedintheroomno:MV401.

NumberofSpecimens:
Minerals : 24 in
noRocks :12inno

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PREFACE

This book entitled “Engineering Geology Lab Manual” is intended for the use of fifth semester(i.e., III-I)B.Tech(civil)studentsofMarriLaxmanReddyInstituteofTechnologyandManagement,Dundigal,Hyderabad.ThemainobjectiveoftheEngineeringGeologyLabManualis to teach the student basic drawing fundamentals in various civil engineering applications,especially in minerals, rocks, structural geology. This book lays foundation of certain basicconcepts and skills that can be repeatedly employed by the students in their future endeavors. ThebookwaswrittenasperthenewsyllabusprescribedbytheJNTUHuniversityinasimplelanguage.

By

Ms.Ch. Rajeshwari,
Assistant Professor,
Department of civil engineering.

ACKNOWLEDGEMENT

It was really a good experience, working at Engineering Geology Lab. First, I would like to thankDr.V. Varalakshmi, Professor, Department of Civil Engineering, Marri Laxman ReddyInstituteoftechnology&Management forgivingthetechnicalsupportinpreparingthedocument.

I express my sincere thanks to Mr.K. Murali, Head of the Department of Civil Engineering, MarriLaxman Reddy Institute of technology & Management, for his concern towards me and gave meopportunitytoprepare environmentalengineeringlaboratorymanual.

I am deeply indebted and gratefully acknowledge the constant support and valuable patronage ofDr.B.Ravi Prasad, Dean Academics, Marri LaxmanReddyInstituteoftechnology&Management.Iamunboundedlygratefultohimfortimelycorrections andscholarlyguidance.

IexpressmyheartythankstoDr.K. VenkateswaraReddy,Principal,MarriLaxmanReddyInstituteoftechnology&Management,forgivingmethiswonderfulopportunityforpreparingtheenvironmentalengineeringlaboratorymanual.

Atlast,butnottheleastIwouldliketothankstheentireCivilDepartmentfacultiesthosewhohadinspiredandhelpedmetoachievemygoal.

By,

Ms.Ch. Rajeshwari,
Assistant Professor,
Department of civil engineering.

GENERALINSTRUCTIONS

1. Studentsareinstructedto cometo Engineering Geologylaboratoryontime.Latecomersarenotentertainedinthelab.

2. Studentsshouldbepunctualtothelab.

3. Studentsareexpectedtocomepreparedat homewiththeexperimentswhicharegoingtoperform.

4. Studentsareinstructedtodisplaytheiridentitycardsand apronbeforeentering thelab.

5. Studentsareinstructednottobringmobilephonestothelab.

6. ThecomputersandotheraccessoriesusedinEngineeringGeologylabshouldbehandledwithca reandresponsibility.

7. Anydamagetothecomputersduringthelabsessionisstudent'sresponsibility, andpenaltyorfinewillbecollectedfromthestudent.

8. Studentsshouldupdatetherecordsandlabobservationbookssessionwise. Before leavingthelab,thestudentshouldgethislabobservationbooksigned bythefaculty.

9. Studentsshouldsubmitthelabrecords2/3days inadvancetotheconcernedfacultymembersinthestaffroomfortheircorrectionandreturn.

10. Studentsshouldnotmovearoundthelabduringthelabsession.

11. Ifanyemergencyarises,thestudentshouldtakethepermissionfromfacultymemberconcer nedinwrittenformat.

12. Thefacultymembers maysuspendanystudentfromthelabsessionondisciplinarygrounds.

INSTITUTION VISION AND MISSION

VISION

To establish as an ideal academic institution in the service of the nation, the world and the humanity by graduating talented engineers to be ethically strong, globally competent by conducting high quality research, developing breakthrough technologies, and disseminating and preserving technical knowledge.

MISSION

To fulfil the promised vision through the following strategic characteristics and aspirations:

- Utilize rigorous educational experience to produce talented engineers
- Create an atmosphere that facilitates the success of the students
- Prudent and accountable resource management.
- Programs that integrate global awareness, communication skills and leadership abilities.
- Education and Research partnerships with institutions and industries for preparing the students for interdisciplinary research
- Successful alumni in their profession at global level.

DEPARTMENT VISION, MISSION, PROGRAMME EDUCATIONAL OBJECTIVES

AND SPECIFIC OUTCOMES

VISION OF THE DEPARTMENT:

The Civil Engineering department strives to impart quality education by extracting the innovative skills of students and to face the challenges in latest technological advancements and to serve the society.

MISSION OF THE DEPARTMENT:

M-I Provide quality education and to motivate students towards professionalism.

M-II Address the advanced technologies in research and industrial issues.

PEO's

The Programme Educational Objectives (PEOs) that are formulated for the civil engineering programme are listed below:

PEO-I solving civil engineering problems in different circumstances

PEO-II Pursue higher education and research for professional development.

PEO-III Inculcate qualities of leadership for technology innovation and entrepreneurship

PROGRAMME SPECIFIC OUTCOMES

PSO1	**UNDERSTANDING:** Graduates will have ability to describe, analyze and solve problems using mathematical, scientific, and engineering knowledge.
PSO2	**ANALYTICAL SKILLS:** Graduates will have an ability to plan, execute, maintain, manage, and rehabilitate civil engineering systems and processes.
PSO3	**EXECUTIVE SKILLS:** Graduates will have an ability to interact and work effectively in multi-disciplinary teams.

PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

COURSE STRUCTURE, OBJECTIVES & OUTCOMES

COURSE STRUCTURE

Engineering Geology laboratory will have a continuous evaluation during fifth semester for 30 sessional marks and 70 end semester examination marks.

Out of the 30 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 20 marks and internal practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned.

The end semester examination shall be conducted with an external examiner and internal examiner. The external examiner shall be appointed by the Principal / Chief Controller of examinations.

COURSEOBJECTIVE

The objective of this lab is to expose the student to identify the physical properties of Minerals and Rocks in various civilengineeringapplications,especiallyduring construction major Civil constructions like Dams and Tunnels.

COURSEOUTCOME

Attheend ofthecourse,thestudent willbeableto:

- Understand the role of Geological concepts in Civil Engineering.
- Evaluate different types of minerals and rock compositions.
- Understand different geological structures and its suitability for groundwater and building construction
- Evaluate subsurface information through geophysical investigations
- Apply geological principles in selecting sites for tunnels, dams and reservoirs

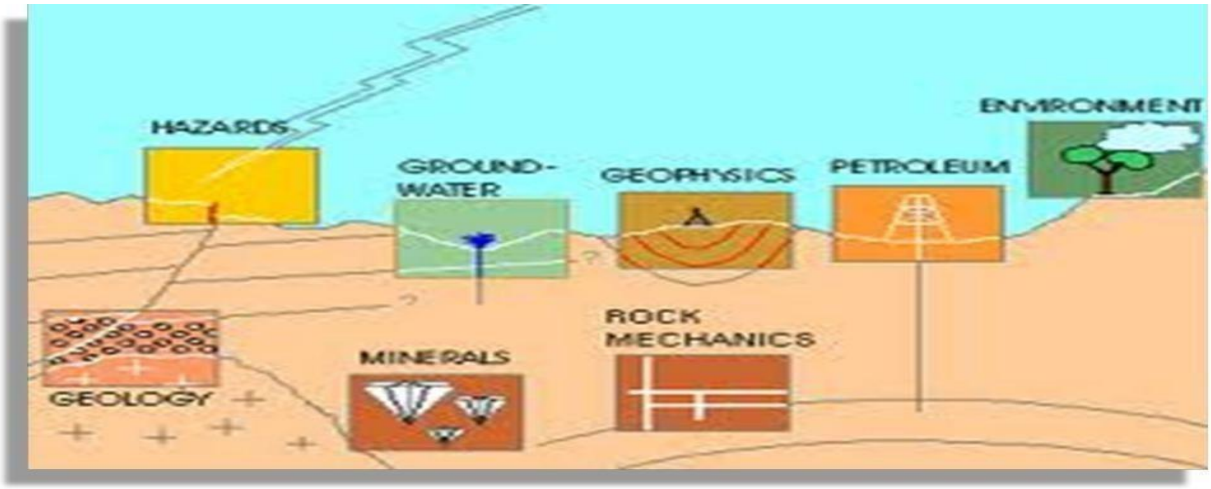
COURSE ARTICULATION MATRIX (CO - PO / PSO MAPPING):

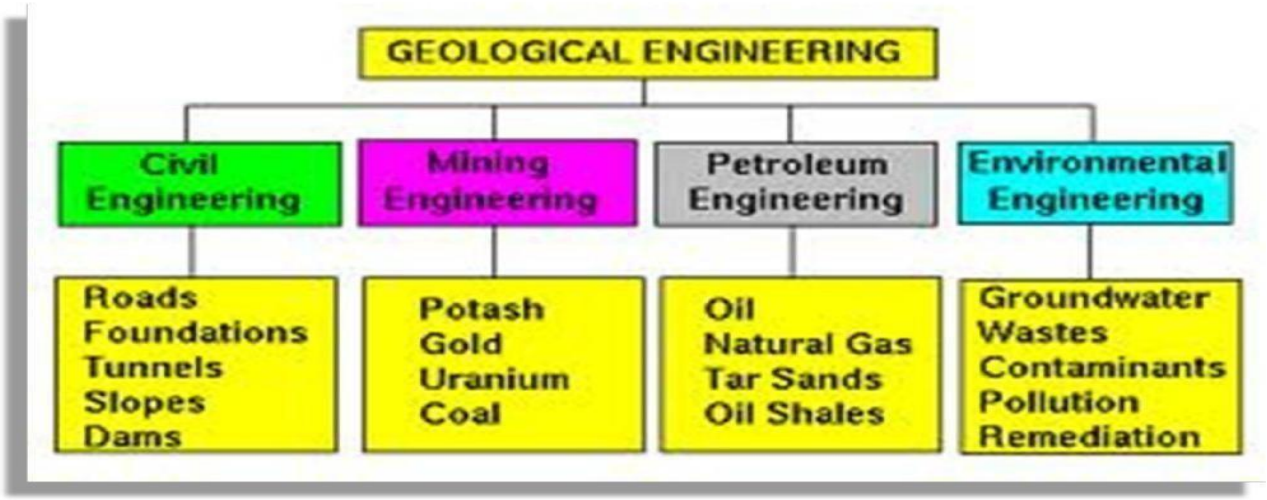
Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CE225.1	3	1	1	1	0	1	1	0	0	0	0	0	1	0	0
CE225.2	3	1	1	1	0	1	1	0	0	0	0	0	1	0	0
CE225.3	3	1	1	2	0	1	1	0	0	0	0	0	1	0	0
CE225.4	3	1	1	1	0	1	1	0	0	0	0	0	1	0	0
CE225.5	3	1	1	2	0	1	1	0	0	0	0	0	1	3	0
CE225.6	3	1	2	2	0	1	1	0	0	0	0	0	1	3	0
Total	18	6	7	9	0	6	6	0	0	0	0	0	6	6	0
Average	3	1	1.2	1.5	0	1	1	0	0	0	0	0	1	1	0

INTRODUCTION TO ENGINEERING GEOLOGY LABORATORY

Scope of Geology

Geology is the science of the earth, it is not a fundamental science like mathematics, physics, chemistry or biology, but is an application of these basic sciences to the problems presented by the earth.





- Engineering geology may defined as the branch of applied science which deals with the application of geology for a safe and economic design and construction of a civil engineering projects

The primary objectives of engineering geology are:

- It enables a civil engineer to understand engineering application of certain conditions related to the area of construction, which are mostly geological.

- It enables a geologist to understand the nature of the geological information that is essential for the safe design and construction of a civil engineering project.
- The scope of engineering geology best studied concerning significant activities of the profession of civil engineer which are: Construction, water resource development, town and regional planning.

Geology in Construction

In all types of heavy construction jobs such as buildings, towers, tanks, dams and reservoir, highway bridges, traffic and hydropower tunnels etc. full geological information about the site of construction (or Excavation) and about the natural materials of construction is paramount importance.The aspect of geology has full relevance in all the three aspects of each construction i.e. planning,designing and execution.

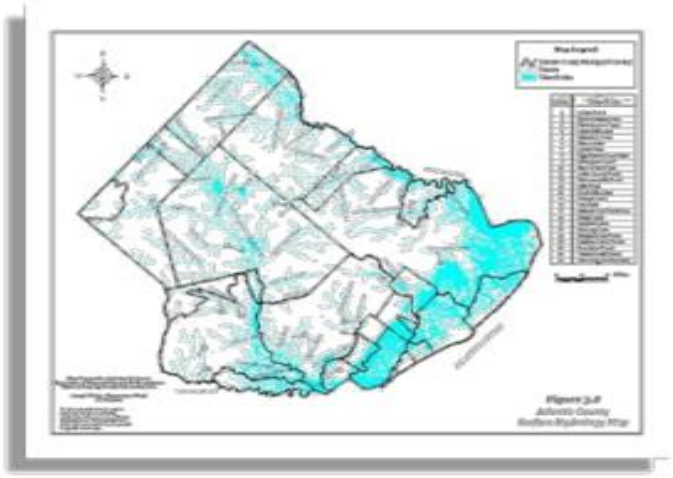
Planning

- Following geological information is greatly useful in planning an engineering project.
- Topographical maps Such maps give details of relief features and are essential to understand relative merit and demerit of all the possible sites.
- Hydrological Maps. These maps give broad details about the distribution and geometry of the surface water channels and also the occurrence and depth contour of groundwater.
- Geological Maps. Petrological characters and structural disposition of rock types as developed in the proposed area depicted in geological maps.

Design

Some of the geological characters that have a direct or indirect bearing upon the design of a proposed project are:

(i) the existence of hard bed rocks and their depth from and inclination.
(ii) The mechanical properties along and across the site of the proposed project;
(iii) Presence, nature and distribution pattern of planes of structural weakness
(iv) The position of ground water table in totality.
(v) Seismic character of the area as deciphered from the seismic history and prediction about future seismicity.



Construction

- The engineer responsible for the quality control of construction materials will derive enormous benefit from his geological background of the nature material such as sand, gravel, crushed rocks.
- Similarly for construction in geologically sensitive areas as those of coastal belts, seismic zones and permafrost regions, knowledge of geological history of the area is of great importance.
- Construction of underground projects like tunnels cannot at all be undertaken without a through knowledge of the geological characters and setting of the rocks and their relevance to the loads imposed.

Geology in Water Resource Development

- Exploration and development of water resources have become very important areas of activities for scientists, technologists and engineers in all parts of the world.
- The water resource engineers have to understand the water cycle in all essential details. Study of water cycle is an essential prerequisite for effective planning and execution of major water resource development programmers on national and regional level.

Geology in Town and Regional Planning

- A town planner is concerned essential with land utilization in as best and as aesthetics a manner as possible for developing cities and towns for meetings social needs indifferent areas.
- The regional Town Planner is responsible for adopting an integrated approach in all such cases of allocation of land for developmental projects.
- Thus a change induced in the natural setup of an area due to a proposed new project is going to lead a series of changes in the adjoining and even in distant places. In nature, nothing works in isolation. As such all sound planning must be in tune with the natural features and processes of a region.

PHYSICAL PROPERTIES AND IDENTIFICATION OF MINERALSSTUDY OF MINERALS

Mineral

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

Common methods of study for the identification of minerals

Method	Principle
X-ray analysis	Based on the study of atomic structure, distinctive for every mineral. Its limitation is expensive, time consuming.
Chemical analysis	Based on the study of chemical composition. Its limitation is expensive, time consuming and not suitable for minerals exhibiting polymorphism (two or more minerals exhibit different physical properties in spite of possessing the same chemical composition).
Optical study	Based on the net effect of chemical composition and atomic structure. Its limitation is expensive.
Study of physical properties	Based on the consistency in physical properties which are due to the definite chemical composition and regular atomic structure. Its limitation is liable for erroneous inference, sometimes.

LABORATORY STUDY

In laboratories minerals are identified preferably by the method of study of physical properties. Advantages

- The unique advantage is that the minerals can be studied in the field itself.
- It does not require any additional requirements, chemicals or equipment.
- It involves no loss or wastage of minerals. Hence repetitive study is possible.
- Immediate inference is possible.
- It is the cheapest and simplest method.

The following are the physical properties identified in the laboratory

1.Form

2. Colour

3.Streak

4. Luster

5.Fracture

6.Clevage

7.Hardness

8.Specific gravity

9.Diaphanibility

1. Form

The form represents the common mode of occurrence of a mineral in nature.

Form	Description	Example
Lamellar form	Mineral appears as thin separable layers.	Different varieties of Mica
Tabular form	Mineral appears as slabs of uniform thickness.	Feldspars, Gypsum
Fibrous form	Mineral appears to be made up of fine threads.	Asbestos
Pisolitic form	Mineral appears to be made up of small spherical grains.	Bauxite
Oolitic form	Similar to pisolitic form but rains are of still smaller size.	Lime stones
Rhombic form	Rhombic shape	Calcite
Bladed form	Mineral appears as cluster or as independent rectangular grains.	Kyanite
Granular form	Mineral appears to be made up of innumerable equidimensional grains of coarse or medium or fine size.	Chromite, Magnetite
Columnar form	Mineral appears as long slender prism.	Topaz
Prismatic form	As elongated	Apatite, quartz
Spongy form	Porous	Pyrolusite
Crystal form	Polyhedral, Geometrical shapes.	Garnets, Galena
Massive form	No definite shape for mineral.	Jasper, Graphite
Concretionary Form	Porous and appears due to accretion of small irregularly shaped masses	Laterite
Nodular form	Irregularly shaped compact bodies with curved surfaces.	Flint

2. Colour

It is the usual body Colour of mineral.

Name of the Mineral	Colour
Olivine	Olivine green
Biotite, Graphite, Magnetite	Black
Chlorite	Green
Garnet	Red
Kyanite	Blue
Amethyst	Violet
Quartz	Colourless, White, Green, Violet, Grey, Yellow, Pink etc
Feldspar	White, Grey, Shades of Red, Green, Dirty white, etc
Calcite	Colourless, white, shades of Red, Grey, Yellow, etc

3. Streak

The colour of the mineral powder is called the streak of a mineral. This is tested by rubbing the mineral on streak plate (An unglazed white porcelain plate).

Name of the Mineral	Body Colour	Streak
Hematite	Steel Grey	Cherry Red
Chromite	Black	Dark Brown
Magnetite	Black	Black
Graphite	Black	Black
Molybdenite	Black	Greenish Black

4. Luster

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

Luster	**Description**	**Example**
Metallic Luster	It is the type of shining that appears on the surface of a metal.	Galena, Gold, Pyrite
Sub metallic Luster	lf the amount of shining is less when compared to metallic luster.	Hematite, Chromite, Magnetite
Vitreous Luster	Shining like a glass sheet.	Quartz, Feldspar
Sub Vitreous Luster	Less shining when compared to vitreous Luster.	Pyroxenes
Pearly Luster	Shining like a pearl	Talc, Muscovite mica
Silky Luster	Shining like silk	Asbestos
Resinous Luster	Shining like a resin	Opal, Agate
Greasy Luster	Shining like grease	Graphite
Adamantine Luster	Shining like a diamond	Garnet, Diamond
Earthy or Dull Luster	No Shining	Bauxite, Magnesite

5. Fracture

Fracture is the nature of the randomly broken surface of a mineral.

Fracture	Description	Example
Even fracture	If the broken surface is plain and smooth.	Magnesite, Chalk
Uneven fracture	If the broken surface isrough or irregular.	Hornblende, Bauxite
Hackly fracture	If the broken surface is veryirregular like end of abroken stick.	Asbestos, Kyanite
Conchoidal fracture	If the broken surface issmooth and curved	Opal
Sub Conchoidal fracture	If the curved nature is less prominent.	Agate, Flint, Jasper

7. Cleavage

The definite direction or plane along which a mineral tends to break easily is called cleavage of that mineral. It occurs as innumerable parallel planes along which the mineral is equally weak. Such parallel planes of weakness are referred to as a set.

Cleavage	Example
One set of cleavage	Mica, Chlorite, Talc
Two sets of cleavages	Feldspars, Pyroxenes, Amphiboles
Three sets of cleavages	Calcite, Dolomite, Galena
Four sets of cleavages	Fluorite
Six sets of cleavages	Sphalerite
No cleavage	Quartz, Olivine, Garnet

7. Hardness

Hardness may be defined as the resistance offered by the mineral to abrasion or scratching. It is determined with the help pH Moh's scale of hardness which consists of ten reference minerals arranged in increasing order of hardness and numbered accordingly.

Moh's Scale of Hardness

Name of the Mineral	Hardness
Talc	1
Gypsum	2
Calcite	3
Fluorite	4
Apatite	5
Feldspar	6
Quartz	7
Topaz	8
Corundum	9
Diamond	10

8. Specific gravity or Density

Specific gravity or Density of minerals depends on their chemical composition and atomic structure.

Density	Range	Example
Low density	Specific gravity less than 2.5	Gypsum (2.3), Graphite (2-2.3)
Medium density	Specific gravity between 2.5 and 3.5	Quartz (2.7), Feldspar(2.5)
High density	Specific gravity greater than 3.5	Chromite (4.5- 4.8)

9. Degree of transparency

Degree of transparency is tested along the thin sharp edges of mineral keeping it against a powerful source of light. Depending upon the resistance offered by the minerals to the passage of light through them the transparency is classified.

Degree of Transparency	Example
Transparent	Thin layers of Muscovite, rock crystal
Translucent	Agate, Calcite
Opaque	Galena, Pyrite

10.Special properties

Some minerals exhibit unique characters which enable them to be identified easily.

Name of the Mineral	Special property
Talc	smooth touch or soapy feel
Graphite	Marks on a paper easily
Pyrolusite	Soils the fingers
Halite	Saline taste
Magnetite	Strongly attracted by any ordinary magnet
Chalk	Rough feeling of touch, adheres strongly to the tongue

EXPERIMENT – 1

Study of physical properties and Identification of minerals referred

Under theory

Application of minerals:

They are used in the manufacture of concrete, bricks and pipes and in building hoPractical Usage and roads.

HORNBLENDE

1. *FORM:*	:	*Granular*
2. *Colour:*	:	*Pale Pink /greenish black*
3. *Streak:*	:	*White*
4. *Luster:*	:	*Vitreous*
5. *Fracture:*	:	*Uneven*
6. *Cleavage:*	:	*Absent*
7. *Diaphaneity:*	:	*Opaque*
8. *Hardness:*	:	*5-6*
9. *Specific Gravity:*	:	*3.0-3.5*
10. *Occurrence:*	:	*Adilabad*
11. *Origin:*	:	*Igneous*
12. *Practical Usage:*	:	*Tiles*
13. *Name of the Specimen*	:	*Feldspar*
14. *Chemical Composition*	:	*KAI Si308*

GARNET

1. Form	*:*	*Rhombic*
2. Color	*:*	*Ruby*
3. Streak	*:*	*Light Brown*
4. Luster	*:*	*Earthy*
5. Fracture	*:*	*Absent*
6. Cleavage	*:*	*Absent*
7. Diaphaneity	*:*	*Opaque*
8. Hardness	*:*	*7*
9. Specific	*:*	*4.5*
10. Name of the Specimen		*: Garnet*
11. Occurrence	*:*	*Gudur, Andhra Pradesh*
12. Practical Usage	*:*	*Ornaments*
13. Chemical Composition		*: $Fe_3 Al_2 (SiO_4)_3$*

OLIVINE

1.	*Form:*	*:*	*Massive*
2.	*Colour:*	*:*	*Yellowish/olive green*
3.	*Streak:*	*:*	*White*
4.	*Luster:*	*:*	*Earthy*
5.	*Fracture:*	*:*	*Uneven*
6.	*Cleavage:*	*:*	*Absent*
7.	*Diaphaneity:*	*:*	*Opaque*
8.	*Hardness:*	*:*	*6-7*
9.	*Specific Gravity:*	*:*	*3 to 3.5*
10.	*Occurrence:*	*:*	*Karnataka*
11.	*Origin:*	*:*	*Igneous*
12.	*Practical Usage:*	*:*	*Paints*
13.	*Name of the Specimen:*		*Olivine*
14.	*Chemical Composition:*		*(Mg, Fe)2 Si04*

BIOTITE

1.	*Form*	*:*	*Lamellar / flanky*
2.	*Color*	*:*	*Dark greenish black / Black*
3.	*Streak:*	*:*	*Dark brown*
4.	*Luster:*	*:*	*Pearly*
5.	*Fracture:*	*:*	*Uneven*
6.	*Cleavage:*	*:*	*Absent*
7.	*Diaphaneity:*	*:*	*Transparent in individual layers & opaque as whole*
8.	*Hardness:*	*:*	*2 to 3*
9.	*Specific Gravity:*	*:*	*2 .7 to 3*
10.	*Occurrence:*	*:*	*Nellore*
11.	*Origin:*	*:*	*Metamorphic*
12.	*Practical Usage:*	*:*	*Iron boxes*
13.	*Name of the Specimen:*		*Biotite*
14.	*Chemical Composition:*		*K(Mg, Fe3) (AI Si3) O10 (OH, F)2*

KYANITE

1.	*Form:*	*:*	*Bladed*
2.	*Colour:*	*:*	*Blue*
3.	*Streak:*	*:*	*Colourless*
4.	*Luster:*	*:*	*Vitreous*
5.	*Fracture:*	*:*	*Uneven*
6.	*Cleavage:*	*:*	*2 sets*
7.	*Diaphaneity:*	*:*	*Opaque*
8.	*Hardness:*	*:*	*4-5*
9.	*Specific Gravity:*	*:*	*3.6*
10.	*Occurrence:*	*:*	*Karnataka*
11.	*Practical Usage:*	*:Abrasive and Ornamentas purposes*	
12.	*Name of the Specimen*	*:*	*Kyanite*
13.	*Chemical Composition*	*:*	*$AI_2\ SiO_5$*

VIVA QUESTIONS

S.NO	**Form**	**Description**
1	Lamellar form	
2	Tabular form	
3	Greasy Lustre	
4	Crystal form	
5	Pearly Lustre	
6	Rhombic form	
7	Metallic Lustre	
8	Bladed form	
9	Translucent	
10	Even fracture	

Name of the Mineral		**Body Colour**
11	Talc	
12	Hornblende	
13	Mica	
14	Garnet	
15	Graphite	
16	Pegmatite	
Name of the Mineral		**Specific Gravity**
17	Muscovite	
18	Hematite	
19	Olivine	
20	Qaurtz	
Cleavage		**Example**
21	One set of cleavage	
22	Six sets of cleavages	
Name of the Mineral		**Hardness**
23	Biotite	
24	Muscovite	
25	Hematite	
26	Olivine	
27	Qaurtz	
28	Pyroxene	
Name of the Mineral		**Chemical composition**
29	Hornblende	
30	Garnet	
31	Olivine	
32	Biotite	
33	kyanite	

Name of the Mineral		Streak
34	Hornblende	
35	Garnet	
36	Olivine	
37	Biotite	
38	kyanite	
Name of the Mineral		**Lustre**
39	Hornblende	
40	Garnet	
41	Olivine	
42	Biotite	
43	kyanite	
Mineral property		**Example**
44	Columnar form	
45	Even fracture	
46	Uneven fracture	
47	Transparent	
48	Silky Lustre	
49	Concretionary Form	
50	Nodular form	

Lab In charge Signature

Date:

EXPERIMENT – 2

Study of physical properties and Identification of minerals referred

Under theory

Application of minerals:

They are used in the manufacture of concrete, bricks and pipes and in building hoPractical Usage and roads.

TALC

1. Form	*:*	*Foliated / massive*
2. Colour	*:*	*White pale yellow , pale green*
3. Streak	*:*	*White*
4. Luster	*:*	*earthy*
5. Fracture	*:*	*uneven*
6. Cleavage	*:*	*Absent*
7. Diaphaneity	*:*	*Translucent along edges*
8. Hardness	*:*	*1*
9. Specific	*:*	*2.7*
10. Name of the Specimen:		*Talc*
11. Occurrence	*:*	*Udaipur, Rajasthan*
12. Practical Usage	*:*	*It is used as talcum powder and in creams etc.*
13. Chemical Composition:		*$Mg_3 Si_4 O_{10} (OH)_2$*

CALCITE

Form	:	*Rhombic*
Colour	:	*Colorless white / pale colur*
Streak	:	*White*
Luster	:	*Vitreous*
Fracture	:	*Rarely found*
Cleavage	:	*3 sets*
Diaphaneity	:	*Transparent to translucent*
Hardness	:	*3*
Specific	:	*2.5 to 3*
Name of the Specimen:		*Calcite*
Occurrence	:	*Tamil Nadu*
Practical Usage	:	*Bombs, gun powders, anti – air craft*
Chemical Composition:		*Caco3*

ASBESTOS

1.	*Form:*	*:*	*Fibrous*
2.	*Colour:*	*:*	*Green*
3.	*Streak:*	*:*	*Colourless*
4.	*Luster:*	*:*	*Silky*
5.	*Fracture:*	*:*	*Uneven*
6.	*Cleavage:*	*:*	*Absent*
7.	*Diaphaneity:*	*:*	*Opaque*
8.	*Hardness:*	*:*	*4 to 6*
9.	*Specific Gravity:*	*:*	*3 to 4.5*
10.	*Occurrence:*	*:*	*Cuddapah, Andhra Pradesh*
11.	*Origin:*	*:*	*Metamorphic*
12.	*Practical Usage:*	*:*	*It is used to make sheets*
13.	*Name of the Specimen*	*:*	*Asbestos*
14.	*Chemical Composition*	*:*	*$2Mg_3 Si_2 O_5 (OH)_4$*

CHLORITE

1.	*Form:*	*:*	*Foliated*
2.	*Colour:*	*:*	*Black and Green*
3.	*Streak:*	*:*	*Colourless*
4.	*Luster:*	*:*	*Pearly*
5.	*Fracture:*	*:*	*Uneven*
6.	*Cleavage:*	*:*	*Absent*
7.	*Diaphaneity:*	*:*	*Opaque*
8.	*Hardness:*	*:*	*1.5-2.5*
9.	*Specific Gravity:*	*:*	*2.6 to 2.9*
10.	*Occurrence:*	*:*	*Karnataka*
11.	*Practical Usage:*	*:*	*Paints*
12.	*Name of the Specimen:*		*Chlorite*
13.	*Chemical Composition:*		*CiO_2*

MUSCOVITE

1.	*Form:*	*:*	*Lamellar*
2.	*Colour:*	*:*	*White*
3.	*Streak:*	*:*	*White*
4.	*Luster:*	*:*	*Vitreous*
5.	*Fracture:*	*:*	*Uneven*
6.	*Cleavage:*	*:*	*Absent*
7.	*Diaphaneity:*	*:Transparent in individual layer & opaque as whole*	
8.	*Hardness:*	*:*	*2 to 3*
9.	*Specific Gravity:*	*:*	*2.5*
10.	*Occurrence:*	*:*	*Gudur*
11.	*Origin:*	*:*	*Metamorphic*
12.	*Practical Usage:*	*:*	*Poor conductor of heat*
13.	*Name of the Specimen*	*:*	*Muscovite*
14.	*Chemical Composition*	*:*	*KAI2 (AI Si3) O10 (OH, F)2*

VIVA QUESTIONS		
S.NO	***Form***	***Description***
1	***Massive form***	
2	***Vitreous Lustre***	
3	***Sub Vitreous Lustre***	
4	***Pisolitic form***	
5	***Oolitic form***	
6	***Resinous Lustre***	
7	***Granular form***	
8	***Adamantine Lustre***	
9	***Sub metallic Lustre***	
10	***Fibrous form***	

Name of the Mineral		***Body Colour***
11	*Biotite*	
12	*Muscovite*	
13	*Hematite*	
14	*Olivine*	
15	*Quartz*	
16	*Pyroxene*	
Name of the Mineral		***Specific Gravity***
17	*Talc*	
18	*Hornblende*	
19	*Mica*	
20	*Garnet*	
Cleavage		***Example***
21	*Two sets of cleavages*	
22	*No cleavage*	
Name of the Mineral		***Hardness***
23	*Qaurtz*	
24	*Pyroxene*	
25	*Galena*	
26	*Emerald*	
27	*Jasper*	
28	*Chromite*	
Name of the Mineral		***Chemical composition***
29	*Talc*	
30	*Calcite*	
31	*Asbestos*	
32	*Chlorite*	
33	*Muscovite*	
Name of the Mineral		***Streak***

34	*Talc*	
35	*Calcite*	
36	*Asbestos*	
37	*Chlorite*	
38	*Muscovite*	
Name of the Mineral		***Lustre***
39	*Talc*	
40	*Calcite*	
41	*Asbestos*	
42	*Chlorite*	
43	*Muscovite*	
Mineral property		***Example***
44	*Massive form*	
45	*Vitreous Lustre*	
46	*Sub Vitreous Lustre*	
47	*Pisolitic form*	
48	*Oolitic form*	
49	*Resinous Lustre*	
50	*Granular form*	

Lab In charge Signature

Date:

EXPERIMENT – 3

Study of physical properties and Identification of minerals referred

Under theory

Application of minerals:

They are used in the manufacture of concrete, bricks and pipes and in building of Practical Usage and roads.

FLINT

1.	*Form*	*:*	*Tabular form*
2.	*Colour*	*:*	*Brown*
3.	*Streak*	*:*	*Colourless*
4.	*Luster*	*:*	*Earthy*
5.	*Fracture*	*:*	*Absent*
6.	*Cleavage*	*:*	*Absent*
7.	*Diaphaneity*	*:*	*Opaque*
8.	*Hardness*	*:*	*7*
9.	*Specific Gravity*	*:*	*3 to 4*
10.	*Occurrence*	*:*	*Vizayanagaram, Visakhapatnam*
11.	*Origin*	*:*	*Igneous*
12.	*Practical Usage*	*:*	*Fillers of fertilizers*
13.	*Name of the Specimen:*		*Flint*
14.	*Chemical Composition:*		*Silica*

FELDSPAR

1.	*Form*	*:*	*Tabular*
2.	*Colour*	*:*	*Pale Pink*
3.	*Streak*	*:*	*White*
4.	*Luster*	*:*	*Vitreous*
5.	*Fracture*	*:*	*Uneven*
6.	*Cleavage*	*:*	*Absent*
7.	*Diaphaneity*	*:*	*Opaque*
8.	*Hardness*	*:*	*7*
9.	*Specific Gravity*	*:*	*2.5*
10.	*Occurrence*	*:*	*Adilabad*
11.	*Origin*	*:*	*Igneous*
12.	*Practical Usage*	*:*	*Tiles*
13.	*Name of the Specimen*	*:*	*Feldspar*
14.	*Chemical Composition*	*:*	*KAI Si308*

QUARTZ

1.	*FORM*	*:*	*Massive (some times crystals)*
2.	*Colour*	*:*	*Colourless or White*
3.	*Streak*	*:*	*Colourless*
4.	*Luster*	*:*	*Vitreous*
5.	*Fracture*	*:*	*Uneven to conchoidal*
6.	*Cleavage*	*:*	*Absent*
7.	*Diaphaneity*	*:*	*Transparent to translucent*
8.	*Hardness*	*:*	*7*
9.	*Specific Gravity*	*:*	*3*
10.	*Name of the Specimen*	*:*	*Quartz*
11.	*Occurrence*	*:*	*South India*
12.	*Origin*	*:*	*Igneous*
13.	*Practical Usage*	*:*	*Used as gemstone and in watch industries etc*
14.	*Chemical Composition*	*:*	*Sio2*

JASPER

1.	*FORM:*	*Massive*
2.	*Colour:*	*Dark Brown/ red colur in common*
3.	*Streak:*	*Dark Brown*
4.	*Luster:*	*Resinious*
5.	*Fracture:*	*Conchoidal*
6.	*Cleavage:*	*Absent*
7.	*Diaphaneity:*	*Opaque*
8.	*Hardness:*	*7*
9.	*Specific Gravity:*	*2.5 – 2.65*
10.	*Occurrence:*	*Vizayanagaram*
11.	*Origin:*	*Sedimentary*
12.	*Practical Usage:*	*Paints and Soil Stabilization*

13. Name of the Specimen : Jasper

14. Chemical Composition : Sio2

MAGNETITE

Form	:	*Granular*
Colour	:	*Gray / black*
Streak	:	*Brown*
Luster	:	*Metallic to sub metallic*
Fracture	:	*Uneven*
Cleavage	:	*Absent*
Diaphaneity	:	*Opaque*
Hardness	:	*5-6*
Specific	:	*5.2*
Name of the Specimen	:	*Magnetite*
Occurrence	:	*Goa, Maharashtra*
Practical Usage	:	*Iron ore*
Chemical Composition	:	*Fe_3O_4*

VIVA QUESTIONS

S.NO	***Form***	***Description***
1	*Earthy or Dull Lustre*	
2	*Conchoidal fracture*	
3	*Sub Conchoidal fracture*	
4	*Bladed form*	
5	*Translucent*	
6	*Prismatic form*	
7	*Spongy form*	
8	*Hackly fracture*	
9	*Columnar form*	
10	*Tabular form*	

Name of the Mineral		***Body Colour***
11	*Jasper*	
12	*Graphite*	
13	*Pegmatite*	
14	*Kyanite*	
15	*Biotite*	
16	*Muscovite*	
Name of the Mineral		***Specific Gravity***
17	*Qaurtz*	
18	*Pyroxene*	
19	*Galena*	
20	*Emerald*	
Cleavage		***Example***
21	*Three sets of cleavages*	
22	*One set of cleavage*	
Name of the Mineral		***Hardness***
23	*Chromite*	
24	*Chlorite*	
25	*Calcite*	
26	*Asbestos*	
27	*Talc*	
28	*Hornblende*	
Name of the Mineral		***Chemical composition***
29	*Flint*	
30	*Feldspar*	
31	*Qaurtz*	
32	*Jasper*	
33	*Magnetite*	
Name of the Mineral		***Streak***
34	*Flint*	
35	*Feldspar*	

36	*Qaurtz*	
37	*Jasper*	
38	*Magnetite*	
Name of the Mineral		***Lustre***
39	*Flint*	
40	*Feldspar*	
41	*Qaurtz*	
42	*Jasper*	
43	*Magnetite*	
Mineral property		***Example***
44	*Lamellar form*	
45	*Tabular form*	
46	*Greasy Lustre*	
47	*Crystal form*	
48	*Pearly Lustre*	
49	*Rhombic form*	
50	*Metallic Lustre*	

Lab In charge Signature

Date:

EXPERIMENT – 4

Study of physical properties and Identification of minerals referred

Under theory

Application of minerals:

They are used in the manufacture of concrete, bricks and pipes and in building Practical Usage and roads.

CHROMITE

Form	:	Granular
Colour	:	Black
Streak	:	Black
Lustre	:	Sub metallic
Fracture	:	Uneven
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	5-6
Specific	:	4.5 -5.0
Name of the Specimen	:	Chromite
Occurrence	:	Karnataka
Practical Usuage	:	Paints, Cr ore
Chemical Composition	:	$Fe\ Cr_2\ O_4$

PYROLUSITE

Form	:	*Massive ,spongy*
Colour	:	*Dark brownish Black*
Streak	:	*Black*
Luster	:	*Earthy*
Fracture	:	*Uneven*
Cleavage	:	*Indistinct*
Diaphaneity	:	*Opaque*
Hardness	:	*Variable*
Specific	:	*4.5-5.0*
Name of the Specimen	:	*Pyrolusite*
Occurrence	:	*Adilabad, Vizayanagaram*
Practical Usage	:	*Maganese ore (steel industries)*
Chemical Composition	:	*Mno_2*

PYROXENE

Form	:	*Prismatic*
Colour	:	*Black, Apple green*
Streak	:	*Black*
Luster	:	*Earthy*
Fracture	:	*Uneven*
Cleavage	:	*Two set clevage*
Diaphaneity	:	*Opaque*
Hardness	:	*5-7*
Specific	:	*3.0-4.0*
Name of the Specimen	:	*Pyroxene*
Occurrence	:	*Earth's crust*
Practical Usage	:	*Commercial use*
Chemical Composition	:	*Ca,Na*

GRAPHITE

Form	:	*Massive*
Colour	:	*Black*
Streak	:	*Gray*
Luster	:	*Sub-Metallic or greasy*
Fracture	:	*Uneven*
Cleavage	:	*1 set , not distinct*
Diaphaneity	:	*Opaque*
Hardness	:	*1-2*
Specific	:	*2.5 to 2.8*
Name of the Specimen	:	*Graphite*
Occurrence	:	*Anakapalli, Andhra Pradesh*
Practical Usage	:	*Pencils*
Chemical Composition	:	*C*

HEMATITE

Form	:	*Massive*
Colour	:	*Steel gray*
Streak	:	*Brown*
Luster	:	*Metallic to sub metallic*
Fracture	:	*Uneven*
Cleavage	:	*Absent*
Diaphaneity	:	*Opaque*
Hardness	:	*5-6*
Specific	:	*5.2*
Name of the Specimen:		*Hematite*
Occurrence	:	*Goa*
Practical Usage	:	*Steel, and iron industries*
Chemical Composition:		*Fe_2O_3*

VIVA QUESTIONS		
S.NO	***Form***	***Description***
1	*Columnar form*	
2	*Even fracture*	
3	*Uneven fracture*	
4	*Transparent*	
5	*Silky Lustre*	
6	*Concretionary Form*	
7	*Nodular form*	
8	*Pisolitic form*	
9	*Sub Conchoidal fracture*	
10	*Resinous Lustre*	

Name of the Mineral		***Body Colour***
11	*Chromite*	
12	*Chlorite*	
13	*Calcite*	
14	*Asbestos*	
15	*Talc*	
16	*Hornblende*	
Name of the Mineral		***Specific Gravity***
17	*Biotite*	
18	*Muscovite*	
19	*Hematite*	
20	*Olivine*	
Cleavage		***Example***
21	*Four sets of cleavages*	
22	*No cleavage*	
Name of the Mineral		***Hardness***
23	*Jasper*	
24	*Graphite*	
25	*Pegmatite*	
26	*Kyanite*	
27	*Biotite*	
28	*Muscovite*	
Name of the Mineral		***Chemical composition***
29	*Chromite*	
30	*Pyrolusite*	
31	*Graphite*	
32	*Hematite*	
33	*Magnesite*	

Name of the Mineral		***Streak***
34	*Chromite*	
35	*Pyrolusite*	
36	*Graphite*	
37	*Hematite*	
38	*Magnesite*	
Name of the Mineral		***Lustre***
39	*Chromite*	
40	*Pyrolusite*	
41	*Graphite*	
42	*Hematite*	
43	*Magnesite*	
Mineral property		***Example***
44	*Oolitic form*	
45	*Rhombic form*	
46	*Sub metallic Lustre*	
47	*Fibrous form*	
48	*Opaque*	
49	*Oolitic form*	
50	*Even fracture*	

Lab In charge Signature

Date:

EXPERIMENT – 5

Study of physical properties and Identification of minerals referred

Under theory

Application of minerals:

They are used in the manufacture of concrete, bricks and pipes and in building hoPractical Usage and roads.

MAGNESITE

Form	:	*Massive*
Colour	:	*White*
Streak	:	*White*
Luster	:	*Earthy*
Fracture	:	*Even to conchoidal*
Cleavage	:	*Absent*
Diaphaneity	:	*Opaque*
Hardness	:	*4-5*
Specific	:	*3.0-3.2*
Name of the Specimen	:	*Magnesite*
Occurrence	:	*Doddakanya, South India*
Practical Usage	:	*Magnesium ore, jertilizers*
Chemical Composition	:	*Mgco3*

PYRITE

Form	:	*Cubic / granular*
Colour	:	*Fool's gold, brass yellow*
Streak	:	*Black*
Luster	:	*Metallic to sub – metallic*
Fracture	:	*Uneven*
Cleavage		*3 sets*
Diaphaneity	:	*Opaque*
Hardness	:	*6-7*
Specific	:	*5*
Name of the Specimen:		*Pyrite*
Occurrence	:	*Cuddapah, Andhra Pradesh*
Practical Usage	:	*Paints, Paper industries*
Chemical Composition:		*FeS_2*

GALENA

Form	:	*Cubic / granular/ blocks*
Colour	:	*Gray and black*
Streak	:	*Black*
Luster	:	*Splendent*
Fracture	:	*Rarely found*
Cleavage	:	*3 sets cubic*
Diaphaneity	:	*Opaque*
Hardness	:	*6*
Specific	:	*5.5*
Name of the Specimen	:	*Galena*
Occurrence	:	*Maharashtra*
Practical Usage	:	*Ornamental and atomic purposes*
Chemical Composition	:	*Pbs*

BAUXITE

Form	:	*Pisolitic spongy or massive*
Colour	:	*Dirty white with differentcoloured patches*
Streak	:	*Brown*
Luster	:	*Earthy*
Fracture	:	*Uneven*
Cleavage	:	*Absent*
Diaphaneity	:	*Opaque*
Hardness	:	*4*
Specific	:	*3.5*
Name of the Specimen	:	*Bauxite*
Occurrence	:	*Visakhapatnam, Srikakulam*
Practical Usage	:	*Aluminum ore*
Chemical Composition	:	*Al*

HALITE

1.	*Form*	:	*Granular*
2.	*Colour*	:	*is clear or white*
3.	*Streak*	:	*White*
4.	*Luster*	:	*vitreous.*
5.	*Fracture*	:	*Conchoidal*
6.	*Cleavage*	:	*Perfect*
7.	*Diaphaneity*	:	*transparent to translucent*
8.	*Hardness*	:	*2*
9.	*Specific*	:	*2.1*
10.	*Name of the Specimen*	:	*Halite*
11.	*Occurrence*	:	
12.	*Practical Usage*	:	*Major source of salt and as mineral specimens*
13.	*Chemical Composition*	:	*Nacl*

CORUNDUM

1.	*Form*	*:*	*trigonal*
2.	*Colour*	*:*	*Green, Brown, Pink*
3.	*Streak*	*:*	*White*
4.	*Luster*	*:*	*Vitreous*
5.	*Fracture*	*:*	*Conchoidal*
6.	*Cleavage*	*:*	*Absent*
7.	*Diaphaneity*	*:*	*transparent to translucent*
8.	*Hardness*	*:*	*9*
9.	*Specific*	*:*	*4.0*
10.	*Name of the Specimen*	*:*	*Corundum*
11.	*Occurrence*	*:*	*several places in India*
12.	*Practical Usage*	*:*	*gemstone*
13.	*Chemical Composition*	*:*	*Al_2o_3*

VIVA QUESTIONS

S.NO	***Form***	***Description***
1	*Oolitic form*	
2	*Rhombic form*	
3	*Sub metallic Lustre*	
4	*Fibrous form*	
5	*Opaque*	
6	*Oolitic form*	
7	*Even fracture*	
8	*Translucent*	
9	*Adamantine Lustre*	
10	*Sub metallic Lustre*	

Name of the Mineral		***Body Colour***
11	*Quartz*	
12	*Pyroxene*	
13	*Galena*	
14	*Emerald*	
15	*Jasper*	
16	*Chromite*	
Name of the Mineral		***Specific Gravity***
17	*Chromite*	
18	*Chlorite*	
19	*Calcite*	
20	*Asbestos*	
Cleavage		***Example***
21	*Three sets of cleavages*	
22	*Six sets of cleavages*	
Name of the Mineral		***Hardness***
23	*Talc*	
24	*Hornblende*	
25	*Mica*	
26	*Garnet*	
27	*Graphite*	
28	*Pegmatite*	
Name of the Mineral		***Chemical composition***
29	*Pyrite*	
30	*Galena*	
31	*bauxite*	
32	*halite*	
33	*Corundum*	
Name of the Mineral		***Streak***
34	*Pyrite*	
35	*Galena*	
36	*bauxite*	
37	*halite*	
38	*Corundum*	
Name of the Mineral		***Lustre***
39	*Pyrite*	
40	*Galena*	

41	*bauxite*	
42	*halite*	
43	*Corundum*	
Mineral property		***Example***
44	*Earthy or Dull Lustre*	
45	*Conchoidal fracture*	
46	*Sub Conchoidal fracture*	
47	*Bladed form*	
48	*Translucent*	
49	*Prismatic form*	
50	*Spongy form*	

INTRODUCTION

MEGASCOPIC AND MICROSCOPIC STUDY OF ROCKS

A rock is defined as an aggregate of minerals. It is also described as unit of earth's crust. Based on their origin, geologically rocks are classified into igneous rocks, Sedimentary rocks, metamorphic rocks.

Igneous rocks:

These are characterized by vesicular structure, amygdaloidal structure and Aphanitic structure if they are volcanic. If they are Hypabyssal or plutonic, they are dense, compact and exhibit interlocking texture.

Sedimentary rocks:

Occurrence of normal or cross bedding, cementing material, fossils, ripple marks, mud cracks, tracks and trails and peculiar forms such as modular, concretionary, pisolitic, Oolitic, etc indicate that the rocks under study of sedimentary rocks.

Metamorphic rocks:

Occurrence of alignment of minerals (lineation, foliation) and metamorphic minerals indicate the rocks under the study of metamorphic group.

IGNEOUS ROCKS

Terminology related for the description of igneous rocks

1. Texture

Phaneric	If minerals are visible to naked eye by virtue of their size.
Aphanitic	If minerals are too fine to be seen by naked eye.
Phaneric coarse	If minerals are greater than 5mm in size.
Phaneric medium	If minerals are 2mm to 5mm in size.
Phaneric tine	If minerals are less than 2mm in size.
Equigranular	If minerals are nearly of same size.
Inequigranular	If some minerals are distinctly larger than others.
Interlocking	If minerals are closely interlinked and cannot be separate without damaging surrounding minerals.
Graphic	If angular quartz grains occur with some orientation in feldspars.

2. Colour

Leucocratic	If the rock looks pale coloured or white coloured, it indicates that the rock may be acidic.
Melanocratic	If the rock looks dark coloured or black coloured, it indicates that the rock may be basic or ultra basic.
Mesocratic	If the rock is neither dark coloured nor pale coloured.

3. Structure

Vesicular	If the rock is having empty cavities
Amygdaloidal	If the rock has cavities filled with amygdales

4. Minerals

Primary	If the minerals are present from the beginning of formation of rock.
Secondary	If the minerals are present after the formation of rock.
Essential	If they are major constituents and decide the name of the rock.
Accessory	If they occur in small quantities and their presence or absence has nothing to do in naming a rock.

Oversaturated	If a rock has free quartz.
Under saturated	If a rock has unsaturated minerals like Olivine.
Saturated	If a rock has neither free quartz nor unsaturated minerals.

6. Depth of Formation

Plutonic/Hypabyssal	If a rock is Phaneric and has interlocking texture.
Volcanic	If a rock is vesicular or amygdaloidal and Aphanitic.

SEDIMENTARY ROCKS

Details relevant for the study of sedimentary rocks

1. Bedding or stratification

a) Different beds can be recognized based on colour, grain size, texture, hardness and other physical properties.
b) In case of cross bedding sets of layers will not be parallel but mutually inclined.

2. Cementing Material

Calcareous	It imparts white colour and pale colour to sand stones and can be known by acid test.
Feriginous	Imparts shades of brown, red, or yellow colour to sand Stone
Argillaceous	It provides only weak cohesion for sand particles, which fall of rubbing the sand stone
Siliceous	Resembles calcareous cementing material but provides competence and durability to sand stone.
Glaucontic	It provides green colour to sand stone.

Fossils

May be plant (leaf) fossils or shells (complete or broken) - common in shales and lime stones.

3. Ripple Marks

Rare, may appear in sandstones, shales and lime stones. These appear as ware undulations on rock surface.

4. Peculiar forms

Concretionary, nodular	Laterites, Lime stones
Pisolotic	Lime stones, Laterites
Oolitic	Lime stones
Solution cavities	Lime stones
Lamination	Shales

5. Flaggy

Tendency to break in to slab, due to parallel fractures. Sometimes these are noticed in lime stones and sand stones.

6. Fissility

Tendency to split along bedding planes. Some shale has this character.

7. Conchoidal fracture

In dense compact Lime stones, less distinctly in shales

8. Composition

Argillaceous	Shales
Arinaceous	Sand stones
Calcareous	Lime stones

9. Grain Size

Too fine to be seen as separate particles in shales and lime stones.

10. Surface touch

Gritty or rough in sand stones, smooth in shales and lime stones.

11. Appearance

Panels of colours for laterites, dense very fine grained for lime stone.

METAMORPHIC ROCKS

Details relevant for the study of metamorphic rocks

1. Foliation

It refers to the parallel alignment of platy or lamellar minerals in metamorphic rocks.

2. Lineation

It refers to the parallel alignment of prismatic or columnar minerals in metamorphic rocks.

3. Metamorphic minerals

Minerals like garnet, tale, chlorite, graphite are suggestive of metamorphic origin of a rock.

4. Gneissosse structure

It is generally observed in granite gneisses where in alternating black (bornblende) and white (feldspars and quartz) colour bands appear.

5. Schistose structure

They have predominantly lamellar (mica, tale, chlorite) or prismatic (bornblende, Kyanite, etc) minerals.

These do not have any alternating colour bands.

EXPERIMENT – 6

Megascopic and microscopic descriptionand identification of rocks

referred Under theory

Application of Igneous Rocks:

They are used in the manufacture of concrete, bricks and pipes and in building Practical Usage and roads.

AIMS

The aim of this unit is to present you the different type of rocks, main factors for classification and petrogenesis of igneous rocks

OBJECTIVES

After completing this Unit, students should be able to Describe the

- Different type s of Igenous rocks (volcanic, Hypabasal and plutonic rocks).
- Main factors used in the classification of igneous rocks.
- Order of crytallisation in which minerals are formed.
- Petrogenesis.

PEGMATITE

I Petrography

1. Colour index	: Leucocratic (light colour)
2. Mineralogy	: a) Essential minerals : Quartz, Feldspars,
	b) Accessory minerals: Bery1, tourmaline, apatite
3. Texture	: Very coarse grained granular
4. Structure	: Pegmatitic

II Petrogenesis

1. Mode of formation	: Veins and dykes.
2. Depth of formation	: Great depth
3. Conditions of formation	: Plutonic conditions (high pressure and high temperature)
4. Name of the rock	: **Pegmatite.**

GRANITES

Granites are of two types, based on their coulour (a) pink granite, in which the K-feldspars are more predominant than the plagioclase feldspars. (b) Grey granite, in which the lagioclase feldspars are more predominant than the k-feldspars. They exhibit two distinct types of a) Equigranular b) Inequigranular (porphyritic). They are the most abundant rock types among other igneous rocks. In hand specimen, granite is a light colored coarse grained granular rock. It is mainly composed of quartz, feldspars, and micas. Apatite, magnetite, zircon and sphene are found as accessories. The coarse grained texture indicates that the rock is formed under the plutonic conditions.

The systematic description of the granular granite is given in a new format below.

I. Petrography

1. Colour index Leucocratic
2. Mineralogy
   a) essential minerals : quartz, alkali feldspar and micas
   b) accessory : apatite, magnetite, zircon, sphene, Hornblende and pyroxene.
3. Texture : Coarse grained, Equi granular.

II. Petrogenesis

1. Mode of formation : Big batholiths to small plutonic
2. Depth of formation : Great depth (deep seated)
3. Conditions of formation : Plutonic conditions (high pressure and high temperature).
4. Name of the rock : **Granite**

PORPHYRITIC GRANITE.

I. Petrography

1. Colour Index : leucocratic
2. Mineralogy : quartz, alkali feldspars, and micas.
   a) Essential minerals : apatite, zircon, magnetite, sphene, Hornblende and pyroxene.
   b) Accessory minerals : Coarse grained in equigranular
3. Texure : Coarse grained in equigranular
4. Structure : Porphyritic

II. Petrogenesis

1. Mode of formation : Big batholiths to small plution
2. Depth of formation : Great to intermediate depth
3. Conditions of formation : Plutonic conditions (high pressure and High temperature.
4. Name of the rock : **Porphyritic granite**

DOLERITE

Dolerite is a dark coloured medium grained granular rock. It is mainly composed of labradorite plagioclase feldspar and augite pyroxene. Magnetite, apatite and sphene are found as accessories. The medium grained texture indicates that the rock is formed under hypabyssal conditions.

The systems description of the rock is given in a new formal below;

I. Petrography

1. Colour index : Melanocratic
2. Mineralogy :
   a) Essential minerals : Labradorite plagioclase and augite pyroxene.
   b)Accessory minerals : Magnetite, olivine, apatite and sphene.
3. Texture : Medium grained.

II. Petrogenesis

1. Mode of formation : Dykes
2. Depth of formation : Intermediate (shallow depth)
3. Conditions of formation : Hypabyssal conditions (moderate)pressure and temperature)
4. Name of the rock : **Dolerite.**

BASALT

Basalt is a dark-ash coloured fine grained rock. It is mainly composed of labradorite Plagioclase augite pyroxene. Magnetite, olivine and apatite are found as accessories. Quartz, calcite and zeolities are found as secondary minerals in cavities and vesicles of the rock. The fine grained texture indicates that the rock is formed under volcanic conditions. The systematic description of the rock is given in a new format below**.**

I. Petrography

1. Colour index : Melnocratic
2. Mineralogy :

   a)Essential minerls : labradorite plagioclase and augite pyroxene

   b)Accessory minerals : olivine. Hornblende, magnetite and apatite.
3. Texture : Fine grained
4. Structure : Vesicular and amygdaloidal

II. Petrogeneis

1. Mode of formation : Sills, flows, and dykes
2. Depth of formation : Surface intrusive and extrusives
3. Conditions of formation : Volcanic conditions

   (low pressure and temperature)
4. Conditions of formation : **Basalt**

VIVA QUESTIONS		
S.NO	*FORM*	***DESCRIPTION***
1	*Phaneric*	
2	*Aphanitic*	
3	*Phaneric coarse*	
4	*Phaneric medium*	
5	*Phaneric tine*	
6	*Equigranular*	
7	*Inequigranular*	
8	*Interlocking*	
9	*Graphic*	
Colour		***DESCRIPTION***

10	*Leucocratic*	
11	*Melanocratic*	
12	*Mesocratic*	
Structure		***DESCRIPTION***
13	*Vesicular*	
14	*Amygdaloidal*	
Minerals		***DESCRIPTION***
15	*Primary*	
16	*Secondary*	
17	*Essential*	
18	*Accessory*	
19	*Oversaturated*	

20	*Under saturated*	
21	*Saturated*	
Depth of Formation		***DESCRIPTION***
22	*Plutonic/Hypabyssal*	
23	*Volcanic*	
PEGMATITE PROPERTIES		
24	*Colour index*	
25	*Mineralogy*	
26	*Texture*	
27	*Structure*	
28	*Mode of formation*	
29	*Depth of formation*	
30	*Conditions of formation*	
GRANITE PROPERTIES		
31	*Colour index*	
32	*Mineralogy*	
33	*Texture*	
34	*Structure*	

35	*Mode of formation*	
36	*Depth of formation*	
37	*Conditions of formation*	
DOLERITE PROPERTIES		
38	*Colour index*	
39	*Mineralogy*	
40	*Texture*	
41	*Structure*	
42	*Mode of formation*	
43	*Depth of formation*	
44	*Conditions of formation*	
BASALT PROPERTIES		
45	*Colour index*	
46	*Mineralogy*	
47	*Texture*	
48	*Structure*	
49	*Mode of formation*	
50	*Depth of formation*	

LAB INCHARGE:

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EXPERIMENT – 7

Megascopic and microscopic descriptionand identification of rocks

referred Under theory

Application of Sedimentary Rocks:

They are used in the manufacture of concrete, bricks and pipes and in building hoPractical Usage and roads.

DESCRIPTION OF SEDIMENTARY ROCKS

AIMS

The aim of this unit is to provide provide you the description of some important sedimentary rocks.

OBJECTIVES

After completing this unit you should be able to:

- Identify the sedimentary rocks
- Recognize the minerals of sedimentary rocks
- Describe the textures & formation of sedimentary rocks.

1. CONGLOMERATE

It is a common rudaceous rock formed under continental environment. It is mainly consolidated with rounded and subrounded pebbles and gravels. These pebbles and gravels are made up of quartz, feldspars and rock fragments. Ferrugeneous and siliceous cementing materials envelop the pebbles and gravels. In handspecimen, the rock is easily distinguished from breccias by its characteristic rounded pebbles and gravels.

The systematic description of the rock is given below.

1. Clastic Nonclastic : Clastic
2. Colour : shades of grey, brown
3. Mineralogy : Quartz feldspars, clay, hematite and limonite (goethite)
4. Structure : Rounded rudite
5. Texture
   (a) Grain size : Coarse grained
   (b) Grain shape : Rounded to subrounded
   (c) Sorting : Poorly sorted
6. Nature of matric : Ferrugeneous and siliceous
7. Name : Conglomerate

2. SANDSTONE

It is most common clastic rock founded in basinal environments such as river, lakes and marginal seas. It is formed due to consolidation of sand particles. The sandparticles are mainly made up of rounded quartz grains. In handspecimen, it is in brown or yellow or grey or buff colour, and exhibits medium grained texture.

Sometimes sizegrading and rippling features are seen in it. Well sorting of grains is a characteristic feature of many sandstones. If a sandstone is completely composed of quartz, it is termed as arthoquarzite. If a sandstone contines 75% of quartz and 25% of feldspar, it terms as arkose. If a sandstone has more than 30% of matrix of clay, chlorite and glauconite, it terme as greywacks. A fine grained greywake (sandstone) terms into shale.

The systematic description of the ripple sandstone is given below:

1. Clastic / Nonclastic : Clastic
2. Colour : Brown or yellow or greyor buff
3. Mineralogy : Quartz with little amount of feldspar and Siliceous or ferrugeneous clays
4. Structure : Ripple marks, arenite
5. Texture :
   a) Grain size : Medium grained
   b) Grain shape : Rounded to subrounded
   c) Sorting : Well sorted
6. Nature of matrix : Siliceous or ferrugeneous or both
7. Name of the rock : Ripple sandstone

3. SHALE

It is a fine grained argillaceous sedimentary rock that have been formed by the consolidation of beds of mud, clay or silt. The mud and clay are in chlorite, muscovite nd quartz. In hand specimen, it has varied colours like grey, brown black or yellow and exhibits fine grained texture and thin layering.

The systems description of the rock is given below:

1. Clastic / Non clastic : clastic
2. Colour : Grey brown or black
3. Mineralogy : Chlorite muscovite, kaolin, and quartz.
4. Structure : Thin layering
5. Texture:
   a)Grain size : Fine grained
   b)Grain shape : Variable
   c)Sorting : Poorly sorted
6. Nature of matrix : Ferrugeneous or siliceous
7. Name of the rock : Shale

4. LIMESTONE

It is a fine grained non clastic sedimentary rock that has been formed by the precipitation of calcium carbonate solutions which are derived from seawater. In hand specimen. It looks grey and exhibits fine grained texture. It is made up of mainly calcite. There are many varieties of limestone. It is a limestone is porous with full of for a mineral shells, it terms as chalk. If a limestone contains shells of brachiopods or Lamelli branchs, it terms as shelly limestone. If a limestone contains high volumes percentage of dolomite, it grades into dolomite.

The systematic description of a normal limestone as given below:

1. Clastic / Nonclastic : Non clastic
2. Colour : Grey
3. Mineralogy : Calcite (Ca C03)
4. Structure : layering
5. Texture: a) Grainsize : fine grained
   b) Grainshape : variable
6. Nature of matrix : Calcareous
7. Name of the rock : Limestone

VIVA QUESTIONS

FORM		***DESCRIPTION***
1	*Calcareous*	
2	*Feriginous*	
3	*Argillaceous*	
4	*Siliceous*	
5	*Glaucontic*	
PECULAR FORM		***DESCRIPTION***
6	*Concretionary/nodular*	
7	*Pisolotic*	
8	*Oolitic*	
9	*Solution cavities*	
10	*Lamination*	
SHALE PROPERTIES		
11	*Clastic Nonclastic*	
12	*Colour*	
13	*Mineralogy*	
14	*Structure*	
15	*Grain size*	
16	*Grain shape*	
17	*Sorting*	
18	*Nature of matric*	
SANDSTONE PROPERTIES		
19	*Clastic Nonclastic*	
20	*Colour*	
21	*Mineralogy*	
22	*Structure*	

23	*Grain size*	
24	*Grain shape*	
25	*Sorting*	
26	*Nature of matric*	
CONGLOMERATE PROPERTIES		
27	*Clastic Nonclastic*	
28	*Colour*	
29	*Mineralogy*	
30	*Structure*	
31	*Grain size*	
32	*Grain shape*	
33	*Sorting*	
34	*Nature of matric*	
LIME STONE PROPERTIES		
35	*Clastic Nonclastic*	
36	*Colour*	
37	*Mineralogy*	
38	*Structure*	
39	*Grain size*	
40	*Grain shape*	
41	*Sorting*	
42	*Nature of matric*	
CHALK PROPERTIES		
43	*Clastic Nonclastic*	
44	*Colour*	
45	*Mineralogy*	
46	*Structure*	
47	*Grain size*	
48	*Grain shape*	
49	*Sorting*	
50	*Nature of matric*	

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EXPERIMENT – 8

Megascopic and microscopic descriptionand identification of rocks

referred Under theory

Application of Metamorphic Rocks:

They are used in the manufacture of concrete, bricks and pipes and in building hoPractical Usage and roads.

DESCRIPTION OF METAMORPHIC ROCKS

AIMS

The aim of this unit, is to provide you description of metamorphic rocks.

OBJECTIVES

After completing this unit, you should be able to

- Describe the different types of metamorphic rocks
- Describe the mineralogy of different types of rocks

1. GNEISSES

Gneisses are of many kinds (or varieties) depending upon their colour and composition. All of them have a unique character i.e. gneissosity or banding (or lineation). They are common on rocktypes of the Precambrian terrains. In handspecimen, they are coarse grained rocks with alternate dark and white (light) bands. Each band its own colour and composition. Generally, the white bandsis mainly composed of felsic minerals such as quartz and feldspars, while dark band is rich in maficminerals, such as puroxenes, amphiboles, epidotes, garnets and biotite micas.

They are derived from either sedimentary or igneous rocks by high grade regional metamorphism.

One of the gneisses (quartzofeldspathic gneiss) is described in a systematic way for the clear understanding to the students.

1. Colour : Shades of grayish whits
2. Mineralogy : Quartz, feldspar, biotite, hornblende
3. Structure : Gneissose or banding (felsic and mfic bands)
4. Type of metamorphism : High grade regional metamorphism
5. Conditions of metamorphism : Moderte pressure and high temperature
6. Nature of parent rock : Granite
7. Name of the rock : Quartzo-feldspathic gneiss (peninsular geniss)

2. MARBLE

Marble is either contact (thermal) or regional metamorphic rock transformed from a metamorphosed limestone. It is a coarse grained granular rock commonly exhibits white colour (but some marbles may be in different colours due to impurities). Its colour, texture, soft and smooth surfaces promote the rock into commercial grade in building industry.

Systematic description of the rock is given below:

1. Colour : White (rarely pink, shades of green etc)
2. Mineralogy : Calcite
3. Structure : Beds with sacchardial form
4. Type of metamorphism : Contact (thermal) metamorphism
5. Conditions of metamorphism : High temperature and low pressure
6. Nature of parent rock : Limestone
7. Name of the rock : Marble

3. SLATE

Slate is a fine grained lowgrade regional metamorphism rock; which is transformed from shale by regional metamorphism. It is characterized by slaty cleavage, along which it splits into thin sheets or layers. State is variable in its colour from grey to black Systematic description of the rock is given below.

1. Colour : Variable (grey yellow green brown or black)
2. Mineralogy : Muscovite, chlorite, feldspar, quartz
3. Structure : Sheet or layers with slaty cleavage
4. Type of metamorphism : Regional metamorphism
5. Conditions of metamorphism : Low pressure and low tempera ture
6. Nature of parent rock : Pelitic (shale)
7. Name of the rock : Slate

4. QUARZITE

It is a metamorphosed sandstone formed under either contact or regional metamorphism. In hand specimen, it is rather earthy white to brown in colour and exhibits granular form. It is mainly composed of recrystallized quartz. Its colour. Texture, hard and toughness promote the rock into commercial grade in building industry.

Systematic description of the rock is given below:

1. Colour : Variable (shades of white to brown
2. Mineralogy : Quartz
3. Structure : Beds with granular form
4. Type of metamorphism : Contact metamorphism
5. Conditions of metamorphism: High temperature and low pressure
6. Nature of parent rock : **Sandstone**
7. Name of the rock : **Quartz**

VIVA QUESTIONS		
FORM		***DESCRIPTION***
1	*Foliation*	
2	*Lineation*	
3	*Gneissosse structure*	
4	*Schistose structure*	
SLATE PROPERTIES		
5	*Colour*	
6	*Mineralogy*	
7	*Structure*	
8	*Type of metamorphism*	
9	*Conditions of metamorphism*	
10	*Nature of parent rock*	
11	*Usage of the rock*	
12	*Composition*	
13	*Unique Charateristics*	
GNIESS PROPERTIES		
14	*Colour*	
15	*Mineralogy*	
16	*Structure*	
17	*Type of metamorphism*	
18	*Conditions of metamorphism*	
19	*Nature of parent rock*	
20	*Usage of the rock*	
21	*Composition*	
22	*Unique Charateristics*	
MARBLE PROPERTIES		
23	*Colour*	
24	*Mineralogy*	
25	*Structure*	

26	*Type of metamorphism*	
27	*Conditions of metamorphism*	
28	*Nature of parent rock*	
29	*Usage of the rock*	
30	*Composition*	
31	*Unique Charateristics*	
QUARZITE PROPERTIES		
32	*Colour*	
33	*Mineralogy*	
34	*Structure*	
35	*Type of metamorphism*	
36	*Conditions of metamorphism*	
37	*Nature of parent rock*	
38	*Usage of the rock*	
39	*Composition*	
40	*Unique Charateristics*	
SCHIST PROPERTIES		
41	*Colour*	
42	*Mineralogy*	
43	*Structure*	
44	*Type of metamorphism*	
45	*Conditions of metamorphism*	
46	*Nature of parent rock*	
47	*Usage of the rock*	
48	*Composition*	
49	*Unique Charateristics*	

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EXPERIMENT -9

GEOLOGICAL STUDY OF

FOLDS, FAULTS & CONFIRMITIES

Application of structural geology:

The primary goal of structural geology is to use measurements of present-day rock geometries to uncover information about the history of deformation (strain) in the rocks, and ultimately, to understand the stress field that resulted in the observed strain and geometries.

STUDY OF FOLDS, FAULTS & CONFIRMITIES

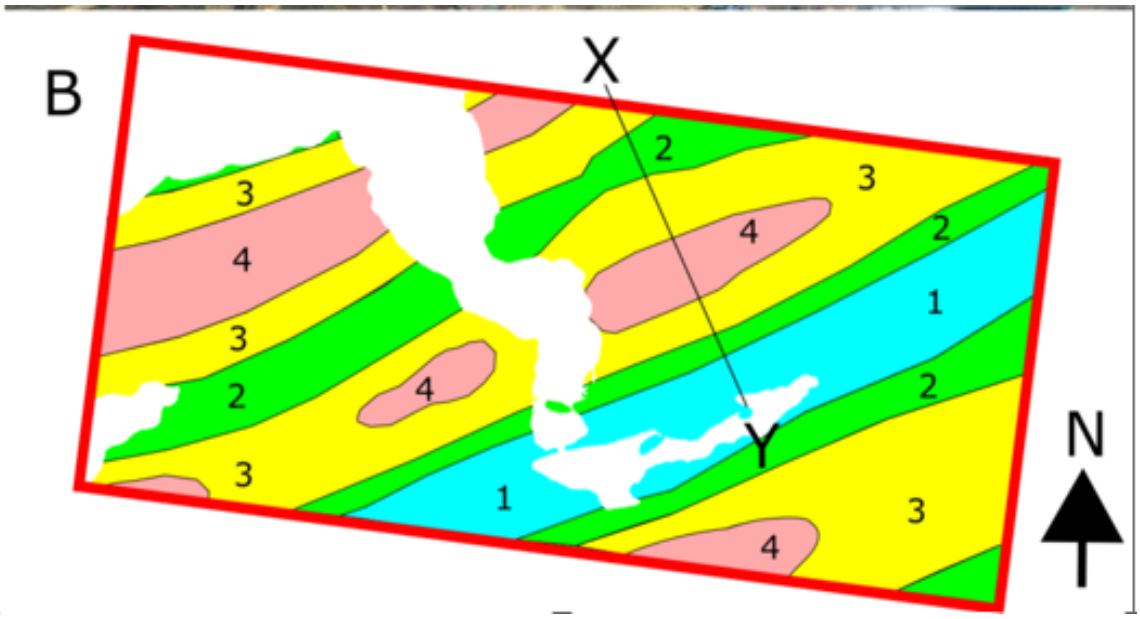


FIG:9.1

a) Describe the patterns formed by the layers of rock exposed in this image. What do these patterns tell you about the geologic structure(s) formed by the rocks in this area?

b) Note the relative ages of the rocks presented in Figure 9.1. Given this information, what kind of structure do you think is found in the red boxed area of the satellite image?

c) Sketch a rough cross-section of your interpretation of the geology in Figure 9.1 , between points X and Y (X-Y).

d) Are data missing from the map that would help you improve the accuracy of your interpretation? If so, what data would help you to understand the geology better?

Block Diagrams

In the diagrams shown in Figure 9.2, numerical labels on beds indicate the relative ages of the beds, with 1 being the oldest and 6 the youngest. Complete the block diagrams by doing the tasks listed below. Assume that the geologic units have not been overturned (flipped upside down).

a) Draw the geological contacts as they would appear on the blank surfaces.

b) Add strike and dip symbols as well as symbols documenting any other geological features. Include the

direction of motion for any faults.

c) Write the name of the structure in the blank beneath each diagram.

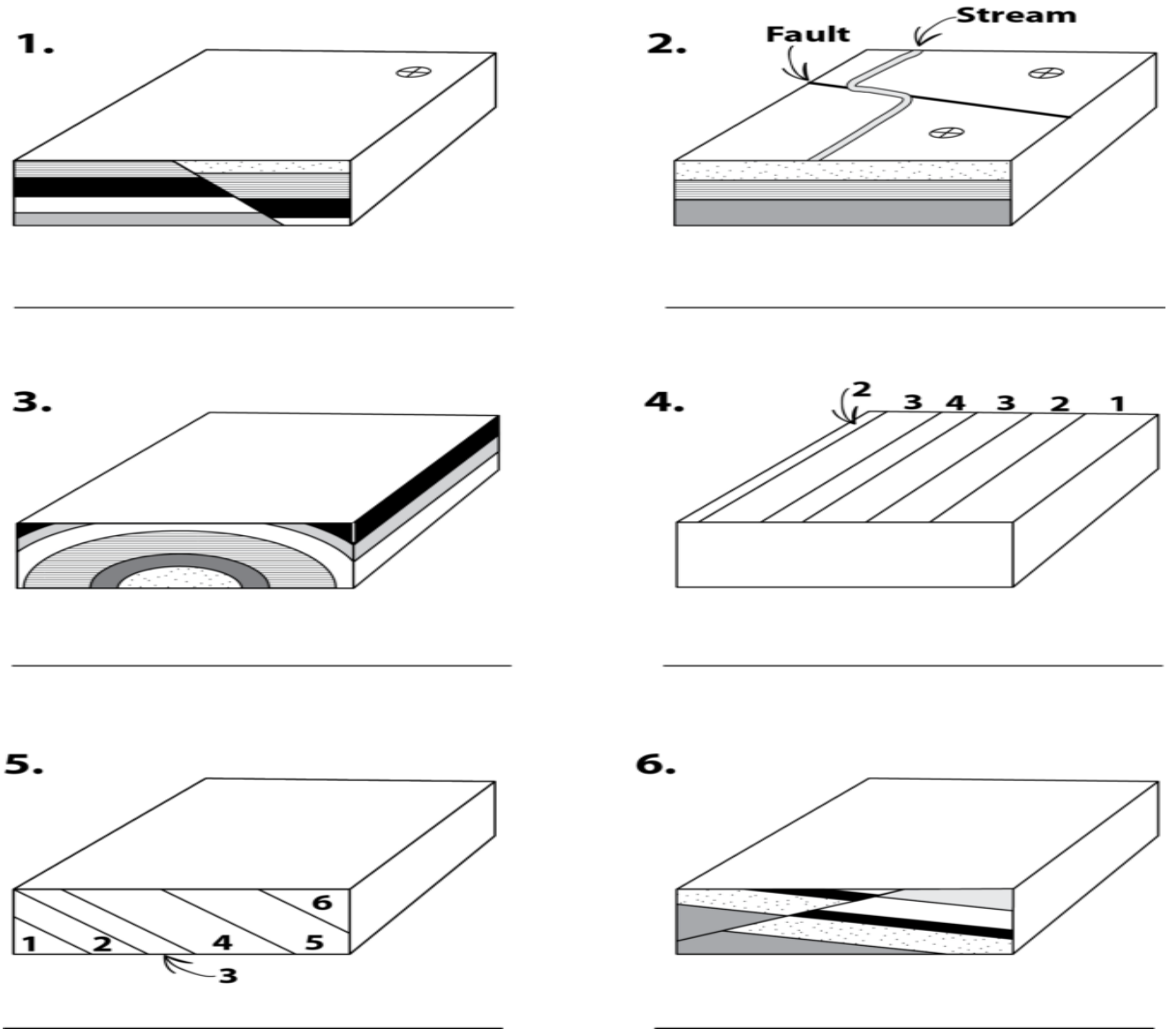


Figure 8.20 | Block diagrams of geological structures.

Drawing Cross-Sections of the Folds, Faults, and Unconformities of the Wavy Wastelands

For this exercise you will use the map of the Wavy Wastelands (Figure 9.3). Remember that the rocks in the legend are not in the correct order. You will have to re-arrange them as part of the exercise.

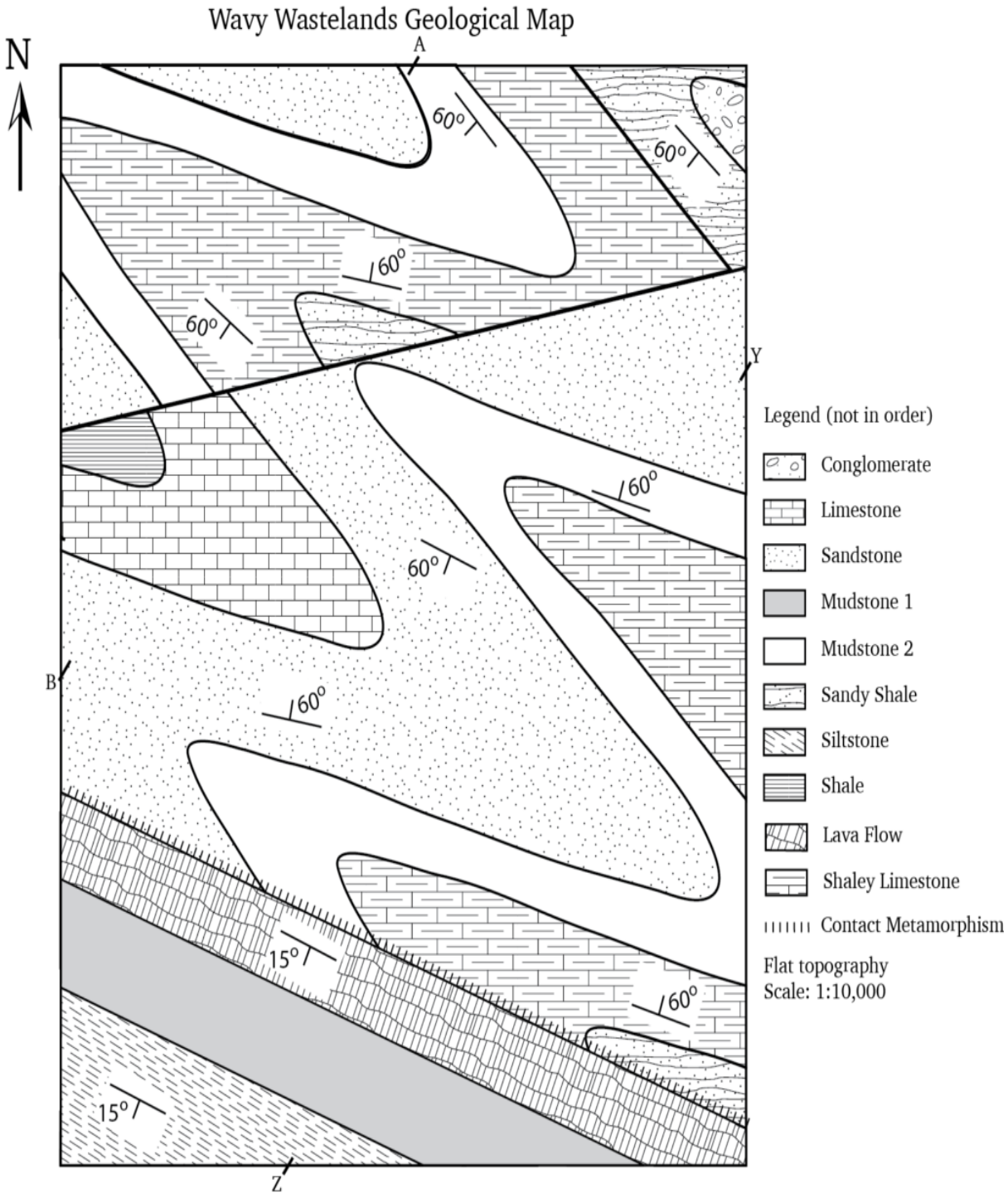


Figure 9.3 | geological map.

a) What kinds of rocks are found in this map area (sedimentary, igneous, and/or metamorphic)? How many units can you see?

b) Note the strike and dip symbols on the map. Which direction are the units striking and dipping? Do the strike and dip of the beds change at all as you move across the map area?

c) There is a major unconformity in the map area. What kind of unconformity is it? Outline the trace of the unconformity in red on your map.

d) Draw fold axial traces on the map for the folds in the map area. (There are six.) Indicate whether the folds are anticlines or synclines by putting the appropriate symbols on the map for each fold. Note that all the folds are plunging in the same direction.

e) Make a list of formations from oldest to youngest. Which geologic laws/principles did you use to prepare your list?

f) There is a fault in the map area. Which side of the fault went up relative to the other side? Mark this on your map. *Hint: Which side has older beds? Use the folds to help you figure out the relative ages of the beds.*

g) The fault is a **reverse** fault. In what direction does the fault plane dip? _____ *Hint: The fault plane always dips toward the hanging wall. In a reverse fault, how does the hanging wall move relative to the footwall?*

h) Note the scale of the map. What is the distance in metres between point Y and point Z? What is the distance in metres between point A and point B?

X to Y distance: _____ A to B distance: _____

i) Prepare a cross-section through the map from position Y to Z (Y-Z).

j) Prepare a cross-section through the map from position A to B (A-B). Draw the fault with a dip angle of 45°.

k) In point form, describe the geological history of the map area.

VV

VIVA QUESTIONS		
S.NO	QUESTION	ANSWER
1	An example of fold mountain range in the Southern America is	
2	Rocks under compressional force are	
3	Rift valleys and block mountains are landforms that are formed by	
4	Faulting takes place when rocks within Earth's crust form	
5	When the rock layers bend downwards, they form a	
6	Faulting occurs due to	
7	Faulting occurs when Crustal rock layer experience	
8	A rift valley forms when the central block is moved	
9	Further uneven compression of plates would cause one limb to be pushed over the other to create a/an	
10	Folding also takes place on a large scale when two	
11	When two geological forces from opposite directions act on each other, the rock layers within the Earth's crust	
12	The Himalayas were formed approximately	
13	slant sides of the folding rocks are known as	
14	In normal fault, the displacement that takes place is	
15	Most of the rift valleys and block mountains are found in	
16	The tremendous compressional forces exerted on the rock layers by geological movements caPractical Usage rock layers to	
17	The reverse fault is caused due to	
18	When the stronger compressional forces push the over thrust fold to move along the fracture line, it forms a	
19	Rocks under tensional force are	
20	A tear fault occurs due to	
21	If the compressional force is unequal, then the folding that will take place would be	
22	Normal fault is caused by	
23	Faulting caPractical Usage the displacement of rocks to occur in	
24	A fold mountain is a type of landform that is created when two crustal plates	
25	Reverse fault is similar to normal fault, except for the	

26	*What do we call a fault in which the hanging wall moves up along the dip with respect to the footwall*	
27	*What do we call a fold in which the rock layers are folded upward, with the limbs sloping up to the axis of the fold*	
28	*The number of major types of faults is*	
29	*What do we call a fault in which the movement is horizontal along the strike?*	
30	*What do we call a downdropped block of the crust, bounded by normal faults on each side?*	
31	*The San Andreas Fault in California is an example of a _____ fault in a _____ plate boundary.*	
32	*The Sierra Nevada Mountains in California are primarily what kind of mountains?*	
33	*If further pushed, the overfold becomes a/an*	
34	*Normal fault takes place when the crust is*	
35	*An example of the folding of two continental plates is*	
36	*The plate boundaries, made up of oceanic sedimentary rocks, are pushed to form a*	
37	*Conversely, a rift valley can be formed from a reverse fault caused by*	
38	*When the amount of compressional force exerted on a rock layer is equal from both sides, the rock layer is likely to warp and crumple*	
39	*The range formed due to the collision of Indo-Australian and Eurasian Plate is*	
40	*An elongated lowland between two highlands that were created from the vertical displacement of rocks due to tensional or compressional forces as a result of faulting is known as*	
41	*When tensional force is applied to rock layers, it develops a*	
42	*When folding occurs in sedimentary rock layers, they bend upwards and form a/an*	
43	*Another force due to which Faulting occurs is*	
44	*The fault or fold of a plate depends on its*	
45	*Even further over limited push would convert recumbent fold into a*	
46	*An example of fold mountain range in Europe is*	
47	*The directions in which the displacement of rocks occurs are*	
48	*An example of fold mountain range is*	

LAB INCHARGE SIGN:
DATE:

EXPERIMENT – 10

Interpretation and drawing of sections forgeological maps
showing tilted beds, faults, uniformities etc.,

Application of Geological Map Studies:

By studying geologic maps, users can identify such potential natural hazard areas for floods, earthquakes, volcanoes, and landslides. These maps can also provide data on important deposits of energy resources such as oil, natural gas, and coal.

GEOLOGICAL MAP -1

AIM

The aim of this unit is to draw a geological section along X-Y axis and interprete the geological map.

OBJECTIVES

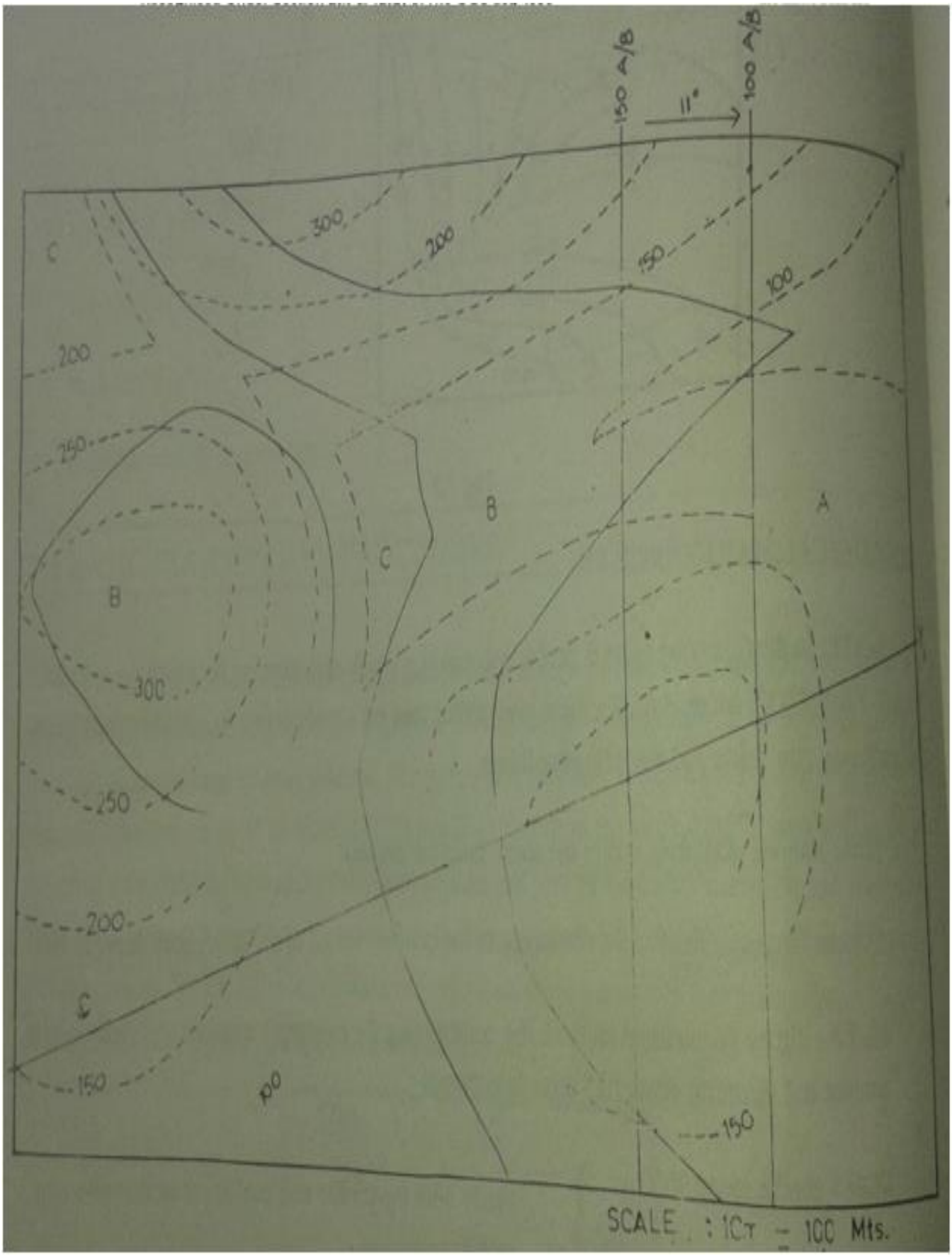
- After drawing the profile you will be able to
- Describe the geology of the area
- Explain the structure of the area
- Describe the topography
- Explain the succession of the beds
- List out the beds

PRECAUTION

Draw two straight lines for the same bedding plain to calculate the dip of the bed

Note: Never draw on straight line for one bedding plane and a second straight line for another Bedding plane for calculation of dip

SECTION ALONG X-Y (TRUE DIP DIRECTION)


150 A/B
11°
100 A/B
300
200
150
100
C
200
250
B
C
B
A
300
250
200
C
150
100
150
SCALE : 1CT = 100 Mts.

SECTION ALONG X-Y (TRUE DIP DIRECTION)

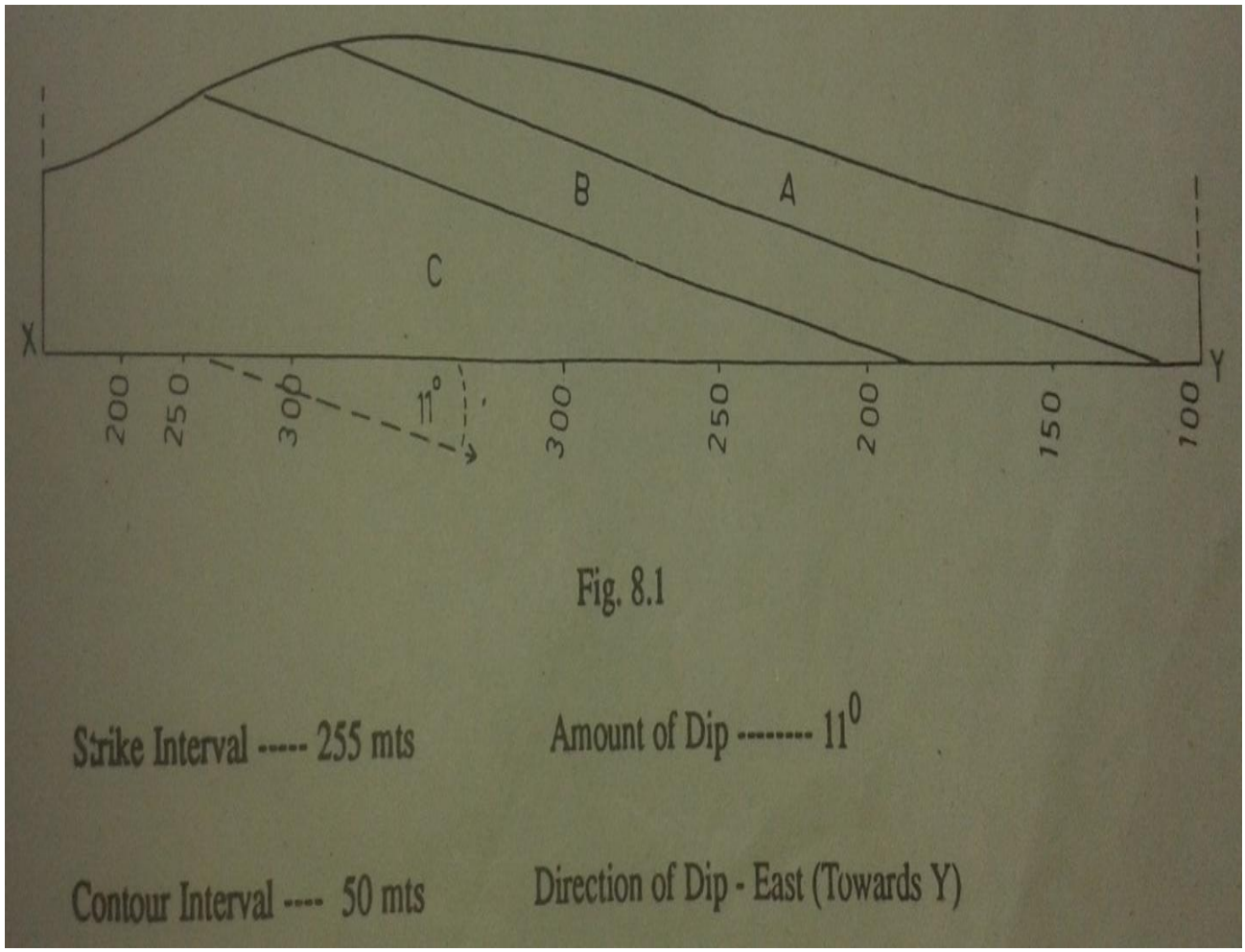


Fig. 8.1

Strike Interval ----- 255 mts

Amount of Dip -------- 11^0

Contour Interval ---- 50 mts

Direction of Dip - East (Towards Y)

GEOLOGICAL INTERPRETATION

Topography

In the map highest contour is of 300 mts. And the lowest is of 100 mts. The area is having two

Hills, one in the west and the other in South-East region. These two hills are having different heights.

Both the hills are showing gradual slopes. These are valleys present in the area.

General Geology

In the area there is only one series of 3 beds which are confirmable.

Geological Structure

In the area the beds are striking North-South and dipping with 11^0 towards East (towards Y). A small out lier is present in Western region.

(When an younger bed is surrounded by an older bed the resulting structure is outlier).

Geological Succession

In the area the beds are deposited in the order: C-B-A in normal marine conditions. All the formations are confirmable. Later they are up-lifted and tilted to attain the present attitude. When they are exposed to erosion, an outlier is formed.

NOTE: This outlier is purely an erosional feature.

GEOLOGICAL MAP -2

GEOLOGICAL INTERPRETATION

Topography

In the given map the maximum topographic elevation is of 400 mts towards North of the area and a minimum of 100 mts, towards south of the area. There are two gently gradient river valleys in the ea directing towards south.

General Geology

There are altogether 5 beds in the area. Their boundaries are almost parallel to each other and all of them belong to only one series.

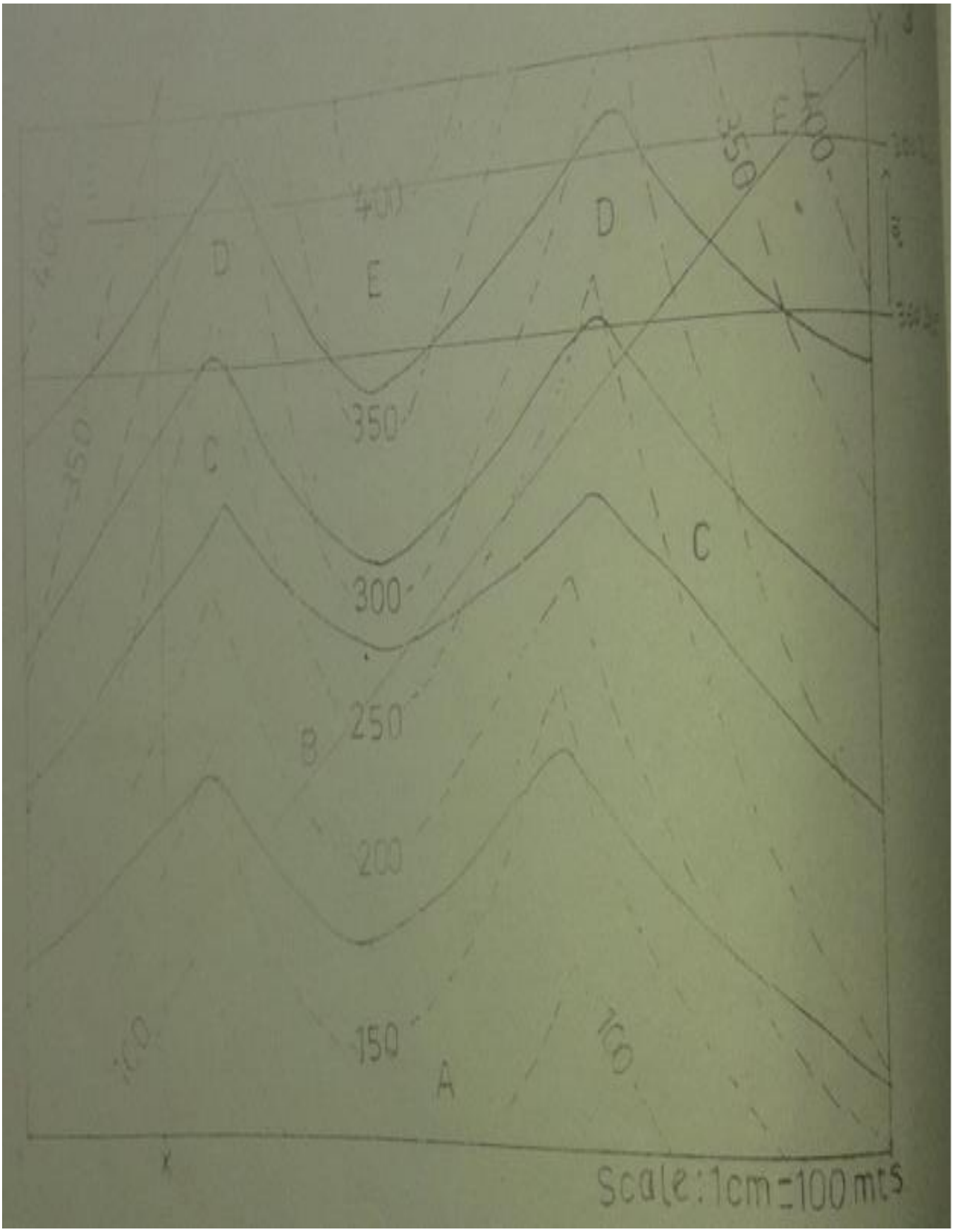
Geological Structure

In the map all the beds are striking in the direction East-West and dipping with an amount of 10^0 towards North (towards Y), No recognizable structure.

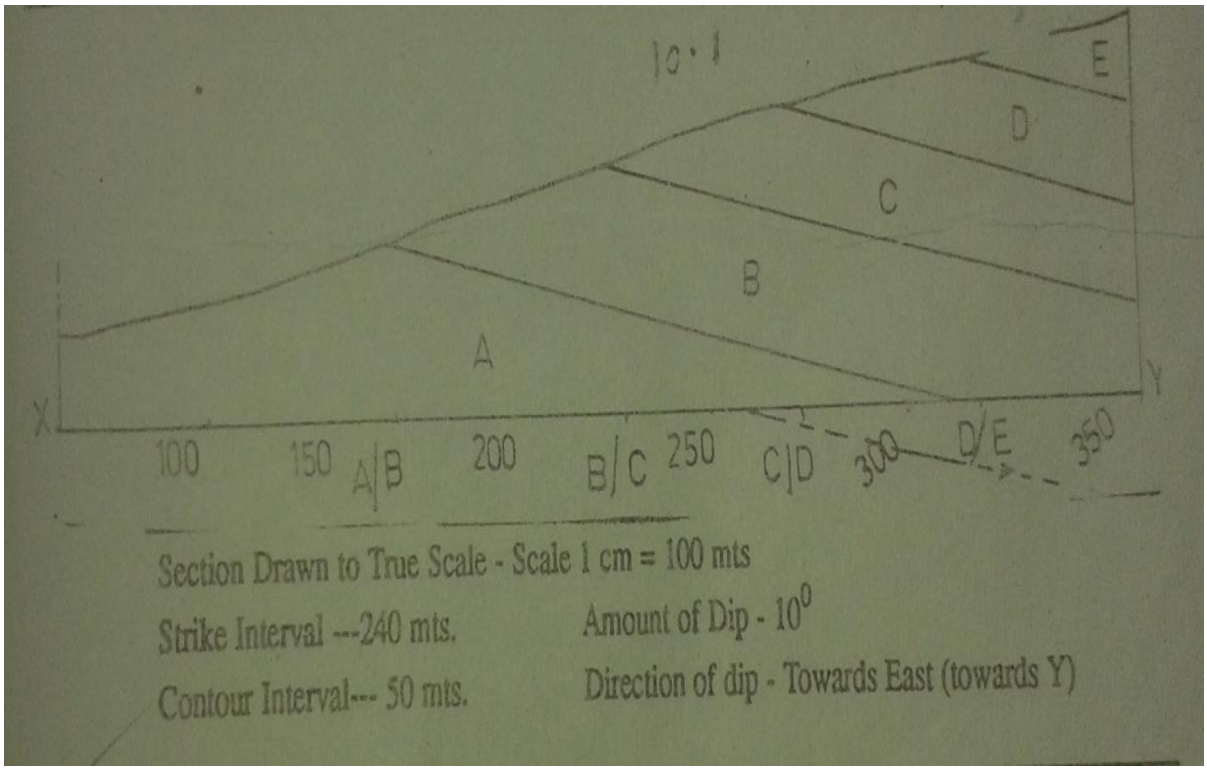
Geological Succession

In the map all the beds are confirmable and belong to only one series. The younger beds follow the older in direction of dip. The beds are deposited in the order A-B-C-D-E in normal marine conditions.

Later on they are up lifted tilted subsequently eroded to give the present configuration.


400
D
E
350
C
300
250
B
200
150
A
X
Scale: 1cm = 100 mts

SECTION ALONG X-Y (TRUE DIP DIRECTION)



GEOLOGICAL MAP -3

GEOLOGICAL INTERPRETATION

Topography

In the given map the highest contour is of 550 mts. In the east and lowest is of 100 mts in the west. The area is of gentle slope from east to west. There is no trace of any prominent valley formation.

General Geology

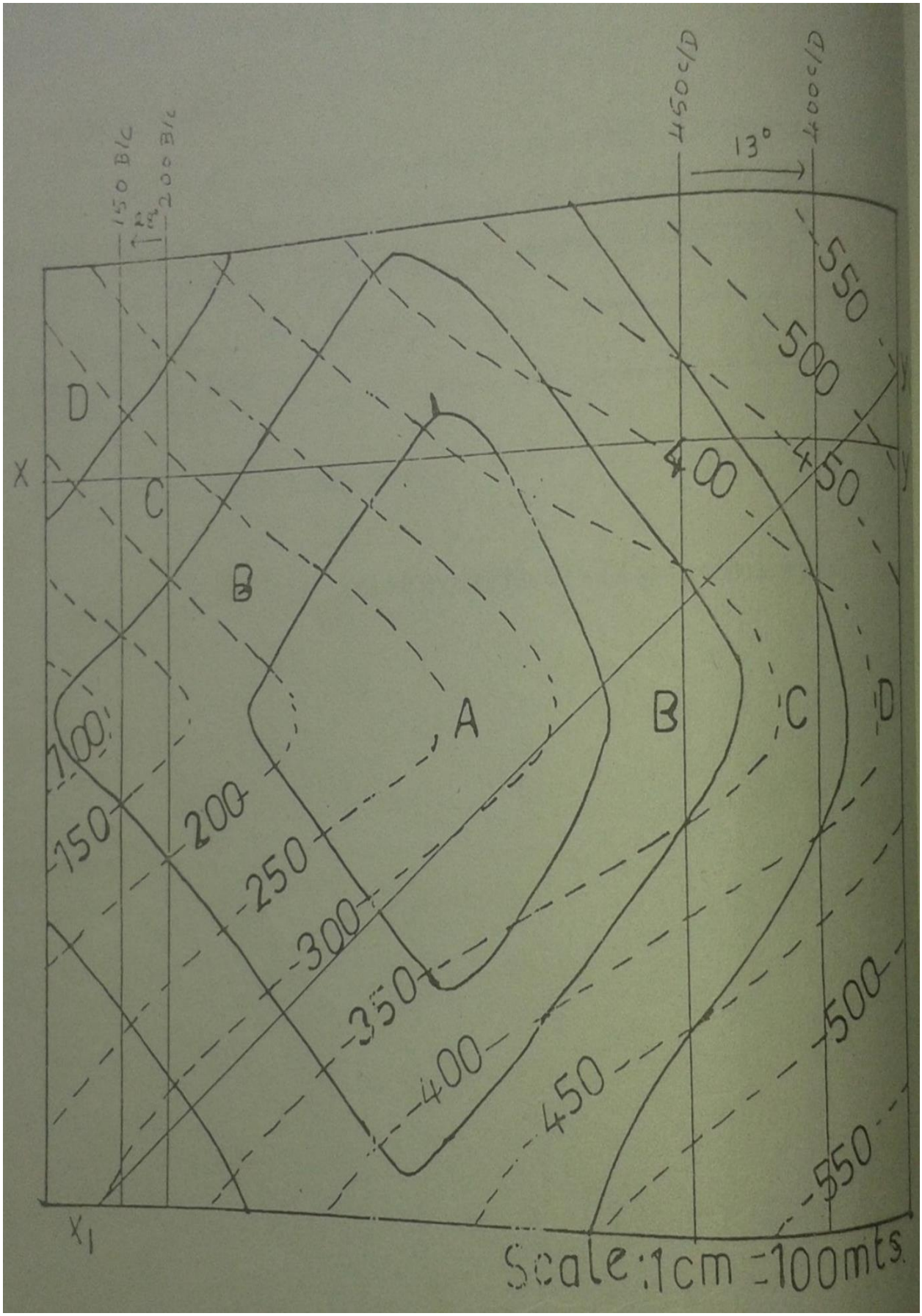
There are 4 beds in the area. All of them belong to one series only. The boundaries are parallel to each other and the beds are repeated.

Geological Structure

In the map all the bedding planes strike in the North – South direction and dip in reverse directions. i.e., the bedding planes towards East dip with an amount of 13^0 towards East and the same bedding planes towards west dip with an amount of 28^0 towards West. In the area the structure is an anticlinal fold which is evident. From the repetition of beds in reverse order and one dipping away from the other in opposite directions.

Geological Succession

In the area all the beds are confirmable and are deposited in normal marine conditions in the order A-B-C-D Later on they were uplifted, tilted and subjected to folding giving rise to anticline. (Anticline is a convex shaped body with the two limbs dipping away from each other and having older group of rocks at the centre.)


150 B/C
200 B/C
450 C/D
400 C/D
13°
D
C
B
A
B
C
D
X
Y
X1
Y1
700
750
200
250
300
350
400
450
500
550
500
550
Scale: 1cm = 100mts

SECTION ALONG X-Y (TRUE DIP DIRECTION)

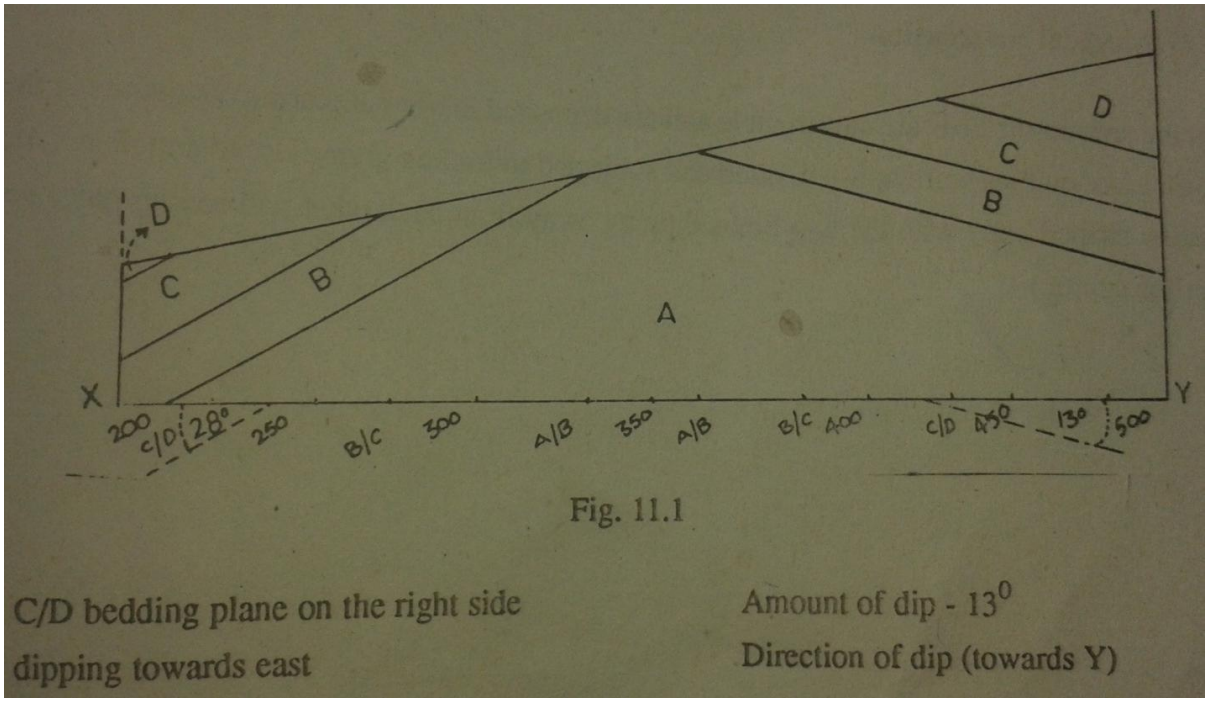


Fig. 11.1

C/D bedding plane on the right side dipping towards east

Amount of dip - 13^0

Direction of dip (towards Y)

GEOLOGICAL MAP -4

GEOLOGICAL INTERPRETATION

Topography

In the given map the highest contour is 550 mts in the West and the West of 100 mts., in the Eastern area. The area is a gentle sloping one from West to East as indicated by the trend of the contours.

General Geology

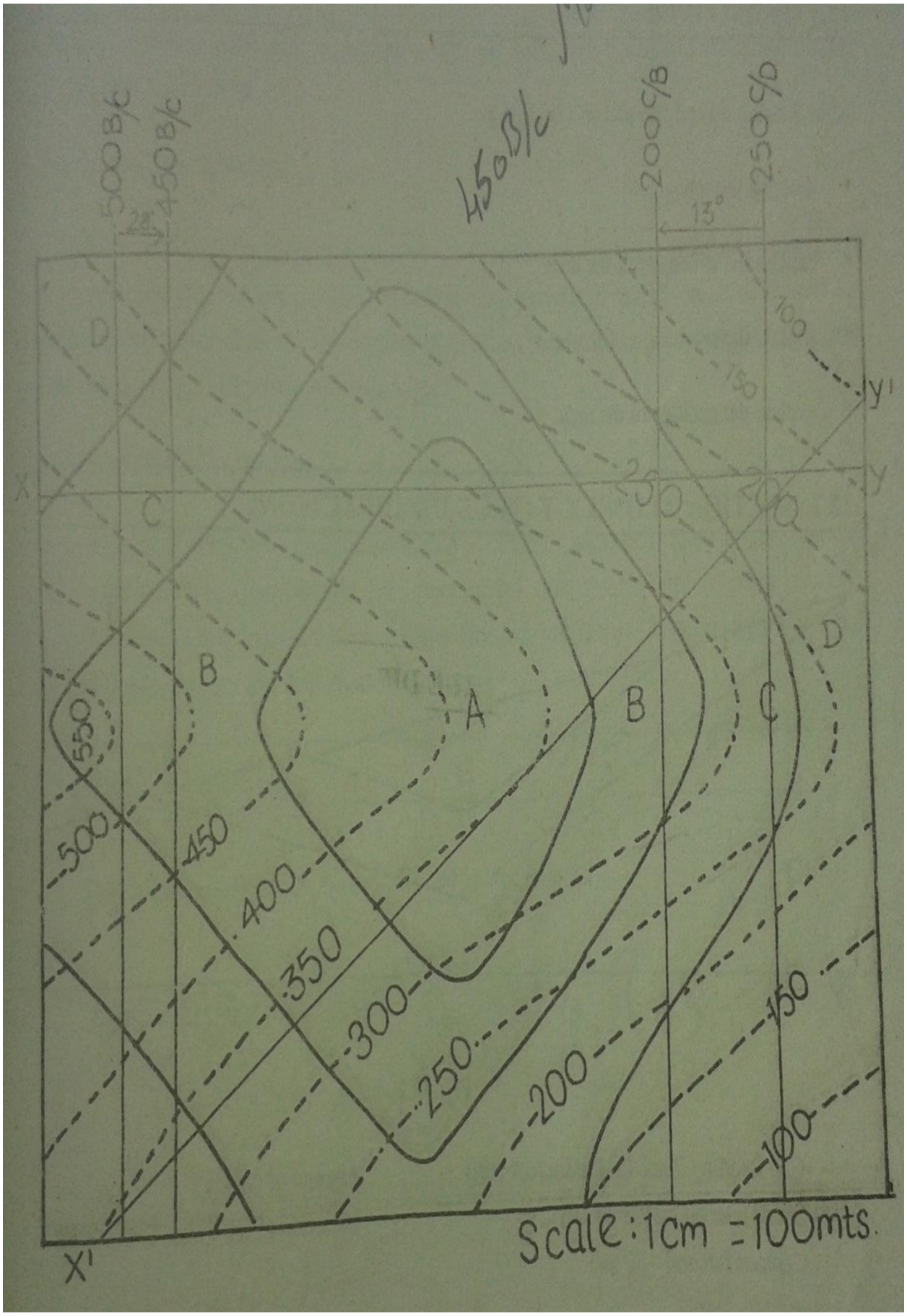
There are 4 beds in the area. All belong to only one series. The boundaries are parallel to each other. The beds are repeated.

Geological Structure

In the map all the beds are strike in North-South direction and they dip in different directions. The beds towards West dip towards east and the beds towards east dip towards West, at of 28^0 and 13o respectively. This reversal of the dip directions of the same beds indicate that the structure is a fold, and the dip directions indicate that it is a syncline.

Geological Succession

In the map all the beds are confirmable and the succession being D to A. These beds are deposited under normal marine conditions and later they were uplifted, tilted and subjected to folding giving rise to a synclinal (a syncline is a concave shaped structure with the two limps dipping towards each other and having younger group of rocks at the centre.


500 B/c
450 B/c
450 B/c
200 c/B
250 c/b
13°
D
C
B
A
B
C
D
y'
y
x
x'
550
500
450
400
350
300
250
200
150
100
Scale: 1cm = 100mts.

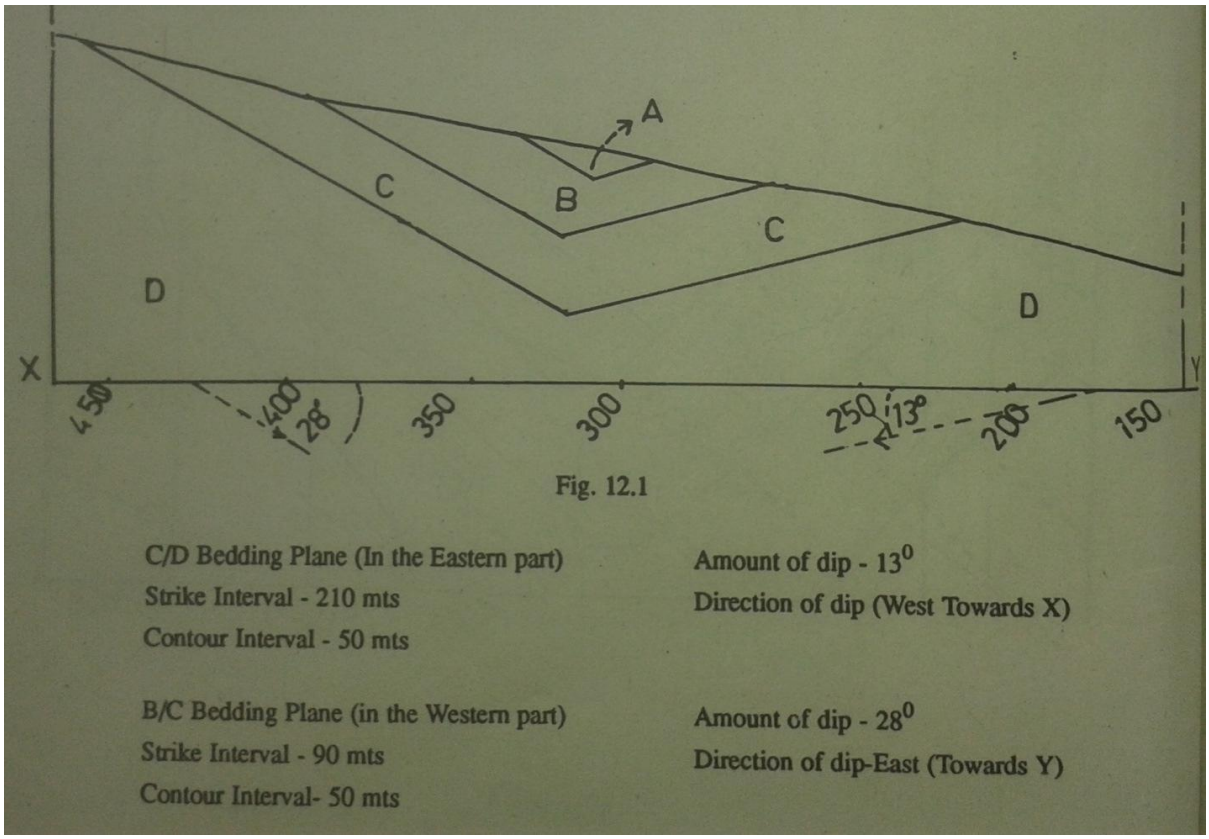


Fig. 12.1

C/D Bedding Plane (In the Eastern part)
Strike Interval - 210 mts
Contour Interval - 50 mts

Amount of dip - 13^0
Direction of dip (West Towards X)

B/C Bedding Plane (in the Western part)
Strike Interval - 90 mts
Contour Interval- 50 mts

Amount of dip - 28^0
Direction of dip-East (Towards Y)

SECTION ALONG X-Y (TRUE DIP DIRECTION)

NO VIVA QUESTIONS WILL BE PROVIDED FOR THIS EXPERIMENT

LAB INCHARGE SIGN:

DATE:

ADD ON

Simple structural geology problems

PROBLEMS – 1

AIM

The aim of this unit is to determine the true and vertical thickness of the formation

OBJECTIVES

After solving the problems you should able to:

- Determine the true thickness of the formation
- Determine the vertical thickness of the formation.

MATERIALS

Set-square, Circular, Erazer, Pencil, White papers

ATTENTION

Before you solve the problems given in exercise you carefully go through the unit.

PROBLEM

The width of out crop of shale formation measured in East-West direction is 750 mts. The strike direction of the shale formation is North-South and dipping with an angle 25^0 towards East. Determine the true and vertical thickness of the formation (The region is one of no relief)

METHOD

1. Assume the scale as 1 cm = 100mts
2. Draw a horizontal line “AB” which represents the East-West direction
3. Draw one more vertical line on “AB” line and note it as “OP” which represents the North-South direction.

4. Take a point “C” on “AB” line form point “C” from “AB” line with a distance 7.5 cms (as per

Scale 750 mts = 7.5 cms) Make a point and not it as “D”. Now the “CD” is the width of the

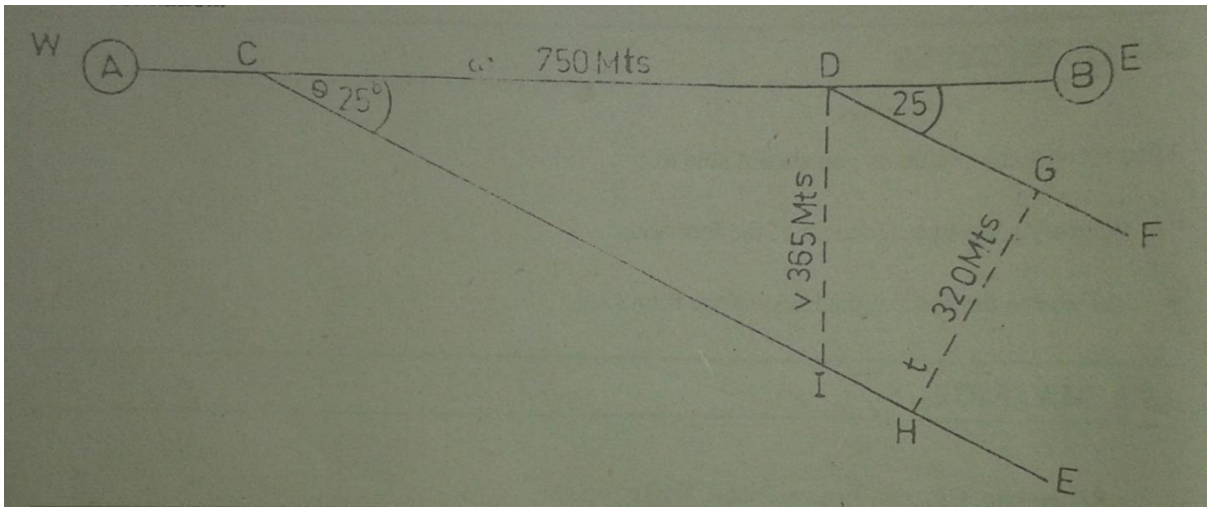
Out crop

5. From point “C” draw a line “CE” with an angle 25^0 to “AB” line towards East direction

6. From the point “D” draw a “DF” line parallel to “CE”

7. Draw a “DI” line from point “D” at right angles to the horizontal line to get the vertical Thickness of the formation

8. Draw another perpendicular line “GH” to “DF” and “CE” lines this is the true thickness Of the formation.



PROBLEM - 2

AIM

The aim of this unit to determine the dip amount of the formations and true thickness of the geological formation.

OBJECTIVES

After solving the problem you should able to:

- Determine the dip amount and dip direction of the geological formations
- Determine the true thickness of the formations

MATERIALS

Set – square, Circular, Erazer, pencil, White papers

ATTENTION

Before you solve the problems you carefully go throught the unit 1 and 2 of Block-I, Course – III

PROBLEM

The width an out crop of a rock formation dipping towards east 200 mts on ground level. Its vertical thickness is 350 mts. Determine the amount of its dip and also the true thickness of the formation.

METHOD

1. Assume the scale as 1 equal to 50 mts.
2. Draw a horizontal line "AB" which represents ground level and East-West direction.
3. Draw a vertical line "OP" on "AB" line which represents North-South direction.
4. Take a point "C" on the "AB" line, from point "C" measure the width of the out crop.
   As per scale 200 mts = 4 cms
5. From point "C" with 4 cms distance put another point and note as "D". Now the "CD" is the Width of the out crop.

6. From the point “D” draw a perpendicular line. As per scale the vertical thickness is 7 cms. (350

Mts = 7 cms). From “D” with a distance of 7 cms put another point oa vertical line and noted

As “E”.

7. Join the points “C” and “E” with a line. The “CE” line represents the bottom of the bed.

8. Draw a line “DG” parallel to “CE”. “DG” is the top of the bed.

9. Draw a perpendicular line “HI” on “CG” line and extend towards the “DG” line. This “HI”

Is the true thickness of the formation.

10. Measure the angle DCE or BDG. This angle gives the dip amount of the bed.