

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
DEVANG PATEL INSTITUTE OF ADVANCE TECHNOLOGY AND RESEARCH
DEPARTMENT OF MECHANICAL ENGINEERING

Elements of Engineering (ME145)

F.Y.B.TECH

EXPERIMENT NO: 3

SCOPE OF CIVIL ENGINEERING

1. Explain role of civil engineers.
2. Define civil engineering.
3. Enlist various branches of civil engineering.
4. Explain geotechnical engineering and structural engineering.
5. Enlist various branches of civil engineering. Explain any two branches in details.
6. Brief the scope of civil engineering based on filed work.

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Ques: 01 Explain role of civil engineers.

- Civil engineers coordinate the needs of society, with technical and economical feasibility.
- Civil engineers are concerned with the impact of their projects on the public and the environment.
- Civil Engineering is a broad discipline that unifies a number of aspects of engineering and sciences.
- Some important roles of a Civil Engineer :-

- To carry out surveying and leveling, detailed soil investigations and planning of various types of buildings as per functional needs.
- To fix the alignments of roads, canals, railways, etc.
- To plan buildings according to bye laws of local authorities.
- To ensure that the design is safe, durable and economical.

- To carry out structural analysis and design of various structures like building, bridges, dams, etc...
- To supervise the work during execution, to ensure the progress of work, to control the quality of work.
- To carry out testing of civil engineering materials like cement, sand, aggregates, reinforcement bars, soil, etc...
- To carry out valuation of land of building for the purpose of sale / buy / taxation.

Ques:- 02 Define civil engineering.

- The civil engineering profession involves analysis, planning, design, construction and maintenance of different types of facilities for government, commerce, industry and the public.
- These includes high-rise office towers, factories, schools, airports,

tunnels and subway systems, dams, canals and water purification and environmental protection facilities, such as solid waste and wastewater treatment systems.

Ques :- 03 Enlist various branches of civil engineering. Explain any two branches in detail.

→ Various branches of civil engineering :-

1. Environmental Engineering
2. Geotechnical Engineering
3. Hydraulics and Water Resource Engineering
4. Construction Materials and Technology.
5. Structural Engineering.
6. Transportation Engineering
7. Construction Management.
8. Urban Planning.

→ Hydraulics and Water Resource Engineering

→ The application of computational techniques and fluid mechanics to the flow, control, collection and supply of water and other liquids.

- Water resource engineering means utilization and development of water resources for agriculture, municipal and power generation purposes.
- Hydraulics and water resource engineering includes design of hydraulic structures and machinery, study of rainfall and its flow and collection, prediction of storms and floods, and mitigation of their impact.

Based on

- Mathematics
 - ↳ for modelling the responses
- Physics
 - ↳ for providing the fundamentals
- Fluid Mechanics
- Hydrology
- Design of water supply networks.
- Design of Hydraulics structures.

→ Construction Materials and Technology

- Utilization of material and equipment to implement the design of structures and other civil engineering projects, and take care of their maintenance.
- Construction materials and technology involves design of new materials and construction methods, improvement of the performance of materials, improvement of the quality of construction.

Based on

- Physics and Chemistry
Up for providing the fundamentals for the behaviour of materials.
- Understanding of the market and practice.
- Architecture and building physics
- Building drawing.
- Surveying
- Maintenance of facilities.

Ques :- Q4 Brief the scope of civil engineering based on field work.

→ Scope of civil engineering based on field work :-

- Building construction
- Construction of heavy structures
- Transportation engineering
- Water resource engineering
- Geo-technical engineering
- Environmental engineering.
- Town planning

→ Building construction :-

- Constructing residential buildings like tenements, flats, row houses, etc ..
- Public buildings like schools, hospitals, shopping complexes etc.
- Industrial buildings like workshops, industrial sheds.
- Includes study of building material and construction method.

→ Construction of heavy structures :-

→ Constructing dams, bridges, port, airport, tunnels, pile foundation etc.

→ Includes study of advance techniques, modern equipment and materials.

→ Transportation engineering :-

→ Constructing structures like roads, railways, bridges, tunnels, harbors, runway, airports.

→ Also includes traffic engineering and study of highway materials.

→ Water resource engineering :-

→ Construction of dams, barrages, canal structure and hydropower stations.

→ Includes irrigation methods, water shed management, rain water harvesting, hydrology, flood control.

→ Geo-technical engineering :-

- Constructing several type of foundations like simple footing, well foundation, pile foundation and foundations of machine subjected to vibrations.
- Includes soil investigation and soil testing.
- Includes construction of earthwork for highway and railway, earth dam.

→ Environmental engineering :-

- Deals with pollution control and public health engineering.
- Types of pollution are water, air, noise and others.
- Public health engineering includes water treatment, waste water treatment, water distribution system and solid waste management.
- Includes design, construction and maintenance of water treatment, water distribution system, sewage system.

→ Town planning :-

- Planning of town by zoning of the land, planning road network, planning other services like water supply and drainage.
- Preparing master plan of town, regulating construction by building bye-laws.

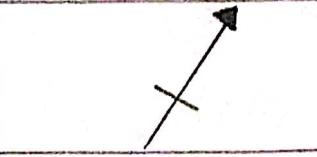
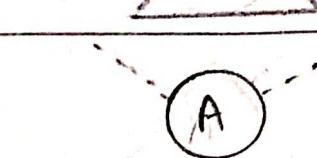
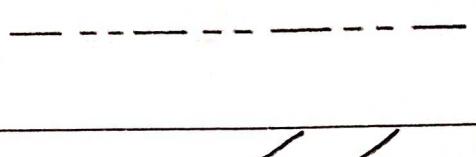
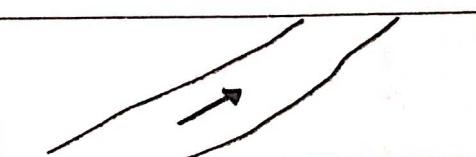
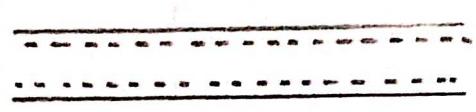
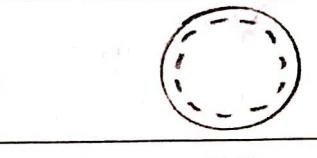
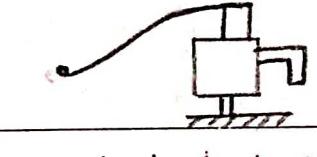
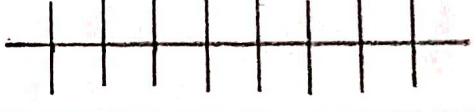
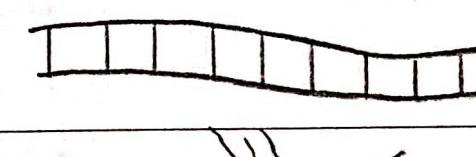
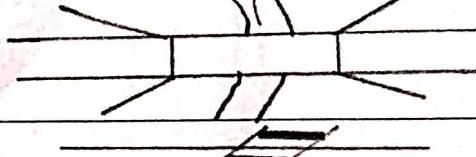
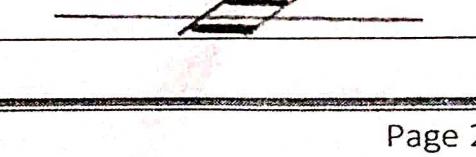
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Name :- Rushik . Rajeshbhai . Rathod

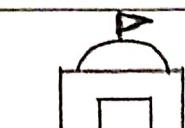
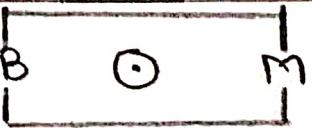
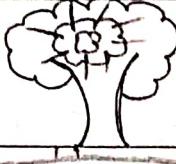
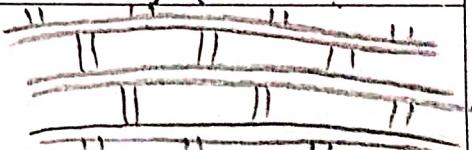
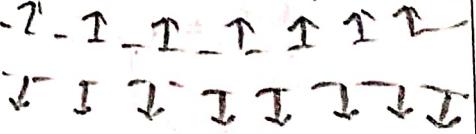
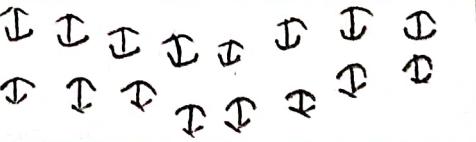
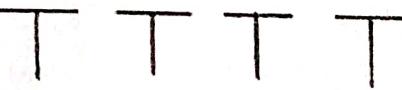
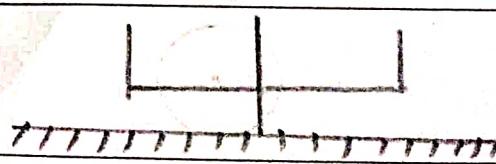
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CONVENTIONAL SYMBOLS

Experiment: 4

Sr. No.	Object	Symbol
1.	North Line	
2.	Main stations	
3.	Traverse stations or sub stations	
4.	Chain line	
5.	River	
6.	Canal	
7.	Open Well	
8.	Tube Well	
9.	Railway Line (single)	
10.	Railway line (Double)	
11.	Road Bridge or culvert	
12.	Railway Bridge or culvert	

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13.	Road & Rail level Crossing	
14.	Wall with gate	
15.	Building (Pakka)	
16.	Building (Katcha)	
17.	Temple	
18.	Bench Mark	
19.	Tree	
20.	Cultivated Land	
21.	Embankment	
22.	Cutting	
23.	Telephone Line	
24.	Telegraph Post	
25.	Electric Line	

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26.	Electric Post <small>date</small>	
27.	Burial Ground or Cemetery	

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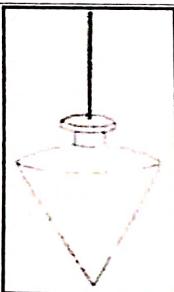
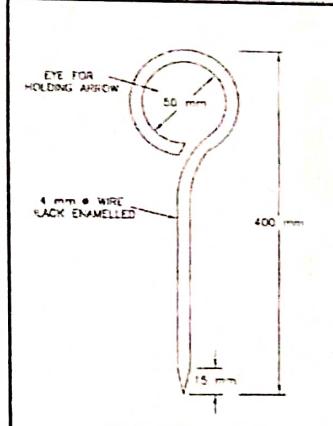
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EXPERIMENT NO: 5

INTRODUCTION TO SURVEYING-2

1. Give the label of below mentioned instruments.

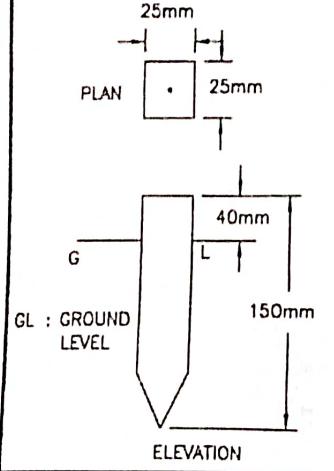
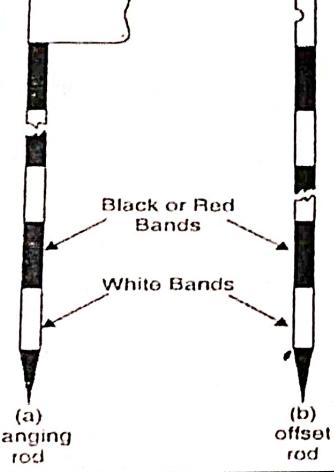
Sr. No.	Instrument	Label
1		Plumb Bob
2	 FIG. 215 STEEL ARROW	Steel Arrow

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3	 <p>PLAN: A square with side dimensions of 25mm each. A central dot is labeled '•'.</p> <p>ELEVATION: A trapezoidal shape. The top horizontal line is labeled '40mm'. The bottom horizontal line is labeled '150mm'. The left vertical line is labeled 'G' (Ground Level). The right vertical line is labeled 'L'.</p> <p>GL : GROUND LEVEL</p>		Peg
4	 <p>(a) Ranging rod: A vertical rod with alternating black and white bands. It has a flag at the top and a pointed end at the bottom.</p> <p>(b) offset rod: A vertical rod with alternating black and white bands. It has a pointed end at both the top and bottom.</p>		a) Ranging rod b) offset rod

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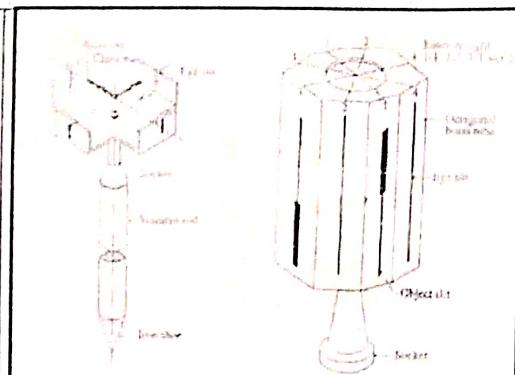
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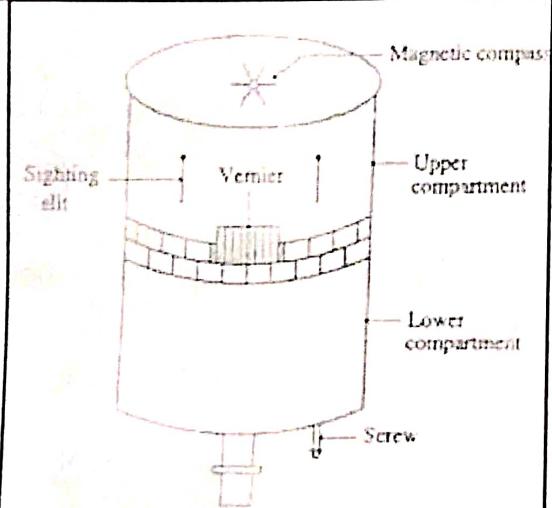
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5



- A) Open cross staff
- B) French cross staff.

6



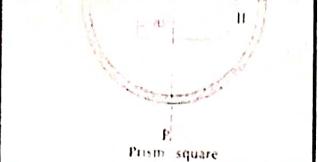
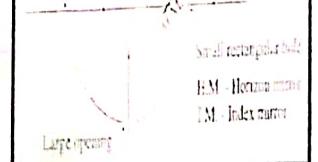
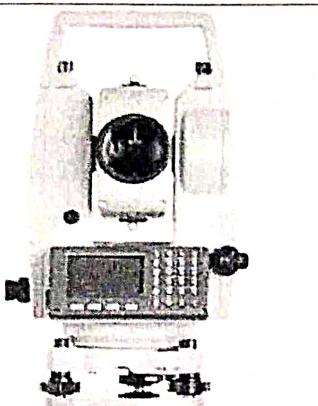
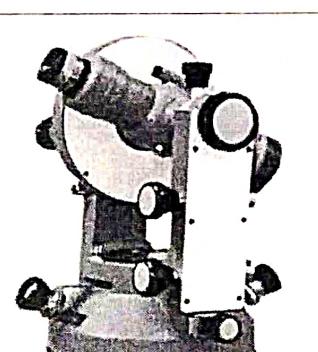
Adjustable cross staff

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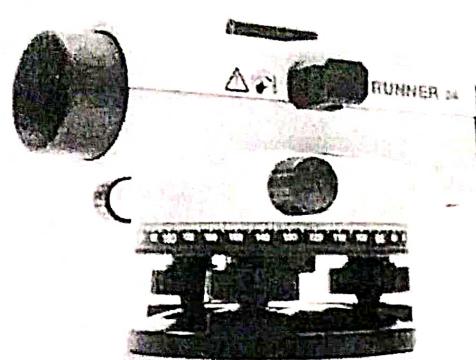
7	 Prism square	 Rampage B.M. - Beam splitter I.M. - Index mirror Large opening Small rectangular polarized light source	Prism square
8			Theodolite [Digital] / Total station
9			Vernier Transit Theodolite

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10		Auto Level
11		Survey Compass

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2. Multiple choice questions

1	Plan is a small-scale representation of a large area. a) True b) false	(b)
2	Plane and geodetic surveying are classifications of surveying based on: a) Methodology b) Earth's curvature c) Object of survey d) Instrument	(b)
3	EDM stands for a) Errorless Distance Measurement b) Electronic Direct Measurement c) Electronic Distance Measurement d) Errorless Direct Measurement	(c)
4	Which of the below is not a classification of surveying? a) Marine b) Basement c) Astronomical d) Land	(b)
5	In the triangulation method, the whole area is divided into: a) Scale triangles b) Triangles c) Obtuse triangles d) Well-conditioned triangles	(d)
6	Hydrographic surveys deal with the mapping of large water bodies a) Heavenly bodies b) Mountaineous region c) Canal system d) Movement of clouds	(c)

7. Define Surveying and state the objective of surveying.
8. Define levelling.
9. Distinguish between plane survey and Geodetic survey.
10. What are the fundamental principles of surveying? Explain in briefly.
11. Give the classification of surveying.
12. Explain the classification of surveying based on method used.

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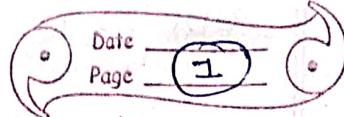
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13. Explain the classification of surveying based on nature of field.
14. Give the difference between plan and map.
15. Define representative fraction.
16. An area of 49 cm^2 of a map represents an area of 2401 km^2 . Find the scale and R.F. of Map?
17. A 10 km long road is indicated in a map by 10cm straight line. Calculate the scale and RF

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9. Distinguish between plane survey and geodetic survey.

* Plane Survey	Geodetic Survey
1) The earth surface is considered as a plane surface.	→ The earth surface is considered as a curved surface.
2) The curvature of the earth is ignored.	→ The curvature of the earth is taken into account.
3) Line joining any two stations is considered to be straight.	→ The line joining any two stations is considered as a curved line.
4) The triangle formed by any three points is considered as plane.	→ The triangle formed by any three points is considered as spherical.
5) The angles of the triangles are considered as plane angles.	→ The angles of the triangles are considered to be spherical angles.
7) Carried out for a small area $< 250 \text{ km}^2$.	→ Carried out for a large area $> 250 \text{ km}^2$.

11. Give the classification of surveying.

→ Surveys can be classified into various categories depending on the purposes, instruments and methods used and the nature of the field.

A) Classification based on instruments :

- 1) Chain survey → linear measurements are made with a chain
- 2) Compass survey → used magnetic compass for surveying.
- 3). Chain and Compass survey → linear measurements are made by chain or a tape and angular measurements are made with magnetic compass.
- 4) Plane table survey → field work and plotting both are done simultaneously.
- 5). Theodolite survey → horizontal angles are measured.
- 6) Tacheometry survey → used to determine horizontal and vertical distances indirectly.
- 7). Levelling survey → used to determine vertical distances and relative heights of points.

8) Photogrammetric Survey.

→ takes measurements with the help of photographs taken by aerial camera.

9) EDM Survey

→ all measurements are made with the help of EDM instrument.

B). Classification based on methods :-

1) Triangulation :-

→ used to do survey when area is large area.

2). Traversing :

→ After the linear measurements, horizontal angles are measured with a compass.

C) Classification based on Purposes :-

1). Geological Survey

→ Geological surveying are conducted to locate different minerals and rocks.

2). Mine Survey

→ It includes both surface and underground surveys.

3) Archaeological Survey

→ It is conducted to locate relics of antiquity, civilization, kingdoms, forts, temples, etc.

4) Military Survey.

→ Aerial surveys are conducted with the help of military surveying.

D) Classification based on Nature of Field :-

1) Land Survey

→ Land survey is done on land to prepare plans and maps of a given area.

2) Hydrographic Survey

→ This survey is conducted on or near the body of water such as lake, river, coastal area.

3) Astronomic Survey.

→ Astronomic surveys are conducted for the determination of latitudes, longitudes, azimuths, local time, etc.

4) Aerial Survey

→ Aerial surveys are conducted from aircraft where aerial cameras take

photographs of the surface of the earth in overlapping strips of land.

16. An area of 49 cm^2 of a map represents an area of 2401 km^2 . Find scale and R.F. of a map.

→ Here, 49 cm^2 represents 2401 km^2 .

$$\therefore 1 \text{ cm}^2 \text{ represents } \frac{2401}{49} = 49 \text{ km}^2.$$

$$\therefore 1 \text{ cm represents } \sqrt{49} \text{ km} = 7 \text{ km}$$

$$\therefore 1 \text{ cm} = 7 \text{ km} \quad [\text{scale of a map}]$$

$$\begin{aligned}\therefore \text{R.F.} &= \frac{1}{7 \times 1000 \times 100} \\ &= \frac{1}{700000}\end{aligned}$$

17. A 10 km long road is indicated in a map by a length of 10 cm straight line. Calculate the scale and R.F. of a map.

→ Here, 10 cm on drawing = 10 km on sheet ground

$$\therefore 1 \text{ cm} = 1 \text{ km} \quad [\text{Scale of a map}]$$

$$\therefore R.F. = 1$$

$$1 \times 1000 \times 100$$

$$\therefore R.F. = 1$$

$$100.000$$

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EXPERIMENT NO: 6

BUILDING COMPONENTS DRAWING-1

1. Classify building based on occupancy.
 2. Classify building based on structure. Explain any one in detail.
 3. Differentiate Load bearing structure and Frame structure
 4. Write down the definitions of following building components.
 - a) Foundation
 - b) Plinth
 - c) Lintel
 - d) Sill
 - e) Beam
 - f) Column
 5. Write down the functions of following building components.
 - a) Foundation
 - b) Plinth
 - c) Beam
 - d) Sill
 - e) Weather shed (Chajja)
 - f) Damp proof course
 6. What is the width of footing when the thickness of the wall is 40cm.
 7. Match the following building type with correct example.
- | | |
|------------------------|--------------------|
| Residential building | a. Stationary shop |
| Institutional building | b. Godowns |
| Assembly building | c. Dormitories |

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| Mercantile Building | d. Mills |
| Industrial Building | e. Temple |
| | f. Old age home |

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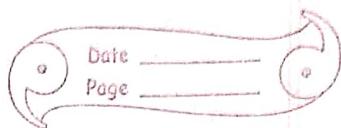
* Write down the definitions of following building components.

Foundation	Foundation is a structure below the G.L. and it is the lowest part of a building.
Plinth	Plinth is the portion of a building above ground upto the finished floor level. It is the lower most part of superstructure of a building.
Lintel	Lintel is defined as a horizontal structural member provided across the opening of door or window.
Sill	Sill is defined as a horizontal structural member provided below the window opening.
Beam	Beam is defined as a horizontal structural member provided below the slab and nested above walls or columns.
Column	Column is an isolated vertical load bearing member of kinetics small section of brick or concrete.

- * Write down the functions of following building components.

Foundation	Foundation transmits the loads and it supports the superstructure also, it provides stability. Furthermore, foundation prevents the effect of expansion and contraction of subsoil.
Plinth	Plinth assists in transmitting the loads from super structure to foundation. It also protects the building from moisture. Plinth prevents entry of rainwater, dust, soil, bacteria, etc. in building.
Beam	Beam absorbs and transmits the loads coming from slab of building.
Sill	Sill provides supports the opening of window. It also provides level surface to place window frames.
Weather shed	Weather shed improves aesthetic look and also to get additional [Chajja] protection from sun and rain.

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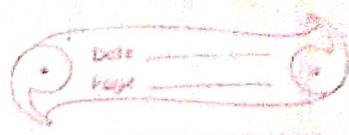
Damp
proof
course.

Damp proof course prevents moisture or water passing from one part of building to the another part.

* Match the following building type with correct example.

1. Residential building → Old age home
2. Institutional building → Dormitories
3. Assembly building → Temple
4. Mercantile building → Godowns
5. Industrial building → Mills.

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* What is the width of footing when the thickness of the wall is 40 cm.

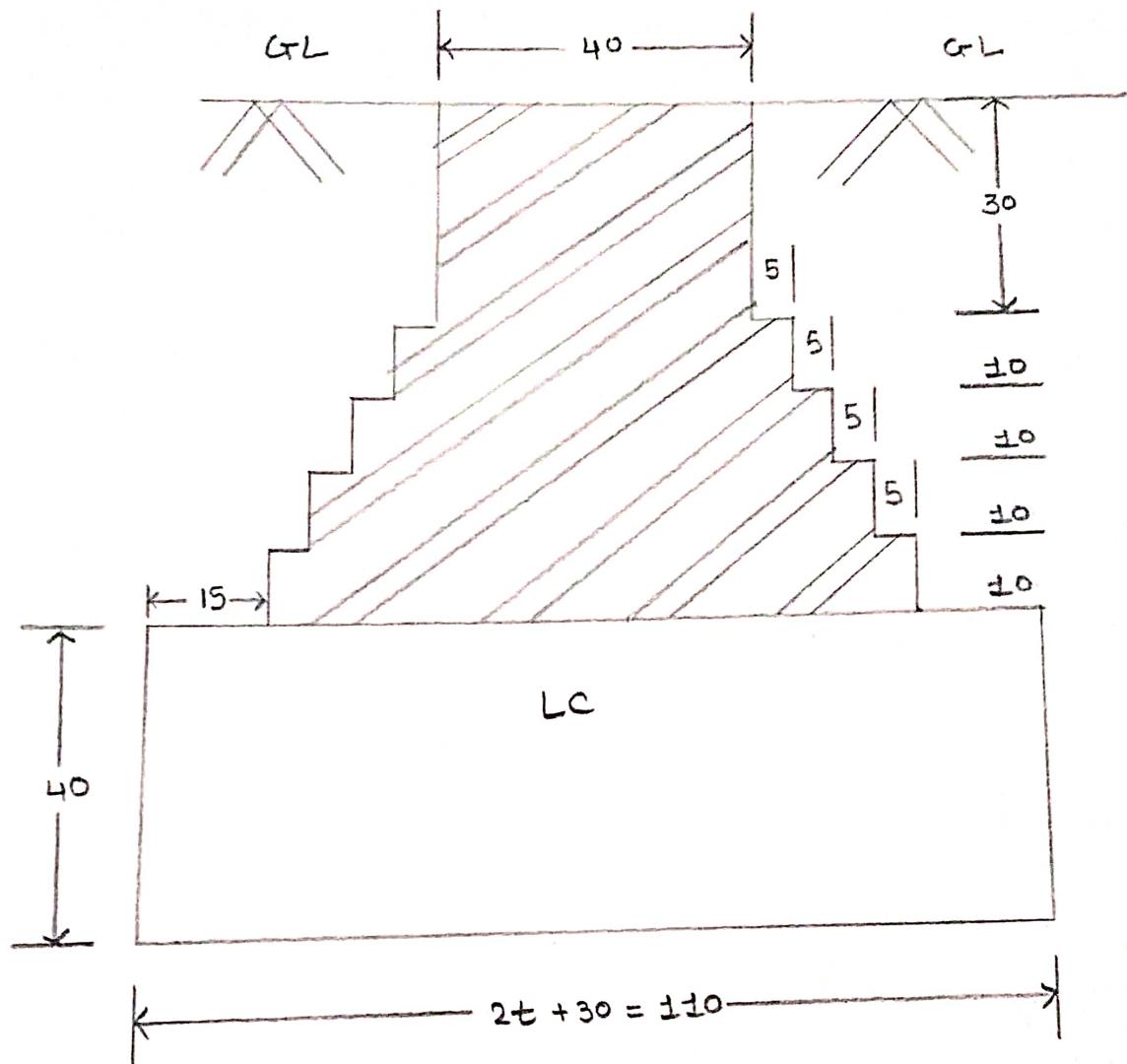
→ Here, we are given,
the thickness of the wall = 40 cm

∴ We know that,
the width of footing = $2t + 30$

where, t = the thickness of
the wall
= 40 cm

$$\begin{aligned}\therefore \text{The width of footing} &= 2 \times 40 + 30 \\ &= 80 + 30 \\ &= 110 \text{ cm.}\end{aligned}$$

* 40 cm thick wall footing :-



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EXPERIMENT NO: 7

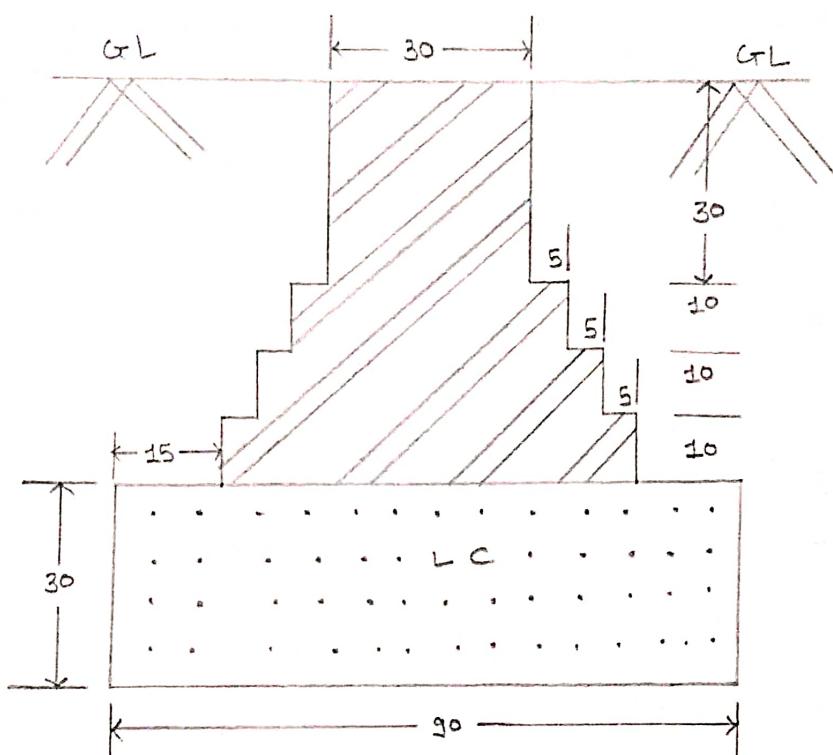
BUILDING COMPONENTS DRAWING-2

1. Draw the building components of section of a 30 cm thick masonry wall.
2. Draw cross section of 20 cm thick wall footing.
3. Draw cross section of 30 cm thick wall footing.
4. Draw cross section of 40 cm thick wall footing.

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* Draw cross section of 30 cm thick wall footing :

Here, $1 \text{ cm} = 1 \text{ mm}$.



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$$\begin{aligned}
 \Rightarrow \text{The width of the footing} &= 2 \times \text{thickness of wall} + 30 \\
 &= 2 \times 30 + 30 \\
 &= 60 + 30 \\
 &= 90 \text{ cm.}
 \end{aligned}$$

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EXPERIMENT NO: 8

20DCS 103

PRINCIPLES OF BUILDING PLANNING

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Rathod.

1. Descriptive questions

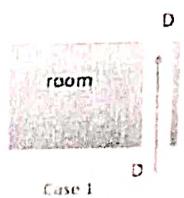
1. Enlist principles of building planning and explain any two in details.
2. Explain the basic requirements of building planning.

2. Multiple choice questions

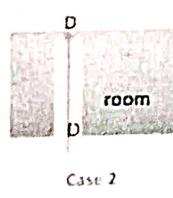
1. Principle of surveying which deals with the direction of wind and light is _____

- a) Aspect
- b) Prospect
- c) Privacy
- d) Circulation

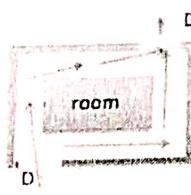
2. Following image shows position of Doors in a room and the direction of circulation. Match the following.



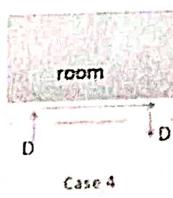
Case 1



Case 2



Case 3



Case 4

	Case Number from figure
Best case	1

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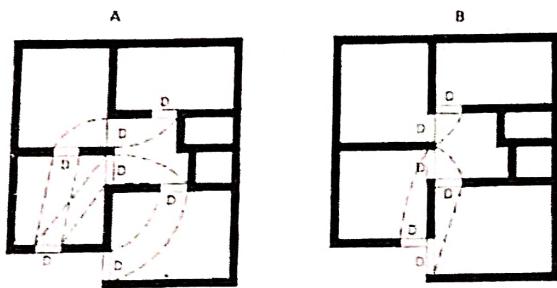
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Poor case	3
Waste is less but less usefull space	2
Better but not practical	4

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3. Which one of the planning is better?



a) A

b) B

c) Both are equally good

d) Both are equally bad

4. If house in figure A is said to be better than Figure B, which principle of planning is considered?

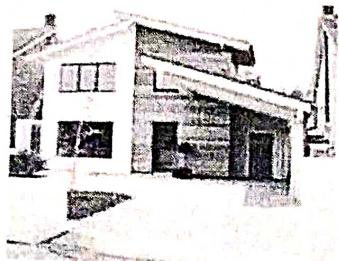


Figure A

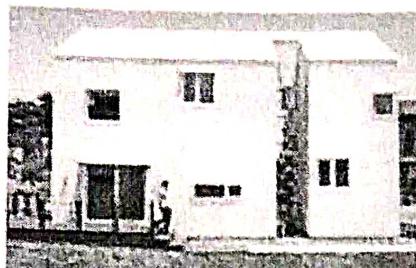


Figure B

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- a) Circulation
- b) Roominess
- c) Elegance
- d) Circulation

5. Which of the following is not a good grouping ?

- a) Bed room, toilet and dressing room grouped together
- b) Dining room close to kitchen
- c) W/C close to dining
- d) Verandah adjacent to drawing room

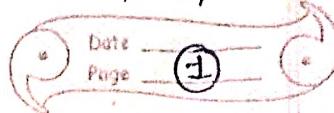
6. The term used to refer the effect derived from space of a room, ie. its length , width and height is _____

- a) Aspect
- b) Prospect
- c) Roominess
- d) Elegance

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Experiment : 8 - A

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* Enlist principles of building planning and explain any two in details.

→ The general principles of building planning are as given below :

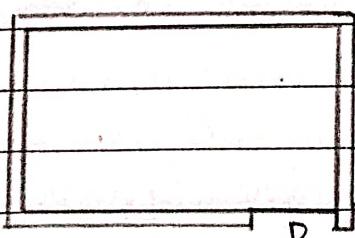
- | | |
|----------------|---------------------------|
| 1) Aspect | 7) Furniture requirements |
| 2) Prospect | 8) Circulation |
| 3) Privacy | 9) Lighting |
| 4) Grouping | 10) Elegance |
| 5) Romminess | 11) Economy |
| 6) Flexibility | 12) Sanitation. |

* **Privacy :**

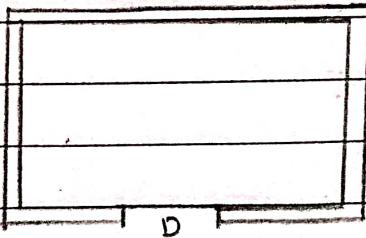
→ Privacy is considered as the most important thing for residential building planning.

→ There should be privacy from one room to another room and also from neighbour building and public building and streets.

→ Ex:-



Preferable



Not - preferable

- Privacy is necessary in the bedrooms, bathrooms and unincils.
- Position of doors and sill height of windows and ventilations are decided as per privacy principle in building planning.
- Doors provided in corners of rooms permit proper privacy as shown in the above figure. At centre door location should be avoided.

* Furniture Requirement :

- During building planning the sizes of furniture to be required for functional utility of the rooms should be considered.
- The size of the rooms should be decided by considering easy accommodation of required furniture.
- By proper discussion with owner about family size and the facilities required, an engineer can plan the building in good manner.

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- Kitchen size should accommodate platform, cupboard, dining table, refrigerator, mill etc.
- Bedroom size should accommodate bed, cupboard, side tables, dressing table etc.
- Children's bedroom should accommodate bed, study table, cupboard, dressing etc. as per furniture requirements of owner.

Thank you !

— X — X —