B.Sc. GEOGRAPHY LAB MANUAL

4th Semester

Prepared By

Pure & Applied Science Dept.

Geography

MIDNAPORE CITY COLLEGE

MIDNAPORE CITY COLLEGE

Department of Pure and Applied Sciences

B.Sc. Honours Major in Geography

Semester: IV

Paper: Major 5P

Weather Map (Practical)

MJ-5P: Weather map (Practical) **Credit 01**

1. Symbols, used to denote weather phenomena, station model

2. Use of weather instruments (hygrometer, barometer)

3. Making of climograph and hythergraph, Preparation of isohytes and isobars, Cross profile of isobars, derivation of pressure gradients based on the cross profile.

4. Interpretation of weather maps issued by IMD.

Introduction

Weather maps are essential tools in meteorology and climatology, providing a synoptic view of atmospheric conditions over a wide area at a specific time. They are crucial for forecasting, understanding weather patterns, and analyzing climate. This lab manual aims to equip undergraduate students with the practical skills necessary to read, interpret, and create basic elements of weather maps. Through hands-on exercises, students will learn to recognize standard meteorological symbols, utilize common weather instruments, construct graphical representations of climatic data, and analyze real-world weather maps issued by the India Meteorological Department (IMD).

Learning Objectives

Upon completion of this lab, students will be able to:

- Identify and interpret common meteorological symbols used on weather maps.
- Understand the components of a station model and extract information from it.
- Describe the function and practical use of a hygrometer and barometer.
- Construct climographs and hythergraphs from given data.
- Prepare maps showing isohyets and isobars.
- Draw a cross-profile of isobars and derive pressure gradients.
- Interpret daily weather maps issued by the India Meteorological Department (IMD), identifying key features and predicting general weather trends.

Course Contents:

1. Symbols, used to denote weather phenomena, station model.
2. Use of weather instruments (hygrometer, barometer).

3. Making of climograph and hythergraph, preparation of isohytes and isobars, cross profile of isobars, derivation of pressure gradients based on the cross profile.
4. Interpretation of weather maps issued by IMD.

Lab 1: Weather Map Symbols and Station Model

Duration: 2-3 hours

Aim: To familiarize students with standard meteorological symbols and the interpretation of a station model.

Materials:

1. Handouts/Charts of standard meteorological symbols (refer to WMO standards)
2. Sample weather maps with station models
3. Pen/Pencil, Ruler

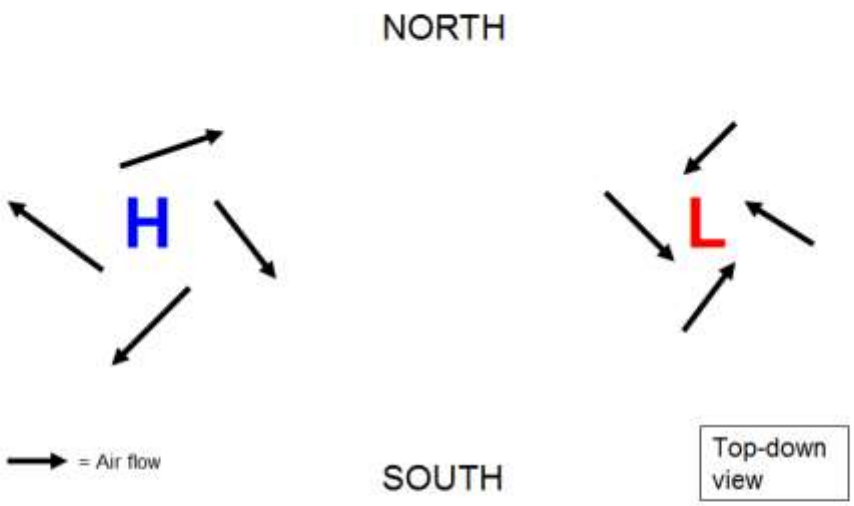
Theory:

Weather maps use a standardized set of symbols to efficiently convey a large amount of meteorological information. These symbols represent phenomena like clouds, precipitation, wind speed and direction, and atmospheric pressure. The station model is a compact arrangement of these symbols and numerical data around a central circle (representing the weather station) that summarizes current weather conditions at that specific location.

Common Weather Map Symbols

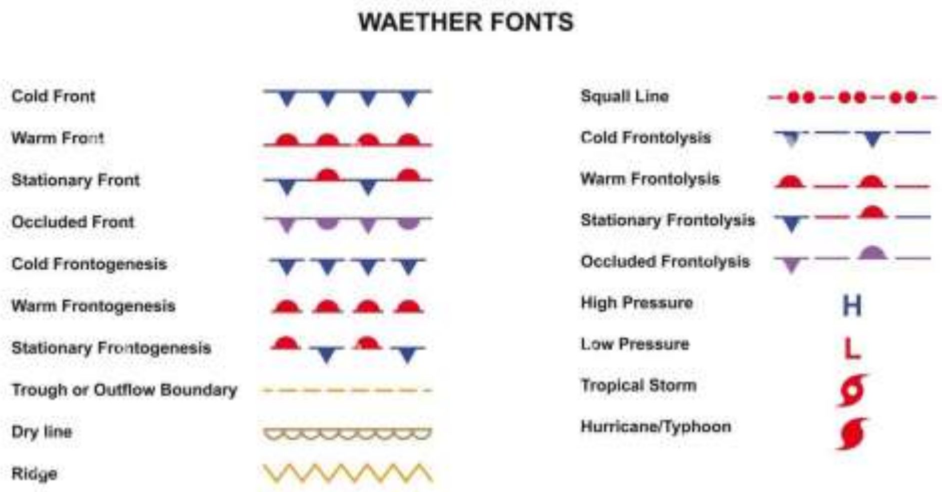
1. Pressure Systems:

- **High Pressure (H):** Represented by a large blue "H." Indicates an area of high atmospheric pressure, typically associated with clear skies, calm winds, and stable weather. Winds blow clockwise around highs in the Northern Hemisphere and counter-clockwise in the Southern Hemisphere.
- **Low Pressure (L):** Represented by a large red "L." Indicates an area of low atmospheric pressure, often associated with clouds, precipitation, and unsettled weather. Winds blow counter-clockwise around lows in the Northern Hemisphere and clockwise in the Southern Hemisphere.
- **Isobars:** Lines connecting points of equal atmospheric pressure. Tightly packed isobars indicate a steep pressure gradient, meaning stronger winds. Widely spaced isobars suggest lighter winds. Pressure values are usually in millibars (mb), with the leading 9 or 10 often omitted (e.g., 085 for 1008.5 mb, 954 for 995.4 mb).



2. Fronts: These lines indicate boundaries between different air masses and are often where significant weather changes occur.

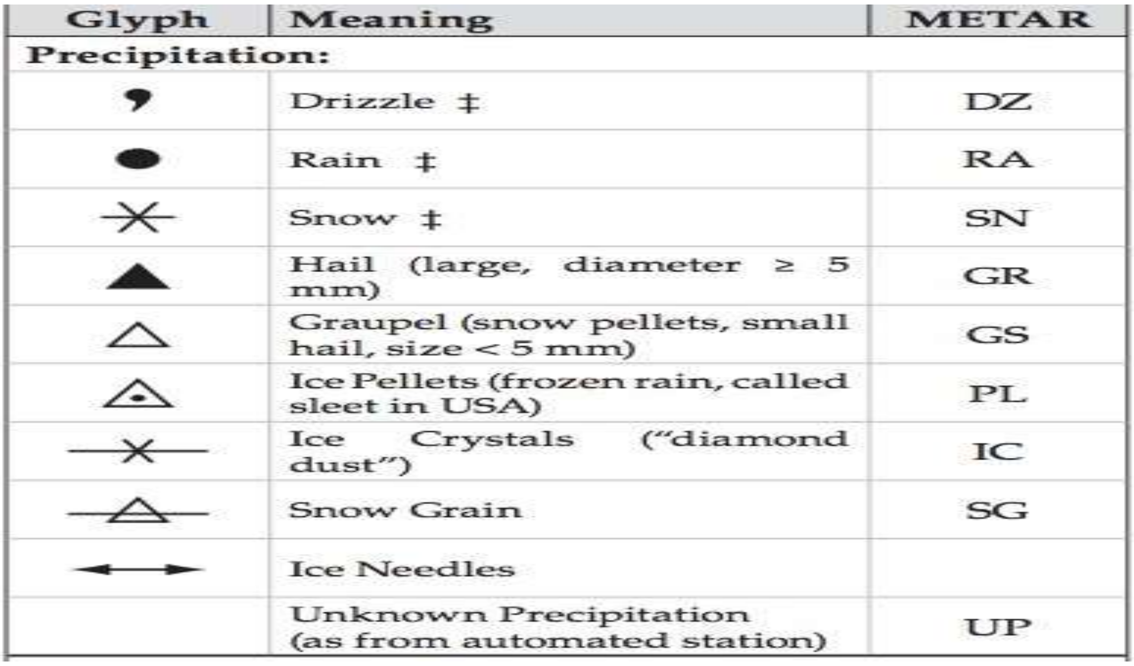
- **Cold Front:** A blue line with blue triangles pointing in the direction the front is moving. Represents the leading edge of a colder air mass replacing a warmer one. Often brings a sudden drop in temperature, strong winds, and possible thunderstorms or showers.
- **Warm Front:** A red line with red semicircles pointing in the direction the front is moving. Represents the leading edge of a warmer air mass replacing a colder one. Often brings gradual temperature increases, steady precipitation, and widespread cloudiness.
- **Stationary Front:** An alternating red and blue line with red semicircles on one side and blue triangles on the opposite side, pointing in opposite directions. Indicates a front that is not moving significantly. Weather can be prolonged and variable.
- **Occluded Front:** A purple line with alternating purple triangles and semicircles pointing in the direction the front is moving. Forms when a cold front overtakes a warm front, lifting the warm air mass off the ground. Can bring a mix of weather, often resembling both cold and warm front characteristics.



3. Precipitation:

- **Rain:** Dots (often blue for light, increasing to red/magenta for heavy).
- **Snow:** Asterisks or snowflakes.
- **Drizzle:** Commas.
- **Showers:** Triangles.
- **Thunderstorms:** A symbol resembling a single arrow or a lightning bolt.
- **Fog/Mist:** Horizontal parallel lines or a wavy line.

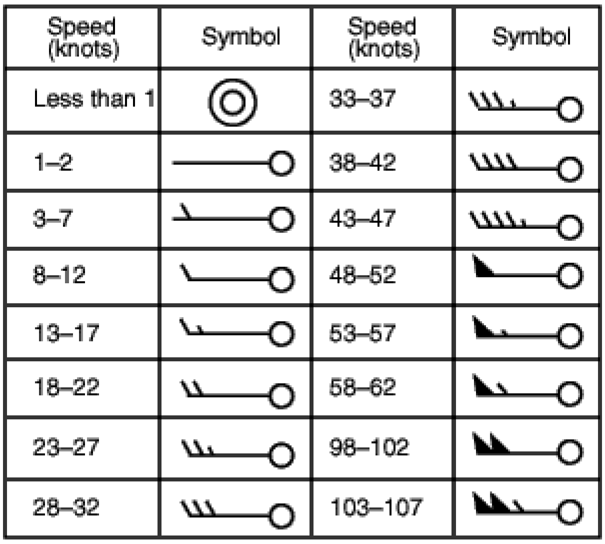
Precipitation Symbols



Glyph	Meaning	METAR
Precipitation:		
	Drizzle ‡	DZ
	Rain ‡	RA
	Snow ‡	SN
	Hail (large, diameter ≥ 5 mm)	GR
	Graupel (snow pellets, small hail, size < 5 mm)	GS
	Ice Pellets (frozen rain, called sleet in USA)	PL
	Ice Crystals ("diamond dust")	IC
	Snow Grain	SG
	Ice Needles	
	Unknown Precipitation (as from automated station)	UP

4. Wind:

- **Wind Barbs:** A line extending from the station plot (see below) that indicates wind direction and speed.
  - The line points *from* the direction the wind is blowing.
  - Half barb**:** 5 knots
  - Full barb**:** 10 knots
  - Pennant (triangle/flag**):** 50 knots
  - Combinations are used to represent various speeds (e.g., one full barb and one-half barb is 15 knots).
  - A circle with no barb indicates calm winds.



Speed (knots)	Symbol	Speed (knots)	Symbol
Less than 1		33–37	
1–2		38–42	
3–7		43–47	
8–12		48–52	
13–17		53–57	
18–22		58–62	
23–27		98–102	
28–32		103–107	

5. Cloud Cover: Often indicated by the filling of the central circle in a station model.

- Empty circle**:** Clear skies (0/8 cloud cover).
- Partially filled circle**:** Partially cloudy (e.g., 1/8, 2/8, 3/8, 4/8 cloud cover).
- Completely filled circle**:** Overcast (8/8 cloud cover).
- "X" in circle**:** Sky obscured (visibility is so low that the sky cannot be seen, even if it's clear above).

Station Model

A **station model** is a standardized symbolic illustration on a weather map that consolidates a wealth of meteorological information observed at a specific reporting station. It allows meteorologists to efficiently visualize and analyze current weather conditions across a broad area, aiding in forecasting and understanding atmospheric patterns.

Imagine trying to fit temperature, dew point, wind speed and direction, pressure, cloud cover, and present weather all in text format for hundreds of locations on a map – it would be unreadable! The station model uses a clever arrangement of symbols to pack this data into a small, interpretable plot.

Here's a breakdown of the key elements you'll find in a typical surface station model and their interpretation:

The Station Model Layout

A common station model looks like this, though minor variations exist:

```
        TT          PPP
        VV          C_H (High Clouds, if reported)
    ww  @   Ch  a   T_d T_d
        Nh          C_M (Middle Clouds, if reported)
        N           C_L (Low Clouds, if reported)
        (Wind Barb)
```

And here's what each part generally represents:

- **@ (Central Circle/Triangle): Station Location & Total Cloud Cover (N)**
  - The center marks the geographic location of the observation station.
  - The degree to which the circle is filled indicates the total amount of the sky covered by clouds (in oktas, or eighths):
    - **Empty circle:** Clear (0/8 cloud cover)
    - **One-quarter filled:** Few clouds (1/8 - 2/8)
    - **Half filled:** Scattered clouds (3/8 - 4/8)
    - **Three-quarters filled:** Broken clouds (5/8 - 7/8)
    - **Completely filled:** Overcast (8/8)
    - **'X' in circle:** Sky obscured (e.g., by fog, heavy snow, or dust)

- **TT (Upper Left): Air Temperature**
  - Reported in degrees Celsius (circtextC) in most international maps. In the US, it's often in Fahrenheit (circtextF).
  - Usually a two-digit number. If negative, a minus sign would precede it.

- **T_d T_d (Lower Left): Dew Point Temperature**
  - Also in degrees Celsius (circtextC) or Fahrenheit (circtextF).

  - A smaller difference between the air temperature (TT) and dew point (Td Td) means the air is closer to saturation (higher humidity), indicating a greater likelihood of fog or precipitation.

- **PPP (Upper Right): Sea Level Pressure (SLP)**
  - Reported in hectopascals (hPa) or millibars (mb).
  - This is an abbreviated value. To decode:
    - If the number is 500 or greater, put a "9" in front and a decimal point before the last digit (e.g., `982` means 998.2 hPa).
    - If the number is less than 500, put a "10" in front and a decimal point before the last digit (e.g., `012` means 1001.2 hPa).
  - This normalization makes plotting easier.
- **ww (Left, below temperature): Present Weather**
  - A specific symbol or two-digit code representing the current weather phenomenon observed at the station (e.g., rain, snow, fog, thunderstorms, drizzle). There are extensive international code tables for these.
  - For example:
    - bullet (one dot) for light rain
    - ast (one asterisk) for light snow
    - equiv for fog
    - text R bold symbol xlongequal for thunderstorm

- **VV (Left, above present weather): Visibility**
  - Reported in kilometres (km) or statute miles (SM).
  - Indicates how far one can see horizontally through the atmosphere.

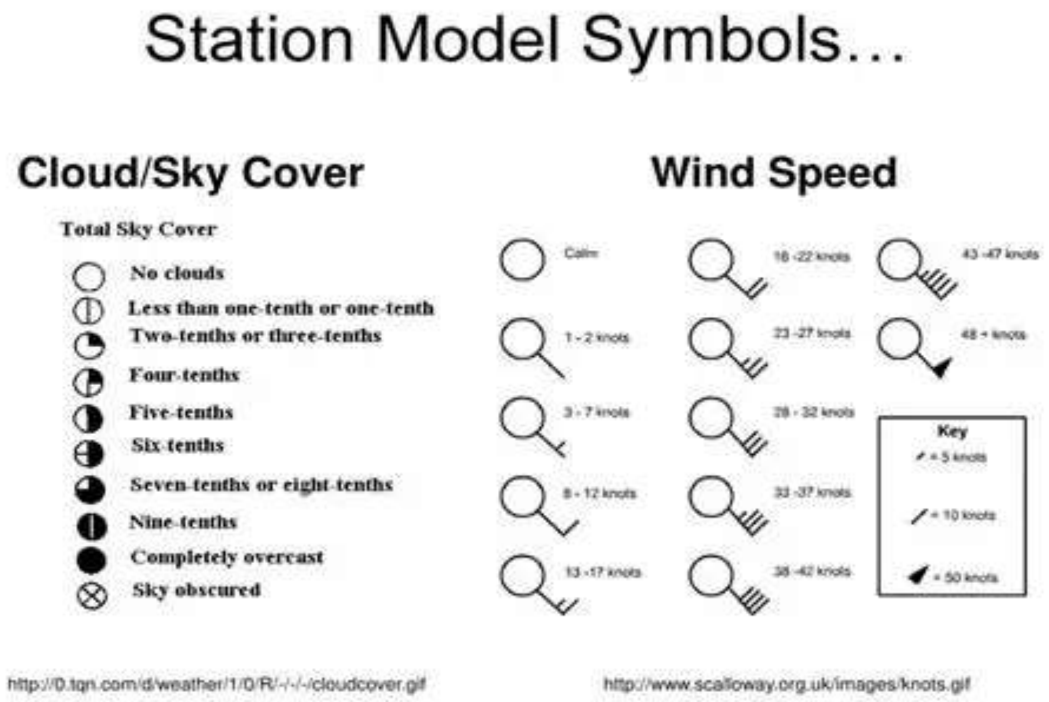
- **a (Right, below pressure): Pressure Tendency Characteristic**
  - A symbol showing how the atmospheric pressure has changed over the past three hours. This indicates whether pressure is rising, falling, or steady, and how quickly.
  - Examples:
    - Bold symbol nearrow: Rising steadily
    - Bold symbols: arrow: Falling steadily
    - Bold symbol text—–– : Steady

- **pp (Right, below 'a'): Pressure Change**
  - The amount of pressure change over the past three hours, in tenths of hPa or mb.
  - For example, `28` could mean a change of 2.8 hPa. The 'a' symbol indicates if it was a rise or fall.

- **Wind Barb (Extending from the central circle): Wind Direction and Speed**
  - **Direction:** The "tail" of the barb points *from* the direction the wind is blowing. So, if the barb points to the northwest, the wind is blowing *from* the northwest.
  - **Speed:** Indicated by short lines (barbs) and flags on the tail:
    - **Half barb:** 5 knots
    - **Full barb:** 10 knots
    - **Pennant (filled triangle):** 50 knots
    - Combinations are used for other speeds (e.g., a full barb and a half barb is 15 knots).
    - A circle around the station dot indicates **calm** winds.

- **C_L, C_M, C_H (Around the central circle): Cloud Types**
  - Symbols representing the predominant low, middle, and high cloud types observed. These provide more specific information than just total cloud cover.
  - Examples:
    - textL−shape for Cumulus (low)
    - textU−shape for Altocumulus (middle)
    - textHook for Cirrus (high)

- **Nh (Left, below ww): Amount of Low or Middle Clouds**
  - Similar to N (total cloud cover), but specifically for the amount of low or middle clouds (in oktas).



How Station Models are Used on Weather Maps

When many station models are plotted across a geographic area on a weather map, meteorologists can:

1. **Identify Pressure Systems:** By observing the pressure values and wind patterns (winds blow clockwise around highs and counter-clockwise around lows in the Northern Hemisphere; opposite in Southern Hemisphere), high ('H') and low ('L') pressure centers can be located and isobars (lines of equal pressure) can be drawn.

2. **Locate Fronts:** Sharp changes in temperature, dew point, wind direction, and present weather across neighboring station models indicate the presence and type of fronts (cold, warm, stationary, occluded). These are then drawn as colored lines with specific symbols.

3. **Analyze Wind Patterns:** The distribution of wind barbs reveals areas of convergence (winds coming together, often associated with lows and fronts) and divergence (winds spreading out, often associated with highs).

4. **Understand Precipitation and Cloud Cover:** The symbols for present weather and cloud cover immediately show where rain, snow, fog, or clear skies are occurring.

5. **Track Trends:** The pressure tendency information helps determine if a high or low-pressure system is strengthening, weakening, or moving towards/away from a location.

In essence, the station model is a compact data visualization tool that allows for rapid and comprehensive analysis of surface weather conditions, forming the foundation for weather forecasting.

1. Why are standardized symbols important in meteorology?
2. What is the significance of the dew point temperature in a station model?
3. How is wind speed measured and represented on a station model?
4. If the atmospheric pressure reading on a station model is "025", what is the actual pressure value?

Lab 2: Use of Weather Instruments (Hygrometer, Barometer)

Duration: 1.5-2 hours

Aim: To understand the working principles and practical applications of a hygrometer and a barometer.

Materials:

1. Sling Psychrometer (Dry and Wet Bulb Hygrometers)
2. Fortin’s Barometer
3. Water, Cloth
4. Psychrometric tables (if using sling psychrometer)
5. Graph paper, Pen/Pencil

Hygrometers are instruments designed to measure humidity, but the "calculation methods" they employ vary significantly depending on the type of hygrometer. Instead of a single calculation, each type relies on different physical principles to derive humidity values.

Here's a breakdown of the main types of hygrometers and their underlying measurement and "calculation" (or derivation) methods:

1. Psychrometers (Dry and Wet Bulb Hygrometers)

Principle: Evaporative cooling. A psychrometer uses two thermometers: a **dry-bulb thermometer** (measures ambient air temperature) and a **wet-bulb thermometer** (whose bulb is covered with a wet wick and exposed to airflow). Evaporation from the wet wick cools the wet-bulb thermometer. The drier the air, the more evaporation occurs, and the greater the temperature difference (wet-bulb depression) between the two thermometers.

Calculation/Derivation Method: Humidity is *not* directly measured. Instead, it's calculated or derived from the dry-bulb temperature and the wet-bulb depression using:

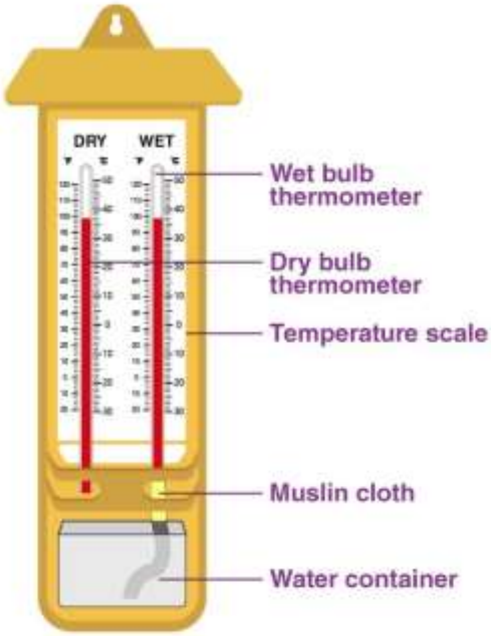
- **Psychrometric Tables/Charts:** These are pre-calculated tables or graphical charts that relate dry-bulb temperature and wet-bulb depression to relative humidity (RH), dew point, or other humidity parameters. This is the most common method for manual psychrometers.
- **Psychrometric Equations (Carrier Equation, August-Roche-Magnus approximation, etc.):** More precise calculations can be performed using complex thermodynamic equations. These equations account for atmospheric pressure and physical constants.
    - **Relative Humidity (RH) calculation often involves:**
        1. **Saturated Vapour Pressure (es):** Calculated at the dry-bulb temperature (Tdry). A common empirical formula for es (in hPa) is: es (T)=6.11×10237.3+T7.5×T (where T is in ∘C)
        2. **Actual Vapour Pressure (e):** This is calculated using the wet-bulb temperature (Twet) and the dry-bulb temperature (Tdry), along with a psychrometric constant (γ) and atmospheric pressure (P): e=es(Twet)−γ×(Tdry−Twet) The psychrometric constant (γ) depends on the instrument design, ventilation, and atmospheric pressure. For aspirated

psychrometers at standard pressure, a common value is around 0.65 hPa/∘C.

3. **Relative Humidity:** RH=es(Tdry)e×100%

- **Dew Point (Td):** Can also be calculated from the dry-bulb temperature and RH or directly from the vapor pressure.

No. of observation	Dry Bulb Temperature(°C)	Wet Bulb Temperature (°C)	Difference (T1 -T2	RH (%)	Average
1	31	28	3	76	
2	32	28	4	70	
3	32	27	5	65	
4	32	28	3	70	
5	32	29	3	76	71.9
6	32	27	5	70	
7	32	29	3	76	
8	32	28	4	70	
9	32	28	4	70	
10	32	29	3	76	



2. Fortin's Barometer

The Fortin's barometer is a highly accurate type of mercury barometer. Its "calculation method" isn't a complex formula you apply to raw sensor data, but rather a precise procedure for taking a reading, followed by applying corrections to that reading. The fundamental principle is still the hydrostatic pressure formula $P=\rho \cdot g \cdot h$, where 'h' is the measured height of the mercury column.

Here's a breakdown of the method:

I. The Fortin's Barometer's Unique Feature: Adjustable Cistern

What sets the Fortin's barometer apart from a simple mercury barometer is its adjustable cistern (the reservoir of mercury at the bottom). This cistern has a flexible bottom (often leather) that can be raised or lowered using a screw. Crucially, there's an **ivory pointer** inside the cistern, and its tip is aligned with the zero mark of the main scale.

II. The Reading Procedure (The "Calculation Method" in Practice):

1. **Level the Instrument:** Ensure the barometer is hanging perfectly vertical. Most Fortin's barometers have leveling screws for this purpose.

2. **Adjust the Cistern Level to Zero:** This is the most critical step for accuracy.
    - Carefully turn the adjusting screw at the bottom of the cistern.
    - Raise or lower the mercury level in the cistern until the tip of the ivory pointer just touches the surface of the mercury. You often look for the tip of the pointer and its reflection in the mercury to meet precisely. This ensures that your starting point for measuring the height of the mercury column is always at the fixed zero mark of the scale.

3. **Read the Top of the Mercury Column (Meniscus):**
    - Locate the top of the mercury column in the main tube. Mercury forms a convex meniscus (curved surface) because it doesn't "wet" the glass.
    - Adjust the sliding vernier scale (which is usually moved by a rack and pinion or screw) so that its lower edge is tangent to the top of the mercury meniscus.
    - Read the main scale value (the mark just below the zero of the vernier scale).
    - Read the vernier scale value (the division on the vernier scale that perfectly coincides with a division on the main scale).
    - Calculate the final uncorrected reading: **Main Scale Reading + (Vernier Scale Reading × Least Count of Vernier)**.

4. **Read the Thermometer:** A thermometer is typically mounted on the barometer itself. Read this thermometer immediately. This temperature is crucial for the necessary corrections.

III. Corrections to the Reading (The "Calculation" Steps):

The raw reading from the Fortin's barometer is highly accurate for the instrument itself, but it needs to be corrected for several factors to get the true atmospheric pressure. These corrections are where the "calculation" aspect truly comes in.

1. **Temperature Correction (for Mercury and Scale):**

- **Mercury Density:** The density of mercury (ρ) changes significantly with temperature. A higher temperature means lower density, so the mercury column will be taller for the same pressure.
- **Scale Expansion:** The brass scale (or material the scale is printed on) also expands or contracts with temperature, affecting the measured height.
- This is the most significant correction. A standard formula or correction tables are used to adjust the observed height (Ht) to what it would be at a standard temperature (usually $0^\circ C$):

$$H_0 = H_t\left[1 - \frac{1 + \alpha_m \cdot t}{(\alpha_m - \alpha_b) \cdot t}\right]$$

Where:

- H_0 is the corrected height at $0^\circ C$.
- H_t is the observed height at temperature t.
- α_m is the coefficient of cubical expansion of mercury (approx. 0.0001818 per $^\circ C$).
- α_b is the coefficient of linear expansion of the brass scale (approx. 0.0000184 per $^\circ C$).
- t is the temperature in degrees Celsius read from the attached thermometer.

2. **Instrumental Error (Calibration Correction):**
   - Each specific Fortin's barometer will have tiny manufacturing imperfections or calibration errors. These are usually provided by the manufacturer as a constant correction value that is either added to or subtracted from the reading.

3. **Gravity Correction:**
   - The acceleration due to gravity (g) varies with latitude and altitude. For highly precise measurements, the observed pressure is converted to an equivalent pressure at a standard gravity (e.g., 45° latitude at sea level).
   - $P_{corrected} = P_{observed} \cdot \frac{g_{standard}}{g_{local}}$
   - Often, a correction table or formula is used based on the location's latitude and elevation.

IV. Final Pressure Calculation:

Once all corrections are applied, you get the final, corrected height of the mercury column ($H_{corrected}$) at standard temperature and gravity. Then, you can use the basic hydrostatic pressure formula to convert this height into a standard pressure unit (Pascals, millibars, etc.):

$$P = \rho_0 \cdot g_{standard} \cdot H_{corrected}$$

Where:

- P is the atmospheric pressure.
- ρ_0 is the density of mercury at $0^\circ C$ (approx. 13595.1 kg/m^3).

- G standard is the standard acceleration due to gravity (approx. 9.80665 m/s2).
- H corrected is the fully corrected height of the mercury column in meters.

The Fortin's barometer, due to its adjustable cistern and the ability to apply these precise corrections, remains a highly accurate and reliable instrument for measuring atmospheric pressure, particularly in laboratory and meteorological settings.

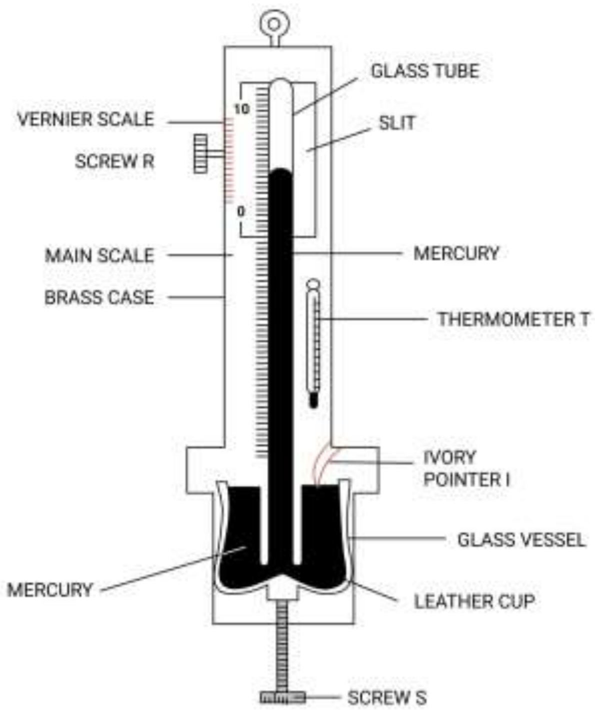
No. of observation	Main Scale Reading in cm	No. of coincidence of Vernier scale	Vernier constant = d/n	Mean no. of coincidence of v. scale	Mean v. scale reading	Total Reading
1	75.40	11	0.1/20 cm = 0.005 cm	11+12+13/3 = 12	12*0.005 cm =0.06 cm	75.40 cm+0.06 cm = 75.46 cm
2	75.40	12				
3	75.40	13				

Atmospheric Pressure = hpg = 75.46 cm * 13.596 * gram /cm³ * 980.6 cm/ second²

= 1.006050649* 10 ^6 dyne / cm² = 1.00605 bar (10^6 dyne/cm² = 1 bar)

= 1.00605*1000 mb (1 bar = 1000 mb)

= 1006.05



Viva Voce Questions:

1. Explain the principle behind how a wet-bulb thermometer measures humidity.
2. What is the significance of the dew point temperature in relation to fog and condensation?
3. How does an aneroid barometer differ from a mercury barometer?
4. What are the typical units of atmospheric pressure measurement?
5. How would a sudden drop in barometric pressure affect weather?

Lab 3: Making of Climograph and Hythergraph, Preparation of Isohytes and Isobars, Cross Profile of Isobars, Derivation of Pressure Gradients

Duration: 3-4 hours

Aim: To develop skills in representing climatic data graphically and spatially, and to understand pressure gradients.

Materials:

1. Graph paper, Millimeter paper
2. Pencils (different colors recommended for clarity)
3. Ruler, Eraser
4. Climate data (monthly average temperature and precipitation for a station for a year)
5. Map outline with weather station data (pressure, rainfall)
6. Calculator

Theory:

Climograph: A graphical representation of monthly average temperature and precipitation for a specific location over a year. It helps visualize the annual climate cycle.

Hythergraph: Similar to a climograph, but typically plots monthly precipitation against monthly mean temperature. It's useful for understanding the combined effect of temperature and rainfall on vegetation or agricultural cycles.

Isohyets: Lines on a map connecting points of equal rainfall.

Isobars: Lines on a map connecting points of equal atmospheric pressure.

Cross Profile of Isobars: A vertical profile showing the change in pressure along a specific line across an isobaric map.

Pressure Gradient: The rate of change of atmospheric pressure over a given horizontal distance, perpendicular to the isobars. A steeper gradient indicates stronger winds.

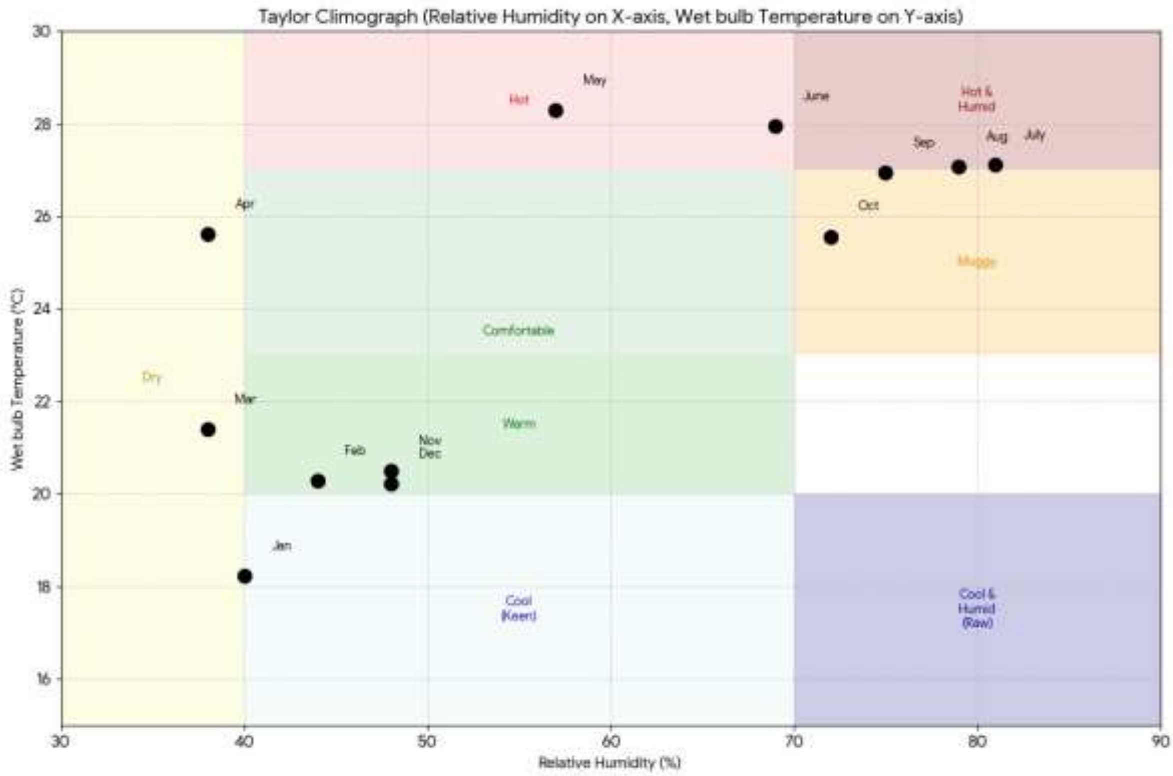
Procedure:

1. **<u>Making a Climograph:</u>**

- **Data:** Provide students with a table of monthly average temperature and precipitation (mm) for a selected weather station for one year.
- **Plotting:**

  a. Draw a graph with months on the x-axis.
  b. On the primary y-axis (left), plot temperature (line graph).
  c. On the secondary y-axis (right), plot precipitation (bar graph). Ensure appropriate scales
  d. Label axes clearly and provide a suitable title.

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Wet bulb Temp. (°C)	18.22	20.28	21.39	25.61	28.28	27.94	27.11	27.06	26.94	25.56	20.50	20.22
R.H. (%)	40	44	38	38	57	69	81	79	75	72	48	48



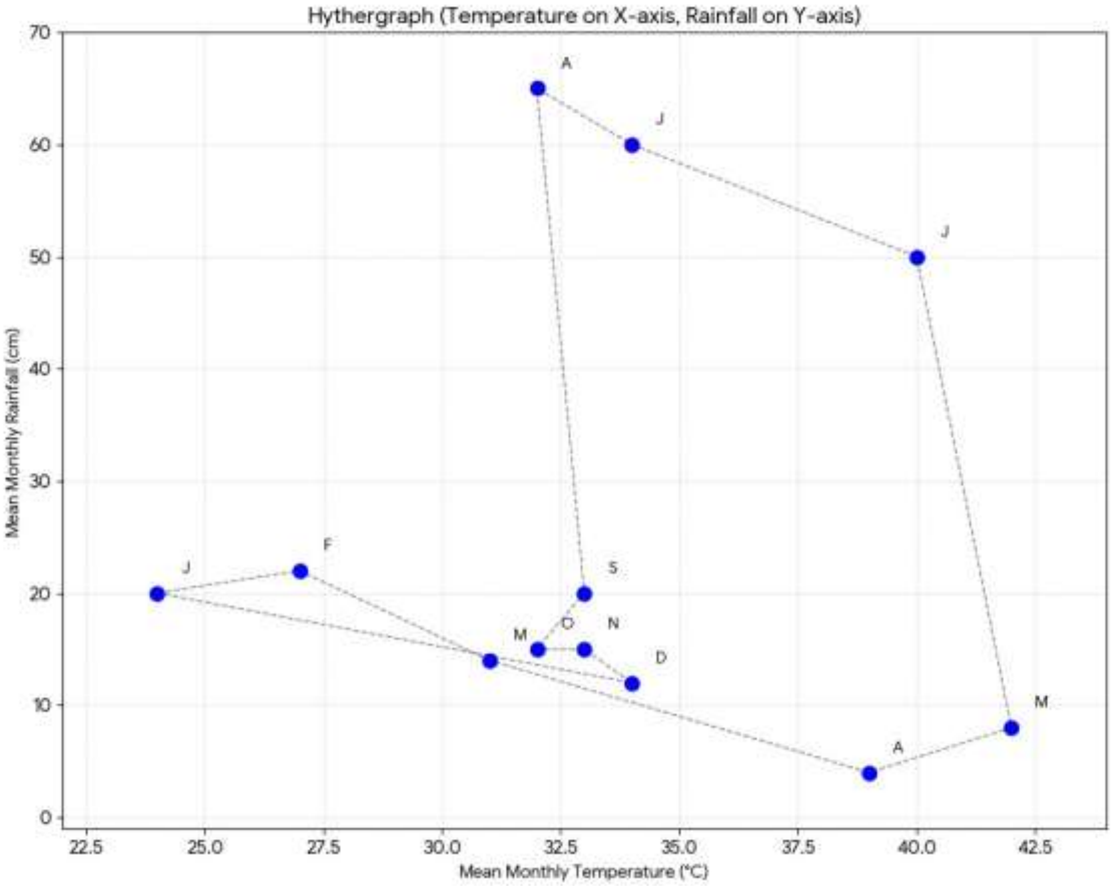
2. **<u>Making a Hythergraph</u>:**

- **Data:** Use the same monthly average temperature and precipitation data.
- **Plotting:**

  1. Draw a scatter plot with temperature on the x-axis and precipitation on the y-axis.
  2. Plot each month as a point.
  3. Label each point with the corresponding month (e.g., "J" for January).

4. Connect the points in chronological order to show the annual cycle.
5. Label axes clearly and provide a suitable title.

Month	Jan	Feb	Mar	April	May	Jun	July	August	Sept	Octo	Nov	Dec
Temp(°C)	24	27	31	39	42	40	34	32	33	32	33	34
Rainfall(cm)	20	22	14	4	8	50	60	65	20	15	15	12



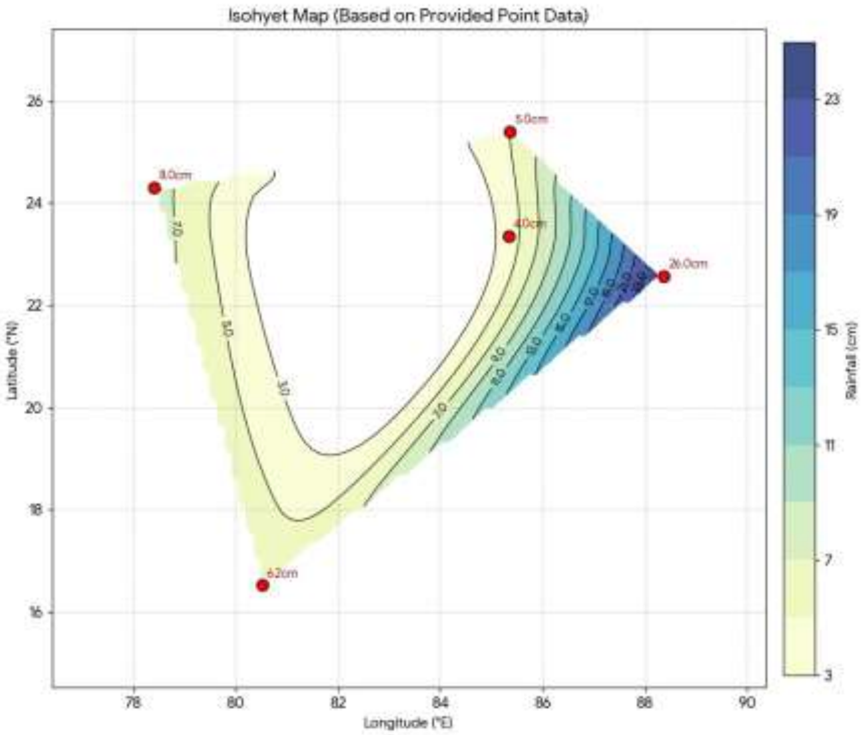
3. **Preparation of Isohyets and Isobars:**

- **Data:** Provide students with a simplified map outline showing weather stations with recorded rainfall amounts (for isohyets) or atmospheric pressure values (for isobars).
- **Isohytes:**

1. Choose an appropriate contour interval (e.g., 20 mm, 50 mm).
2. Identify points with similar rainfall values and draw smooth lines connecting them. Interpolate values between stations where necessary.
3. Label each isohyte with its corresponding rainfall value.

Calculation table for Isohytes Mapping (31/07/2025) accoding to IMD

latitude & longitude	Rainfall (in cm)
22°34’N 88°22’ E	26
25°24’N 85°22’ E	5
16°31’N 80°31’E	6.2
23°21’N 85°220’E	4.0
24°18’N 78°25’E	8.0

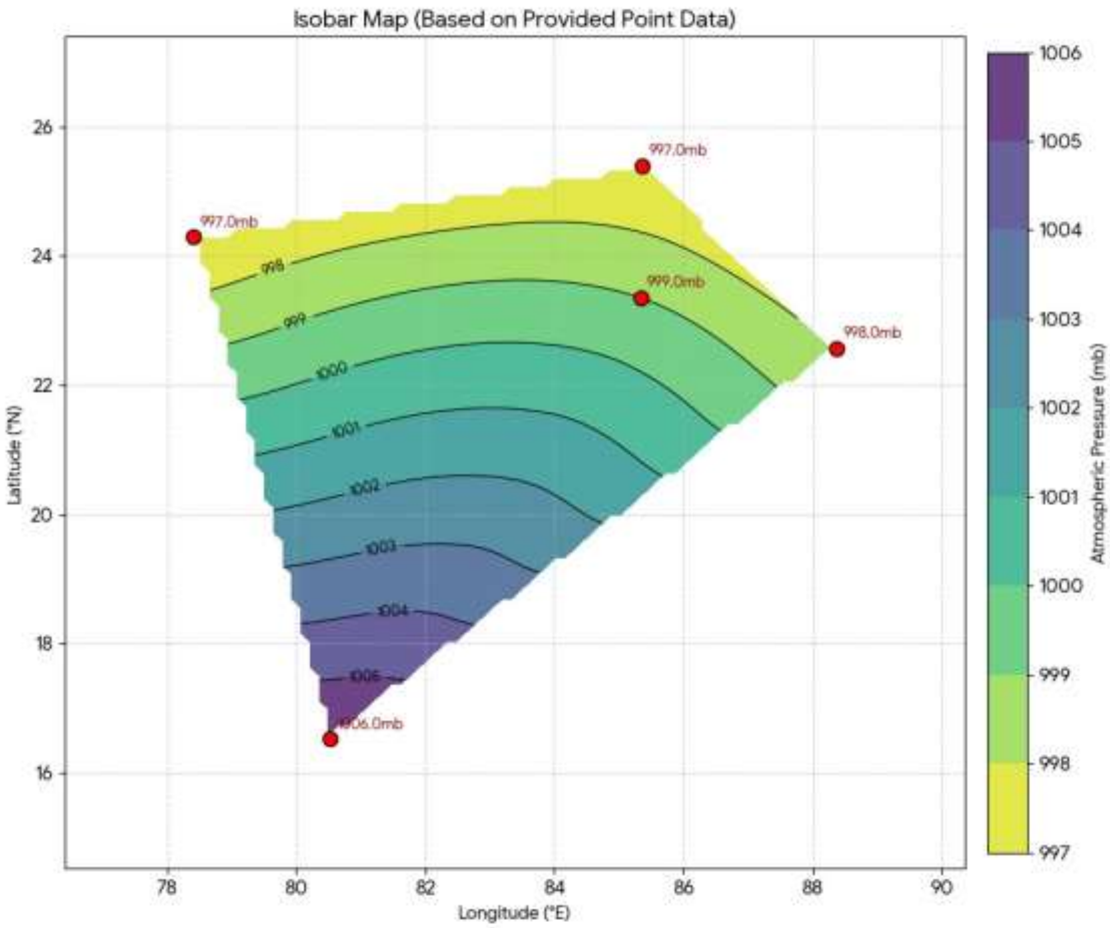


- **Isobars:**

1. Choose an appropriate contour interval (e.g., 2 mb, 4 mb).
2. Identify points with similar pressure values and draw smooth lines connecting them. Interpolate values between stations.
3. Label each isobar with its corresponding pressure value (e.g., 1000 mb, 1004 mb).
4. Remember that isobars never cross and tend to be roughly parallel. Denser isobars indicate stronger pressure gradients.

Calculation table for Isobar Mapping (31/07/2025)

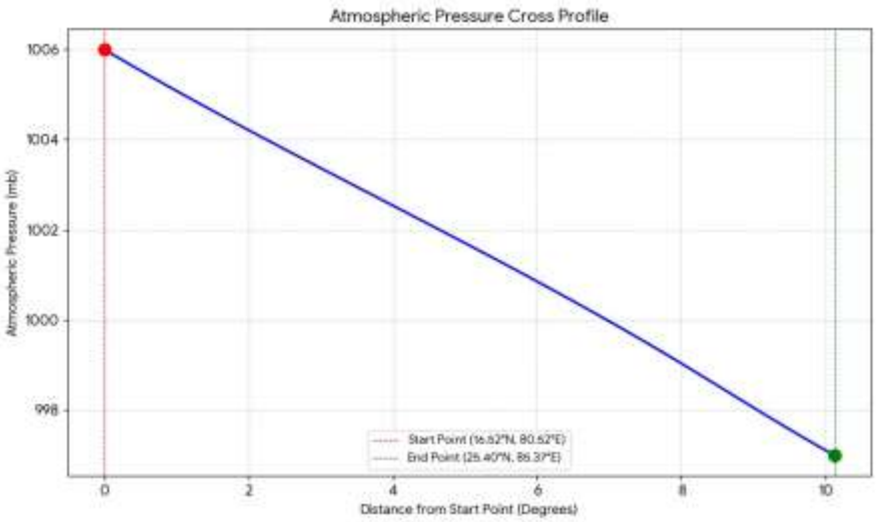
latitude & longitude	Atmospheric Pressure (in mb)
22°34’N 88°22’ E	998
25°24’N 85°22’ E	997
16°31’N 80°31’E	1006
23°21’N 85°220’E	999
24°18’N 78°25’E	8



4. **Cross Profile of Isobars and Derivation of Pressure Gradients:**

- **Drawing a Cross Profile:**
  - On the isobaric map prepared in step 3, draw a straight line (e.g., A-B) across a region where isobars are relatively close together.
  - Draw a new graph with distance along the line A-B on the x-axis.

- On the y-axis, plot the pressure values corresponding to the isobars intersected by line A-B.
- Connect these points to create a cross-profile of pressure.
- Drawing a cross profile using previous atmospheric pressure data



- **Derivation of Pressure Gradient:**

1. Choose two adjacent isobars along your cross-profile line (e.g., 1000 mb and 1004 mb).
2. Measure the perpendicular distance between these two isobars along your cross-profile line using the map scale. Let this distance be 'd' (e.g., in km).
3. The pressure difference (DeltaP) is the difference between the isobar values (e.g., 4 mb).
4. **Pressure Gradient = DeltaP/d** (e.g., mb/km).
5. Calculate the pressure gradient for at least two different sections along your cross-profile line. Discuss where the gradient is steepest and what that implies about wind strength

Viva Voce Questions:

1. What is the primary difference between a climograph and a hythergraph?
2. Why are isobars important for weather forecasting?
3. What does a tightly packed set of isobars indicate?
4. How is the pressure gradient force related to wind speed?
5. What is the significance of interpolating values when drawing isohyets or isobars?

Lab 4: Interpretation of Weather Maps Issued by IMD

Duration: 2-3 hours

Aim: To develop practical skills in interpreting real-time weather maps from the India Meteorological Department (IMD).

Materials:

- Access to the internet for IMD website (https://www.google.com/search?q=www.imd.gov.in)
- Projector/Smartboard to display maps
- Printouts of recent IMD weather maps (Surface Analysis, Upper Air Charts if time permits)
- Pen/Pencil, Notebook

Theory:

The India Meteorological Department (IMD) is the primary agency responsible for meteorological observations, weather forecasting, and seismology in India. They issue various weather maps daily, providing crucial information for public and specialized users. Understanding these maps requires synthesizing knowledge of symbols, pressure patterns, and geographic influences.

Procedure:

1. **Introduction to IMD Website and Map Types:**
   - The instructor will guide students through the IMD website, showing them where to access daily weather maps (e.g., Current Weather, Weather Bulletins, Satellite Images, Radar Images).
   - Focus on the *Surface Analysis Charts* as they contain most of the information covered in previous labs. Briefly introduce other relevant maps like satellite imagery (visible, infrared, water vapor) and radar imagery.
2. **Key Features to Identify on IMD Surface Analysis Charts:**
   - **High-Pressure Systems (Anticyclones):** Indicated by 'H' or 'A' within closed isobars, typically associated with clear skies, calm winds, and stable conditions.
   - **Low-Pressure Systems (Cyclones/Depressions):** Indicated by 'L' or 'C' within closed isobars, associated with cloudy skies, precipitation, and stronger winds.
   - **Troughs of Low Pressure:** Elongated areas of relatively low pressure, often extending from a low-pressure center, associated with unstable weather.
   - **Ridges of High Pressure:** Elongated areas of relatively high pressure, extending from a high-pressure center, associated with stable weather.
   - **Fronts:** (Though less prominent on tropical IMD maps, still important conceptual understanding) Boundaries between air masses of different temperatures and humidities (e.g., cold front, warm front, stationary front, occluded front). Discuss how they are depicted and their associated weather.
   - **Wind Patterns:** Observe the direction and speed of wind barbs around high and low pressure systems (winds blow clockwise around highs and counter-clockwise around lows in the Northern Hemisphere, diverging from highs and converging towards lows).
   - **Precipitation Areas:** Look for shaded regions or symbols indicating rain, thunderstorms, etc.
   - **Temperature and Dew Point Contours:** If available, identify isotherms and isodrosotherms and discuss their significance.
3. **Exercise: Interpreting Daily IMD Maps:**
   - Provide students with 2-3 recent IMD surface analysis charts (printouts or displayed on screen).
   - For each map, students should answer the following questions:

- Identify all major high- and low-pressure centers and their approximate locations.
- Describe the general wind patterns over different regions.
- Identify areas of significant precipitation and describe the likely type of weather.
- Based on the pressure patterns, identify any troughs or ridges.
- Based on the map, describe the expected weather for two specific cities/regions shown on the map (e.g., Delhi, Mumbai, Chennai, Kolkata).
- Predict the general movement of any major weather systems (e.g., cyclone moving eastward).

4. **Discussion and Forecasting:**
   - Facilitate a discussion on the interpretation of the maps.
   - Compare student interpretations and highlight common misconceptions.
   - Discuss the challenges of forecasting based on a single map and the need for a sequence of maps.

Viva Voce Questions:

1. What is the typical weather associated with a low-pressure system in India?
2. How do winds typically behave around a high-pressure system in the Northern Hemisphere?
3. What information can you derive from a sequence of daily weather maps that you cannot from a single map?
4. Why are weather maps crucial for agriculture and aviation?
5. What is the role of the India Meteorological Department (IMD) in weather forecasting?

Assessment

Lab Reports: Students will be required to submit a lab report for each practical session, including observations, data tables, calculations, graphs, and answers to exercise questions.

Practical Exam: A practical examination might involve interpreting a given weather map, drawing a station model, or performing calculations related to pressure gradients.

Viva Voce: Active participation in discussions and accurate answers during viva voce sessions will also be assessed.

Safety Guidelines

Handle all lab equipment with care.

Follow instructor's instructions at all times.

Report any damaged equipment or spills immediately.

Be mindful of electrical connections if using digital instruments.

References and Further Reading

Ahrens, C.D. (2016). Meteorology Today: An Introduction to Weather, Climate, and the Environment. Cengage Learning.

Barry, R.G. & Chorley, R.J. (2009). Atmosphere, Weather and Climate. Routledge.

Chaston, Peter R. 2002. Weather Maps: How to Read & Interpret All the Basic Weather Charts. Chaston Scientific Inc.

Collins, Richard L., 1985. Flying the weather map. Collier Macmillan

IMD Website: www.imd.gov.in

Saha P, Basu P. 2010. Advanced Practical Geography. Book and Allied Pvt. Ltd., Kolkata

Vasquez T., 2003. Weather map handbook. Weather Graphics Technologies, USA.

MIDNAPORE CITY COLLEGE

Department of Pure and Applied Sciences

B.Sc. Honours Major in Geography

Semester: IV

Paper: Major 6

Cartograms and Thematic Mapping (Practical)

Syllabus: Cartograms and Thematic Mapping

1. Concepts of 1D/2D cartograms; Line, Bar and Histograms

2. Cartograms: Proportional Circle, Square, Dots and Spheres and Pie graph

3. Age-Sex Pyramid, Dependency ratio

4. Population Maps and Diagrams: Population density by choropleth, distribution by Dot and sphere.

5. Thematic mapping of Data- Symbols, Dots, Choropleth, Isopleth and Flow diagrams, and their interpretation. Include data from both physical and human geography.

---

1. Concepts of 1D/2D cartograms; Line, Bar and Histograms

A **cartogram** is a thematic map where the size and shape of geographic areas are intentionally distorted to represent a particular variable, such as population, economic data, or travel time, instead of their true geographical dimensions. The primary goal of a cartogram is to visually emphasize the distribution of a chosen variable, making it easier to grasp patterns and trends that might not be apparent on a traditional map.

1D Cartograms (One-Dimensional Diagrams)

1D cartograms, more accurately termed **one-dimensional diagrams**, are graphical representations where only one dimension (typically length or height) is used to represent the magnitude of a variable.

Examples of 1D Cartograms:

1. Simple Bar Diagram
2. Multiple Bar Diagram
3. Subdivided (or Component) Bar Diagram
4. Percentage Bar Diagram
5. Line Graph

2D cartogram (Two-Dimensional Diagrams)

A 2D cartogram is a type of thematic map where the geographical area of regions is distorted to be proportional to a specific statistical variable, rather than their true physical size. This means that regions with higher values for the chosen variable will appear larger on the map, while regions with lower values will shrink, regardless of their actual land area.

1. Rectangles diagram
2. Square diagram
3. Circles diagrams
4. Pie diagrams

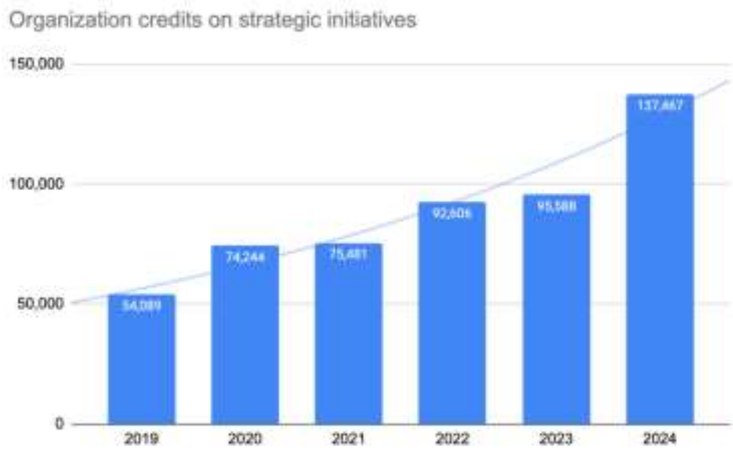


Fig: Simple Bar Graph

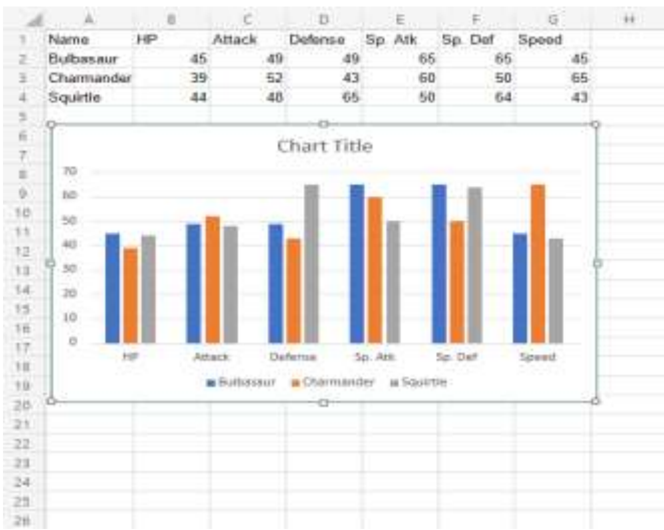


Fig: Multiple Bar Graphs

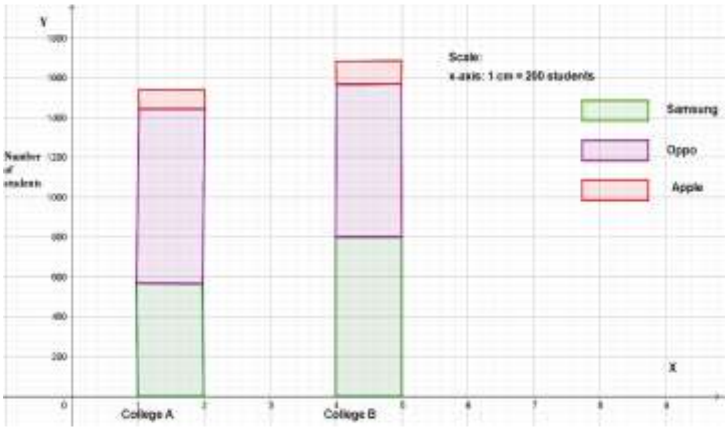


Fig: Sub-divided Bar Graphs

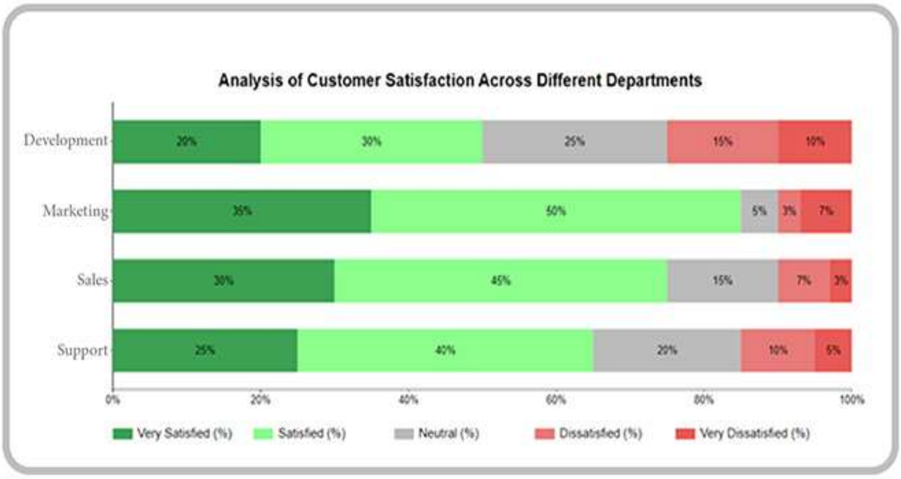


Fig: Percentage Bar Graphs

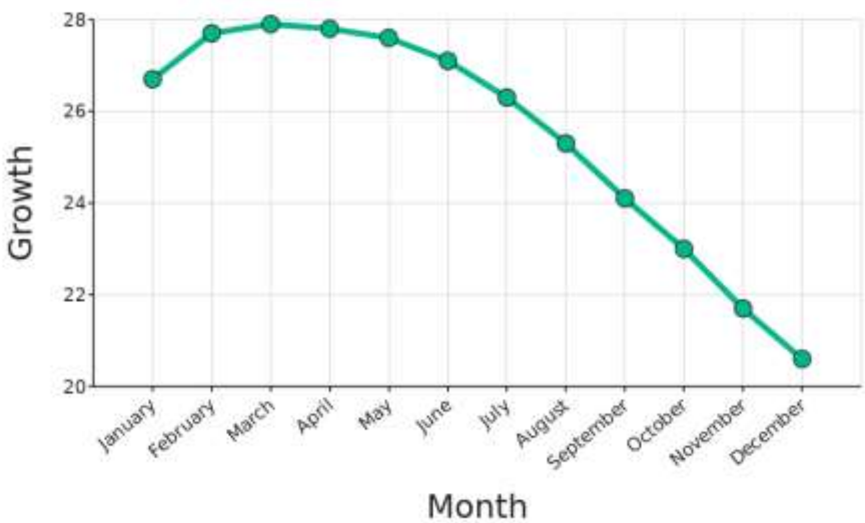


Fig: Simple Line Graphs

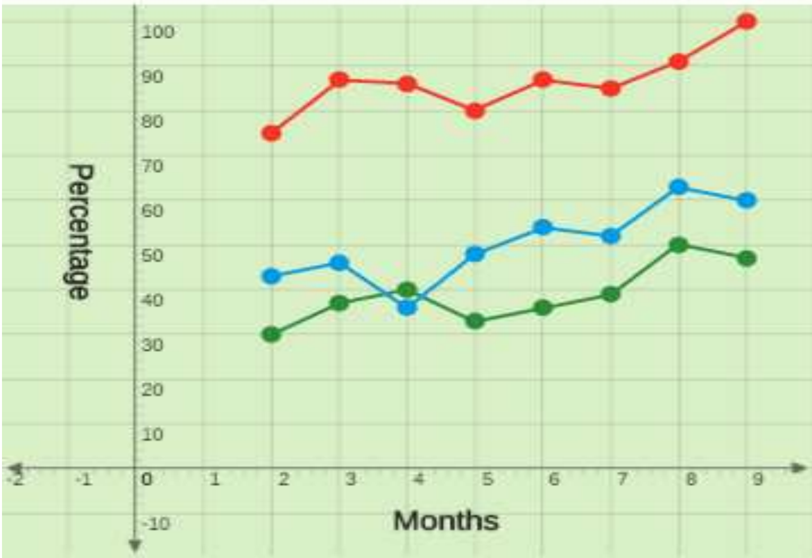


Fig: Multiple Line Graphs

A diagrammatic presentation of data refers to the graphical representation of data using various types of diagrams or charts. It involves the use of visual elements such as lines, bars, points, and shapes to represent numerical or categorical information.

Diagrammatic presentations are widely used in data analysis and communication because they allow for a quick and intuitive understanding of the data. By presenting information visually, complex data sets can be simplified and patterns or relationships can be easily identified.

There are various types of diagrammatic presentations, each suited to different types of data and analysis objectives. Some common types include:

Line diagram

In a line diagram, straight lines are used to indicate various parameters. Here, a line represents the sequence of data associated with the changing of a particular variable.

Properties of Line Diagram

- The Lines are either in vertical or horizontal directions.
- There may be uniform scaling but this is not mandatory.
- The lines that connect the data points offer the statistical representation of data.

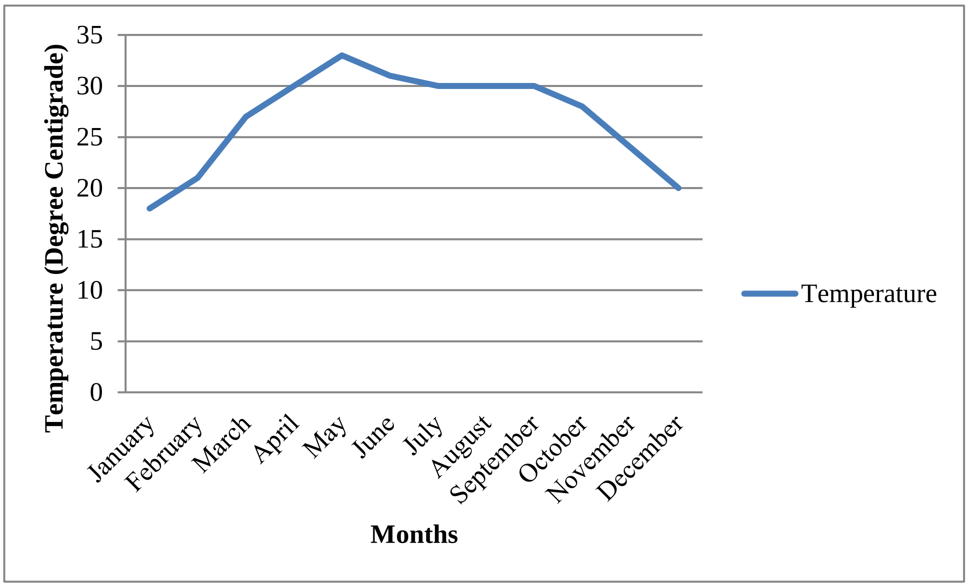
Types of Line Graphs

The following are the types of the line graph. They are:

- Simple Line Graph: Only one line is plotted on the graph.

- Multiple Line Graph: More than one line is plotted on the same set of axes. A multiple line graph can effectively compare similar items over the same period of time.
- Compound Line Graph: If information can be subdivided into two or more types of data. This type of line graph is called a compound line graph. Lines are drawn to show the component part of a total. The top line shows the total and line below shows part of the total. The distance between every two lines shows the size of each part.

Month	Temperature
January	18
February	21
March	27
April	30
May	33
June	31
July	30
August	30
September	30
October	28
November	24
December	20



Use of line graph:

Line graphs are commonly used to represent and analyze data that changes over time or displays a continuous relationship between two variables. Here are some specific uses and advantages of line graphs:

- **Trend Analysis:** Line graphs are effective in illustrating trends and patterns in data over time. By plotting data points and connecting them with lines, line graphs make it easy to identify increasing, decreasing, or fluctuating trends in the data.
- **Comparisons:** Line graphs allow for easy visual comparison of multiple data sets or variables on the same graph. By plotting multiple lines on a single graph, you can observe how different variables or data sets change relative to each other over time.
- **Forecasting and Predictions:** Line graphs can be used to forecast or predict future trends based on existing data. By extending the existing line beyond the plotted data points, you can make predictions about future values or trends.
- **Identifying Relationships:** Line graphs can demonstrate the relationship between two variables. For example, you can plot the relationship between temperature and ice cream sales over time to determine if there is a correlation between the two variables.
- **Data Visualization:** Line graphs provide a clear and concise visual representation of data, making it easier to interpret and understand complex datasets. They simplify complex information into a visually appealing and easy-to-interpret format.

Limited to Continuous Data: Line graphs are most suitable for representing continuous data that can be measured over a specific time period or on a continuous scale. They may not be ideal for representing categorical or discrete data.

- **Oversimplification:** Line graphs simplify data by connecting data points with lines. This simplification can sometimes overlook important variations or fluctuations within the data.
- **Data Density:** Line graphs can become cluttered and difficult to interpret when there is a high density of data points or multiple lines on the same graph. In such cases, it may be necessary to use different techniques, such as smoothing or highlighting specific trends, to enhance readability.

Despite these limitations, line graphs are widely used in various fields such as economics, finance, climate science, social sciences, and more. They provide a powerful tool for visually representing and analyzing data that changes over time, facilitating trend analysis, comparisons, and data-driven decision-making.

Bar diagram

Bar diagrams have rectangular shapes of equal width that represent statistical data in a straightforward manner. Bar diagrams are one of the most widely used diagrammatic representations.

Types of Bar Graphs:

The bar graphs can be vertical or horizontal. The primary feature of any bar graph is its length or height. If the length of the bar graph is more, then the values are greater than any given data.

Bar graphs normally show categorical and numeric variables arranged in class intervals. They consist of an axis and a series of labelled horizontal or vertical bars. The bars represent frequencies of distinctive values of a variable or commonly the distinct values themselves. The number of values on the x-axis of a bar graph or the y-axis of a column graph is called the scale.

The types of bar charts are as follows:

- Vertical bar chart
- Horizontal bar chart

Even though the graph can be plotted using horizontally or vertically, the most usual type of bar graph used is the vertical bar graph. The orientation of the x-axis and y-axis are changed depending on the type of vertical and horizontal bar chart. Apart from the vertical and horizontal bar graph, the two different types of bar charts are: Grouped Bar Graph and Stacked Bar Graph. They are discuss as follows:

Vertical Bar Graphs

When the grouped data are represented vertically in a graph or chart with the help of bars, where the bars denote the measure of data, such graphs are called vertical bar graphs. The data is represented along the y-axis of the graph, and the height of the bars shows the values.

Horizontal Bar Graphs

When the grouped data are represented horizontally in a chart with the help of bars, then such graphs are called horizontal bar graphs, where the bars show the measure of data. The data is depicted here along the x-axis of the graph, and the length of the bars denote the values.

Grouped Bar Graph

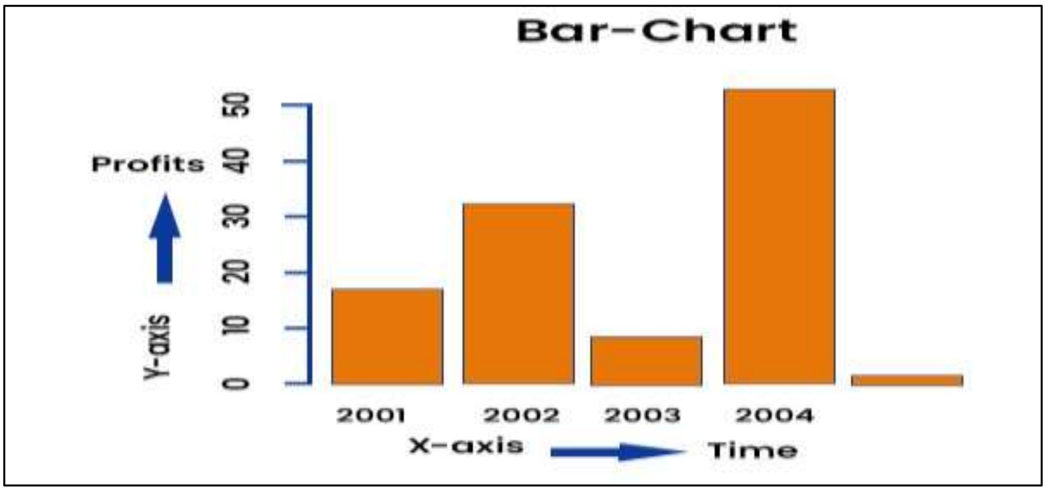
The grouped bar graph is also called the clustered bar graph, which is used to represent the discrete value for more than one object that shares the same category. In this type of bar chart, the total number of instances are combined into a single bar. In other words, a grouped bar graph is a type of bar graph in which different sets of data items are compared. Here, a single colour is used to represent the specific series across the set. The grouped bar graph can be represented using both vertical and horizontal bar charts.

Stacked Bar Graph

The stacked bar graph is also called the composite bar chart, which divides the aggregate into different parts. In this type of bar graph, each part can be represented using different colours, which helps to easily identify the different categories. The stacked bar chart requires specific labelling to show the different parts of the bar. In a stacked bar graph, each bar represents the whole and each segment represents the different parts of the whole.

Properties of Bar Diagram

- The Bars can be vertical or horizontal in directions.
- All bars in a diagram have a uniform width.
- All the Bars have a common and same base.
- The height or width of the Bar shows the required value.

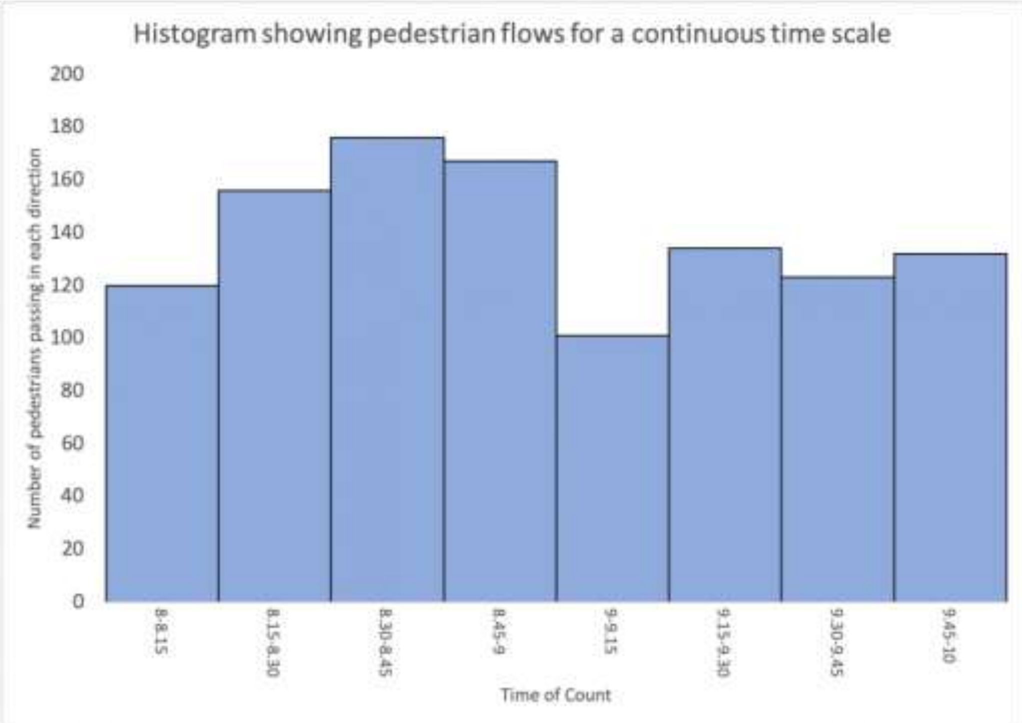


The following is an example of a Bar Chart that has time on the X axis and profits on the Y axis.

Histogram

A histogram appears similar to a bar chart. However, there are key differences between the two. Histograms are used to present continuous data (a bar chart is used to present discrete data). Histograms are ideal for presenting continuous data. Continuous data is data that falls in a continuous sequence e.g. time, distance and temperature. An example of this would be after counting pedestrians at 15-minute intervals over 2 hours, a histogram could be used to present the results.

Class Boundary (Time)	Frequency
8-8.15	120
8.15-8.30	156
8.30-8.45	176
8.45-9	167
9-9.15	101
9.15-9.30	134
9.30-9.45	123
9.45-10	132



---

2. Cartograms: Proportional Circle, Square, Dots and Spheres and Pie graph

---

Proportional Circle diagram

A **Proportional Circle Diagram** (also known as a Proportional Symbol Map using circles, or sometimes a type of circular diagram) is a thematic map or chart that uses circles of varying sizes to represent quantitative data. In this more complex variant, a circle's size is proportional to a total value, and then the circle itself is divided into segments (like a pie chart) to show the breakdown of components within that total. For example, a circle representing a city's total population could be divided into segments showing the proportion of different age groups or religious communities. Based on the calculated radii, draw the circles on a map or as a standalone diagram at their respective locations or categories. Often, colour shading can also be used proportionally to enhance the visual representation.

Calculation for Religious Composition by Divided Proportional Circles

Prepare Divided Proportional Circles based on the distribution of various religious populations in selected states of India, 2011.

State	Hindu	Muslim	Christian	Sikh	Buddhist	Jain	Other Religious Communities
Andhra Pradesh	6,78,36,651	69,86,856	11,81,917	30,998	32,037	41,846	4,768
Gujarat	4,51,43,074	45,92,854	2,84,092	45,587	17,829	5,25,305	28,698
Haryana	1,86,55,925	12,22,916	27,185	11,70,662	7,140	57,167	1,255
Madhya Pradesh	5,50,04,675	38,41,449	1,70,381	1,50,772	2,09,322	5,45,446	4,09,285
Uttar Pradesh	13,39,79,263	3,07,40,158	2,12,578	6,78,059	3,02,031	2,07,111	9,281
West Bengal	5,81,04,835	2,02,40,543	5,15,150	66,391	2,43,364	55,223	8,95,796

Step 1: Add all different religious populations in the table to get the total population.

State	Hindu	Muslim	Christian	Sikh	Buddhist	Jain	Other Religious Communitie s	Total Population
Andhra Pradesh	6,78,36,651	69,86,856	11,81,917	30,998	32,037	41,846	4,768	7,61,15,073
Gujarat	4,51,43,074	45,92,854	2,84,092	45,587	17,829	5,25,305	28,698	5,06,37,439
Haryana	1,86,55,925	12,22,916	27,185	11,70,662	7,140	57,167	1,255	2,11,42,250
Madhya Pradesh	5,50,04,675	38,41,449	1,70,381	1,50,772	2,09,322	5,45,446	4,09,285	6,03,31,330
Uttar Pradesh	13,39,79,263	3,07,40,158	2,12,578	6,78,059	3,02,031	2,07,111	9,281	16,61,28,481
West Bengal	5,81,04,835	2,02,40,543	5,15,150	66,391	2,43,364	55,223	8,95,796	8,01,21,302

Step 2: Calculation for radius of circle (r = Total Population/2π)

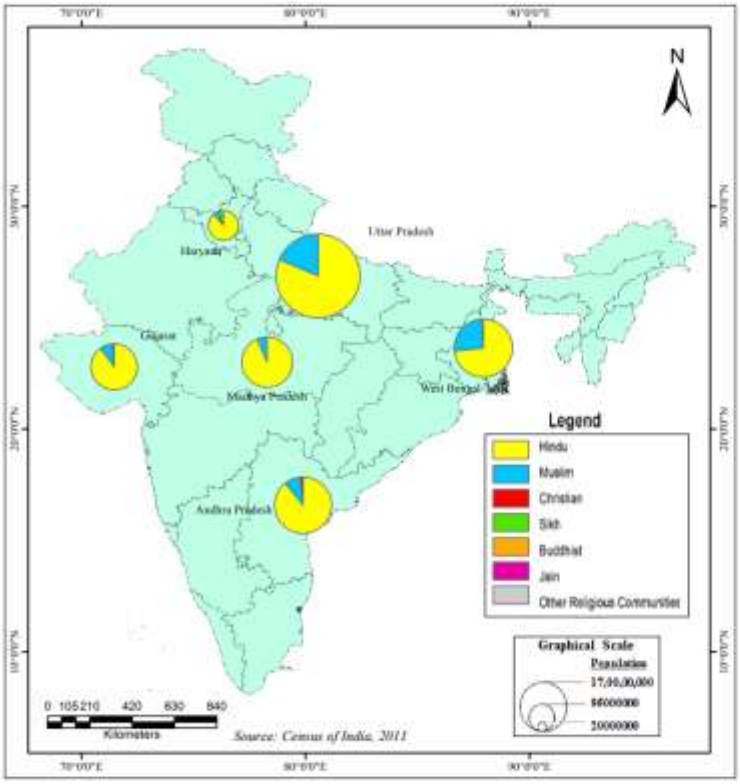
State	Total Population	r = Total Population/2π	Scale: 1cm.=25000000 unit
Andhra Pradesh	7,61,15,073	12114090.11	0.484563604
Gujarat	5,06,37,439	8059198.722	0.322367949
Haryana	2,11,42,250	3364893.596	0.134595744
Madhya Pradesh	6,03,31,330	9602029.393	0.384081176
Uttar Pradesh	16,61,28,481	26440168.94	1.057606758
West Bengal	8,01,21,302	12751701.26	0.51006805

Step 3: Calculation for Graphical Scale

Range	Total Population	r = Total Population/2π	Scale: 1cm.=25000000 unit
Highest	17,00,00,000	27056340.33	1.082254
Medium	95000000	15119719.59	0.604789
Lowest	20000000	3183098.862	0.127324

Step 4: Calculation for division of circle For Hindu (Andhra Pradesh) = (360°* 6,78,36,651) / 7,61,15,073 = 320°50'44.542833

State	Hindu	Muslim	Christian	Sikh	Buddhist	Jain	Other Religious Communities	Total Population
Andhra Pradesh	320°50'44.5428331908"	33°2'44.1554439552"	5°35'24.3245473863"	0°8'47.7983245184556"	0°9'54.8922261429"	0°11'52.505603193732"	0°1'21.1840251404604"	360°
Gujarat	320°56'18.8078421588"	32°39'8.17979637564"	2°1'10.968660164676"	0°19'26.740521770856"	0°7'36.3102806206308"	3°44'4.50456904032"	0°12'14.488329869922"	360°
Haryana	317°39'50.6206766088"	20°49'23.59829251848"	0°27'46.41488015703"	19°56'47.73380316"	0°7'17.675271080418"	0°58'24.28322434935"	0°1'16.930317255732"	360°
Madhya Pradesh	328°12'56.119737456"	22°55'19.61135284116"	1°1'18.368565708"	0°53'58.790061482148"	1°14'56.524641508824"	3°15'16.930755546084"	2°26'32.005082599692"	360°
Uttar Pradesh	290°19'57.8119754208"	66°36'49.84192590084"	0°27'38.361566551614"	1°28'9.667724103264"	0°39'16.201499248044"	0°26'55.712455710708"	0°1'12.4028530664766"	360°
West Bengal	261°4'3322073223480"	90°56'40.36760760588"	2°18'52.7951909718"	0°17'53.905863386994"	1°5'36.527941096116"	0°14'53.25817496076"	4°1'29.924489744328"	360°



Pie/circle chart

Also known as a "circle chart", the pie chart divides the circular statistical graphic into sectors or sections to illustrate the numerical data. Each sector in the circle denotes a proportionate part of the whole. Pie-chart works the best at the time when we want to denote the composition of something. In most cases, the pie chart replaces other diagrammatic representations, such as the bar graph, line plots, histograms, etc.

In practice, the various sections in a pie chart are derived according to their ratio to the total area of the circle. Then according to their individual contributions, sections are divided into parts derived from 360 degrees of the circle.

Question: The percentages of various cops cultivated in a village of particular distinct are given in the following table.

Items	Wheat	Pulses	Jowar	Groundnuts	Vegetables	Total
Percentage of cops	**125/3**	**125/6**	**25/2**	**50/3**	**25/3**	**100**

Represent this information using a pie-chart.

Solution:

The central angle = (component value/100) × 360°

The central angle for each category is calculated as follows

Items	Percentage of cops	Central angle
Wheat	125/3	[(125/3)/100] × 360° = 150°
Pulses	125/6	[(125/6)/100] × 360° = 75°
Jowar	25/2	[(25/2)/100] × 360° = 45°
Groundnuts	50/3	[(50/3)/100] × 360° = 60°
Vegetables	25/3	[(25/3)/100] × 360° = 30°
Total	100	360°

Now, the pie-chart can be constructed by using the given data.

Steps to construct:

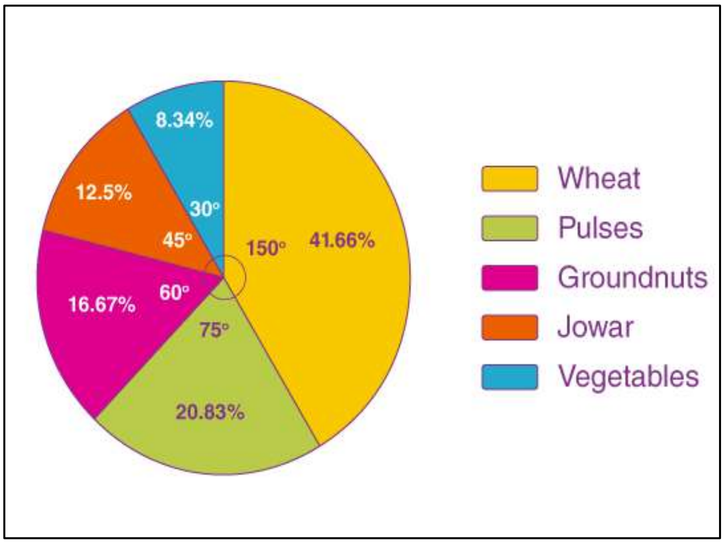
Step 1: Draw the circle of an appropriate radius.

Step 2: Draw a vertical radius anywhere inside the circle.

Step 3: Choose the largest central angle. Construct a sector of a central angle, whose one radius coincides with the radius drawn in step 2, and the other radius is in the clockwise direction to the vertical radius.

Step 4: Construct other sectors representing other values in the clockwise direction in descending order of magnitudes of their central angles.

Step 5: Shade the sectors obtained by different colours and label them as shown in the figure below.



Square Diagram

In geography, a **square diagram** is a two-dimensional diagram used to represent and compare statistical data. It's particularly useful for visualizing quantities where the **area** of the square is proportional to the value it represents.

Formula

For **square diagram**:

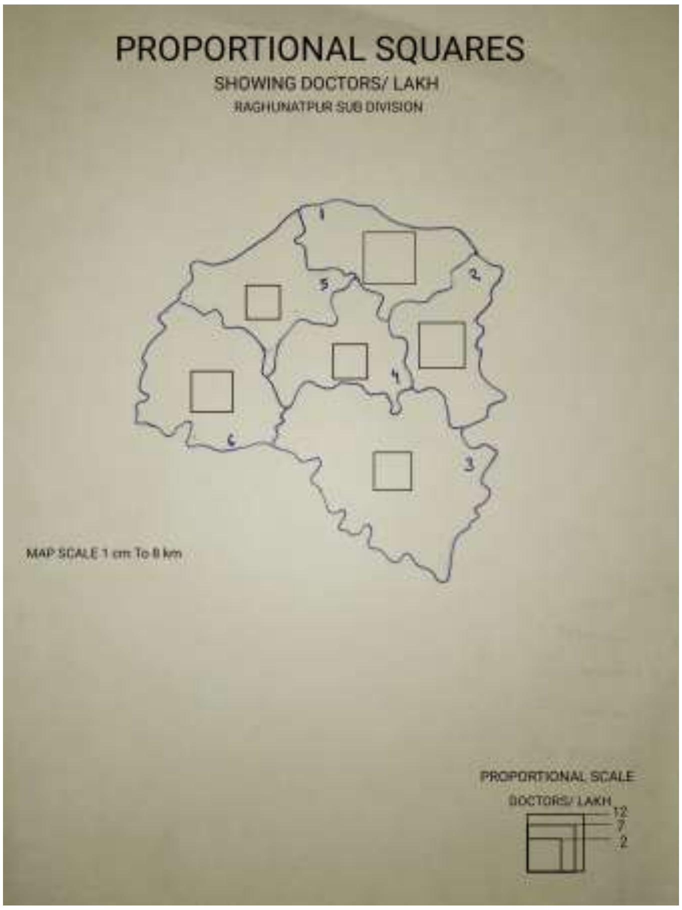
$$\text{Area} \propto \text{Data Value}$$

So,

$$\text{Side of Square} = \sqrt{\frac{\text{Data Value}}{\text{Scale}}}$$

For **rectangle diagram** (if one side is fixed or assigned):

$$\text{Area} = \text{Length} \times \text{Breadth}$$



Dot map

A dot map is a method of representing area data by using individual dots or markers to represent a specific quantity or count of the variable being depicted. Each dot on the map represents a fixed amount or a certain number of occurrences of the variable within a given area or region.

In a dot map, the dots are distributed across the map in locations corresponding to the specific areas or regions to which they belong. The density or concentration of dots in a particular area reflects the higher values or greater occurrences of the variable in that area, while sparser areas indicate lower values or occurrences.

Dot maps are particularly useful when displaying discrete or countable data, such as population counts, crime incidents, disease outbreaks, or the occurrence of specific events. They provide a visual representation that allows viewers to quickly understand the spatial distribution, patterns, and density of the variable of interest across different areas.

When creating a dot map, it is essential to carefully choose the dot size, colour, or other visual attributes to ensure clarity and readability. It is also important to consider any potential biases or limitations of the data and communicate the appropriate scale or legend to interpret the dot representation accurately.

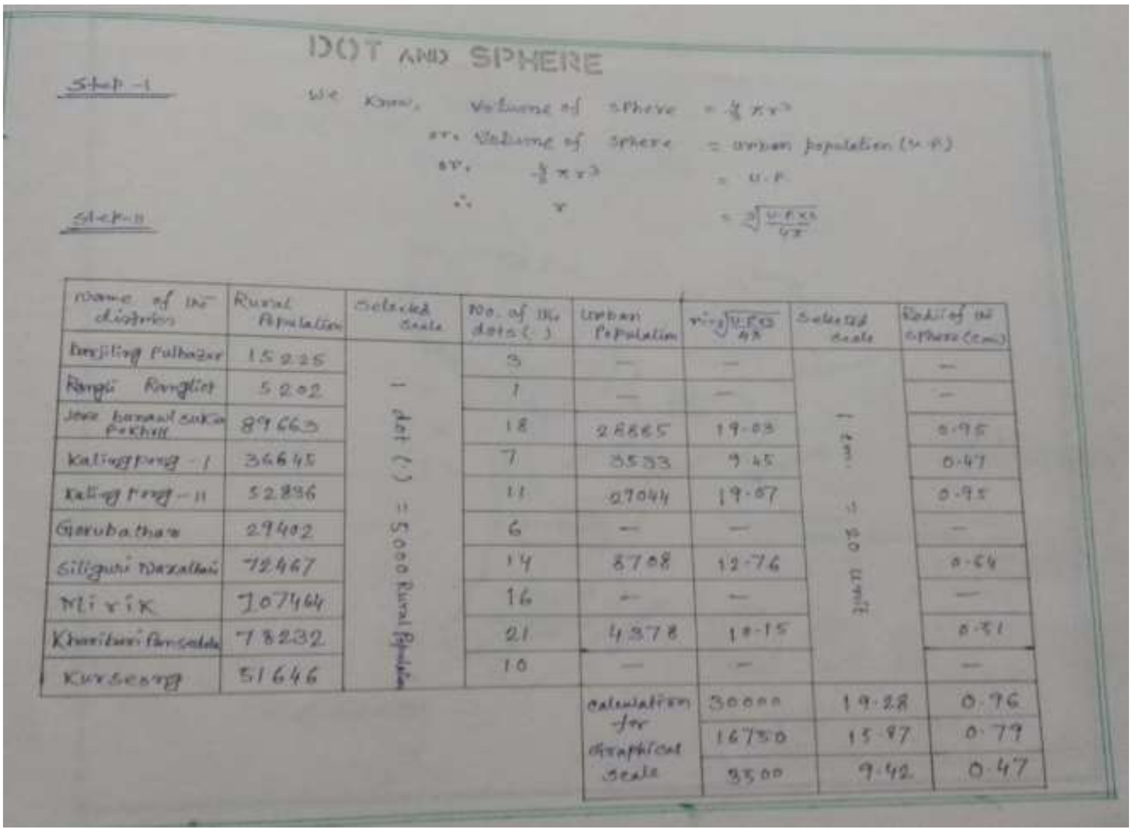
Dot maps can be a powerful tool for visualizing and analysing area data, providing insights into spatial patterns and helping to identify hotspots, clusters, or areas of interest related to the variable being represented.

Sphere Diagram

Dot and Sphere Diagram is generally used to represent Rural and urban population respectively at one goes. However dots can be used separately and sphere can be used separately in different diagrams to represent other aspects.

- Generally Sphere is 3 dimensional diagrams comprising a series of sphere proportional in size to the quantities they represent.
- Volume of a sphere for a represent able item is directly proportional to the quantity of the item it represents.

- **Calculation of radius of a sphere to represent urban population**
- **Formula for volume of sphere=** $\frac{4}{3}\pi r^3$
- **So;** $\frac{4}{3}\pi r^3$ **= volume of sphere**
- **Or** $\frac{4}{3}\pi r^3$ **=urban population**
- **Or** $\pi r^3 = \frac{4}{3} \times$ **urban population**
- **Or** $\pi = \sqrt[3]{\frac{(3xU \cdot P)}{4\pi}}$
- **Where u.p.=urban population(in given sum)**



DOT AND SPHERE

Step-I

We Know, Volume of sphere = $\frac{4}{3}\pi r^3$

or, Volume of sphere = urban population (U.P.)

or, $\frac{4}{3}\pi r^3$ = U.P.

∴ r = $\sqrt[3]{\frac{U.P \times 3}{4\pi}}$

Step-II

Name of the districts	Rural Population	Selected Scale	No. of the dots (.)	Urban Population	$r = \sqrt[3]{\frac{U.P \times 3}{4\pi}}$	Selected Scale	Radii of the sphere (cm)
Darjiling Pulbazar	15225	1 dot (.) = 5000 Rural Population	3	—	—	1 cm = 20 unit	—
Rangli Rangliot	5202		1	—	—		—
Jore bunglow sukia Pokhri	89663		18	28865	19.03		0.95
Kalimpong - I	36645		7	3533	9.45		0.47
Kalimpong - II	52836		11	27044	19.07		0.95
Garubathan	29402		6	—	—		—
Siliguri Naxalbari	72467		14	8708	12.76		0.64
Mirik	107464		16	—	—		—
Kharibari Phansidewa	78232		21	4378	10.15		0.51
Kurseong	51646		10	—	—		—
				Calculation for Graphical Scale	30000	19.28	0.96
					16750	15.87	0.79
					3500	9.42	0.47

---

3. Age-Sex Pyramid, Dependency ratio

Age-Sex Pyramid

A population pyramid, also known as an age-sex pyramid, is a graphical representation of the age and sex distribution of a population. It visually displays the number or proportion of males and females in each age group, typically within a specific geographical area and time period.

Structure and Components:

- **Axes:**

The pyramid consists of two histograms, one for males and one for females, with age groups typically displayed on the vertical (Y) axis and population numbers or percentages on the horizontal (X) axis.

- **Males and Females:**

Males are usually represented on the left side of the pyramid, and females on the right.

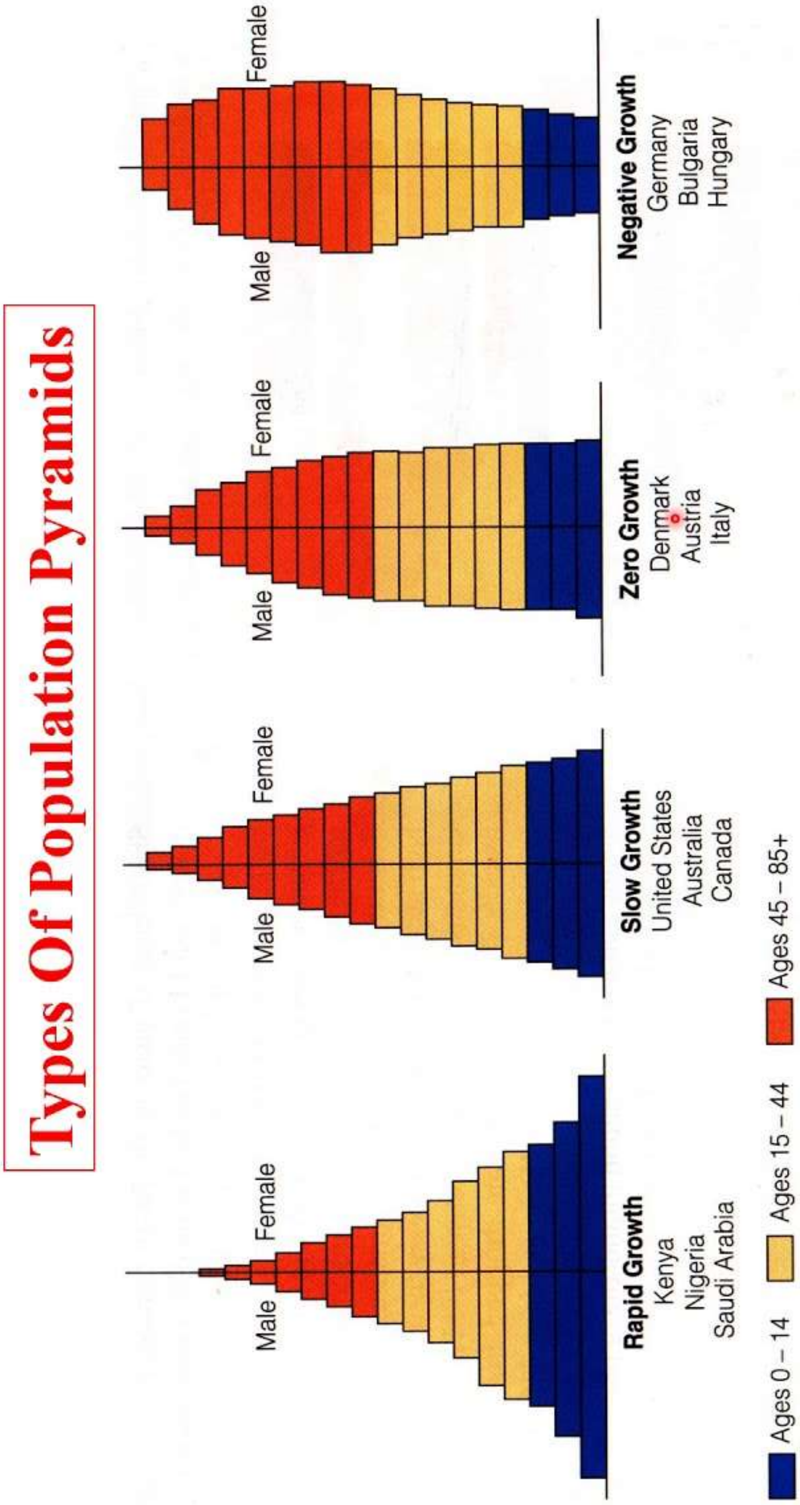
- **Age Groups:**

Age groups are arranged vertically, with the youngest at the base and the oldest at the apex.

<u>Types of Population Pyramids:</u>

- **Expansive (Triangular):**

Characterized by a wide base (high birth rates) and a narrow top (high death rates). This type is typically found in less developed countries.



- **Constrictive (Bell-shaped):**

Shows a narrowing base (lower birth rates) and a wider top (lower death rates), indicating a more stable or even declining population.

- **Stationary (Columnar):**

Exhibits a relatively uniform shape across all age groups, suggesting low birth and death rates and minimal population growth.

Uses and Significance:

- **Population Trends:**

Population pyramids help to visualize and analyze population trends, including birth rates, death rates, and life expectancy.

- **Demographic Transition:**

They can illustrate the stages of the demographic transition model, which describes how birth and death rates change over time in a society.

- **Policy Planning:**

Understanding population structures through pyramids is crucial for policymakers in areas such as healthcare, education, and social security.

- **Economic Development:**

Population pyramids can provide insights into a country's potential workforce and dependency ratios, impacting economic planning and development strategies.

<u>Uses and Significance:</u>

- **Population Trends:**

Population pyramids help to visualize and analyze population trends, including birth rates, death rates, and life expectancy.

- **Demographic Transition:**

They can illustrate the stages of the demographic transition model, which describes how birth and death rates change over time in a society.

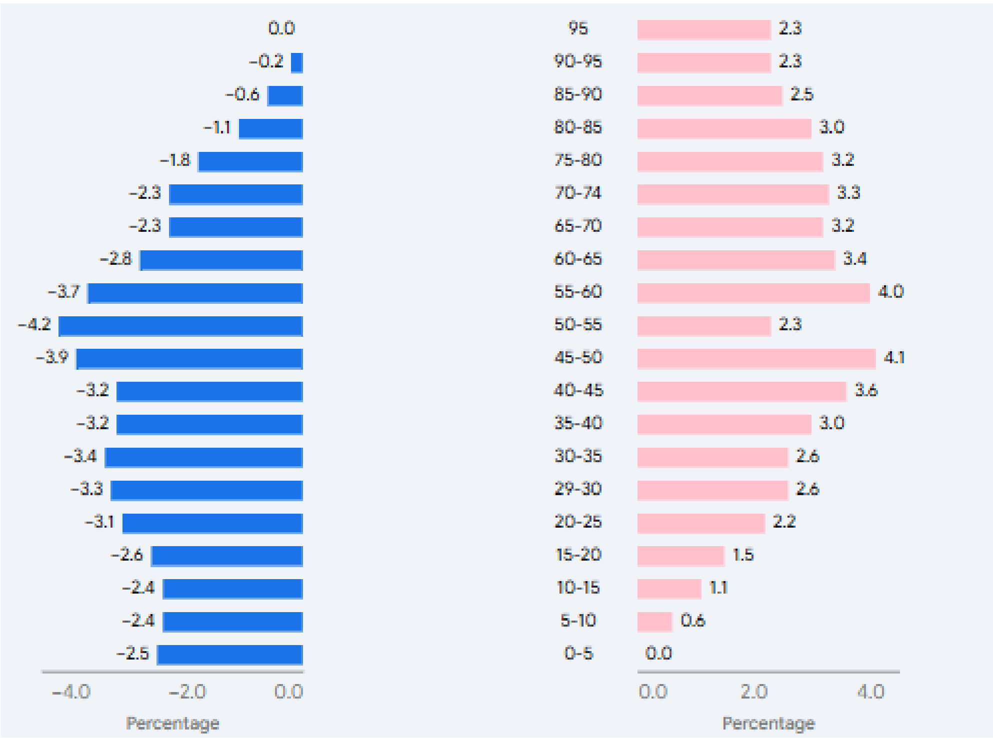
- **Policy Planning:**

Understanding population structures through pyramids is crucial for policymakers in areas such as healthcare, education, and social security.

- **Economic Development:**

Population pyramids can provide insights into a country's potential workforce and dependency ratios, impacting economic planning and development strategies.

AUSTRIA (TOTAL POPULATION 8592400)		
Age Group	Male Population in %	Female Population in %
0-5	2.5	2.3
5-10	2.4	2.3
10-15	2.4	2.3
15-20	2.6	2.5
20-25	3.1	3.0
29-30	3.3	3.2
30-35	3.4	3.3
35-40	3.2	3.2
40-45	3.2	3.4
45-50	3.9	4.0
50-55	4.2	4.1
55-60	3.7	3.6
60-65	2.8	3.0
65-70	2.3	2.6
70-74	2.3	2.6
75-80	1.8	2.2
80-85	1.1	1.5
85-90	0.6	1.1
90-95	0.2	0.6
95+	0.0	0.0



Dependency Ratio

To compute and interpret the dependency ratio for a given population using age-wise demographic data. The Dependency Ratio is a demographic measure that compares the proportion of dependents (young and elderly) to the working-age population. It helps understand the economic burden on the productive population and is important for planning education, healthcare, and retirement systems.

Formulae:

Formulae:

1. **Total Dependency Ratio (TDR)**

$$\text{TDR} = \left(\frac{\text{Population aged 0-14} + \text{Population aged 65+}}{\text{Population aged 15-64}}\right) \times 100$$

2. **Child Dependency Ratio (CDR)**

$$\text{CDR} = \left(\frac{\text{Population aged 0-14}}{\text{Population aged 15-64}}\right) \times 100$$

3. **Old-age Dependency Ratio (OADR)**

$$\text{OADR} = \left(\frac{\text{Population aged 65+}}{\text{Population aged 15-64}}\right) \times 100$$

Materials Required:

- Population data (age-wise) of a country/region
- Calculator / Spreadsheet software (Excel)
- Graph paper (for plotting bar graphs, if required)

Given Data (Example):

Age Group	Population
0–14	25,000
15–64	60,000
65+	10,000

Calculation:

Calculation:

1. Total Dependency Ratio:

$$TDR = \left(\frac{25,000 + 10,000}{60,000}\right) \times 100 = \left(\frac{35,000}{60,000}\right) \times 100 = 58.33$$

2. Child Dependency Ratio:

$$CDR = \left(\frac{25,000}{60,000}\right) \times 100 = 41.67$$

3. Old-age Dependency Ratio:

$$OADR = \left(\frac{10,000}{60,000}\right) \times 100 = 16.67$$

Result:

- **Total Dependency Ratio = 58.33**
- **Child Dependency Ratio = 41.67**
- **Old-age Dependency Ratio = 16.67**

A total dependency ratio of 58.33 means there are about 58 dependents for every 100 working-age individuals. A higher child dependency indicates a young population requiring investments in education, while the old-age dependency reflects pressure on healthcare and pension systems.

4. Population Maps and Diagrams: Population density by choropleth, distribution by Dot and sphere.

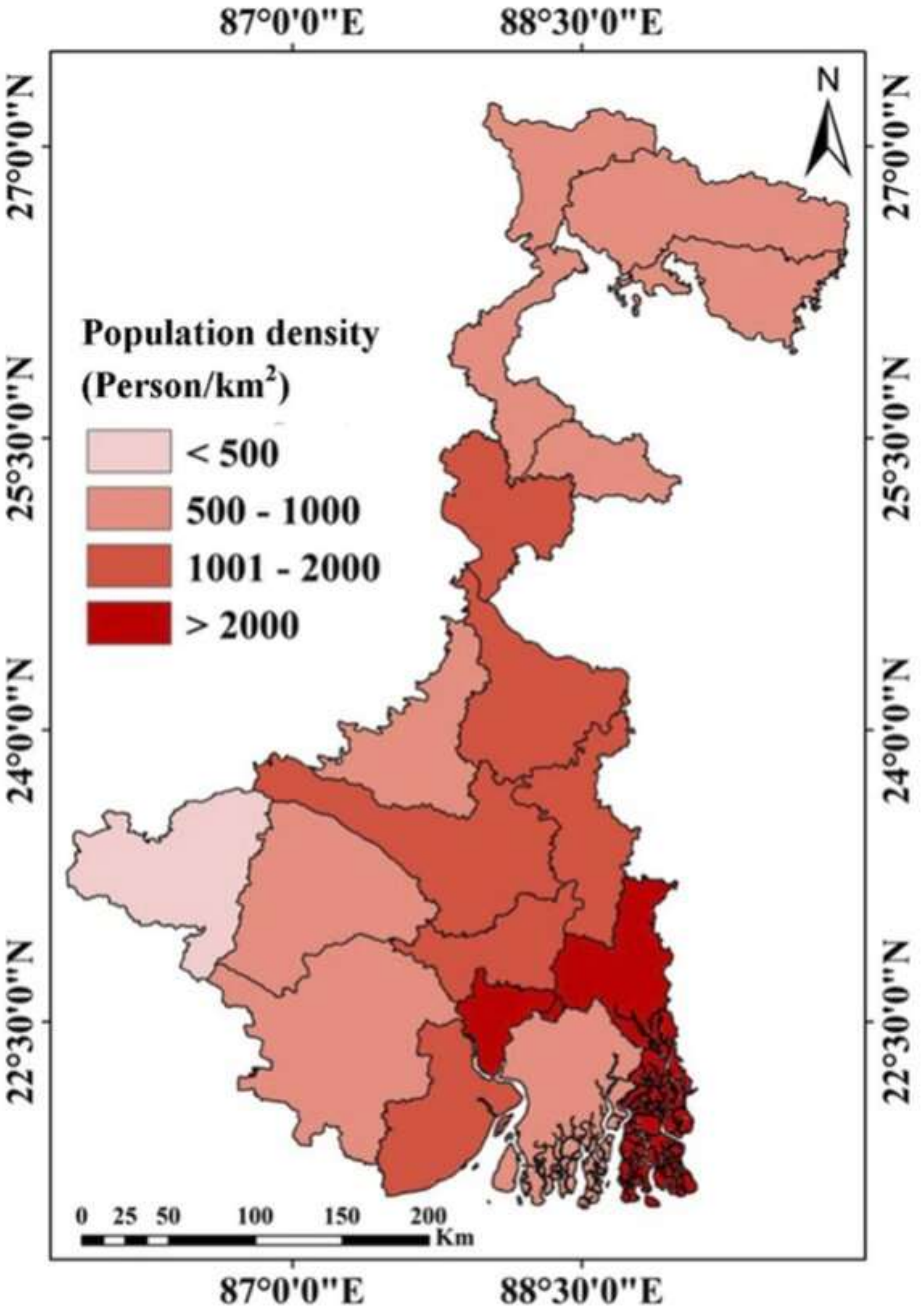
Population density by choropleth

To create a population density map, you'll also need the **area of each district**. Population density is calculated as:

Population Density=Area/Population

District Name	Population (2011 Census)	Area (km²)	Population Density (per km²)
North Twenty Four Parganas	10,009,781	4,094	2445.02
South Twenty Four Parganas	8,161,961	9,960	819.47
Barddhaman	7,717,563	7,024	1098.76
Murshidabad	7,103,807	5,324	1334.3
Paschim Medinipur	5,913,457	6,308	937.49
Hugli	5,519,145	3,149	1752.79
Nadia	5,167,600	3,927	1316.07
Purba Medinipur	5,095,875	4,785	1064.97
Haora	4,850,029	1,467	3306.08
Kolkata	4,496,694	206.08	21810.12
Maldah	3,988,845	3,733	1068.53
Jalpaiguri	3,872,846	6,227	621.9
Bankura	3,596,674	6,882	522.61
Birbhum	3,502,404	4,545	770.61
Uttar Dinajpur	3,007,134	3,140	957.69
Puruliya	2,930,115	6,259	468.14

Koch Bihar	2,819,086	3,387	832.32
Darjiling	1,846,823	2,092.50	882.61
Dakshin Dinajpur	1,676,276	2,219	755.42



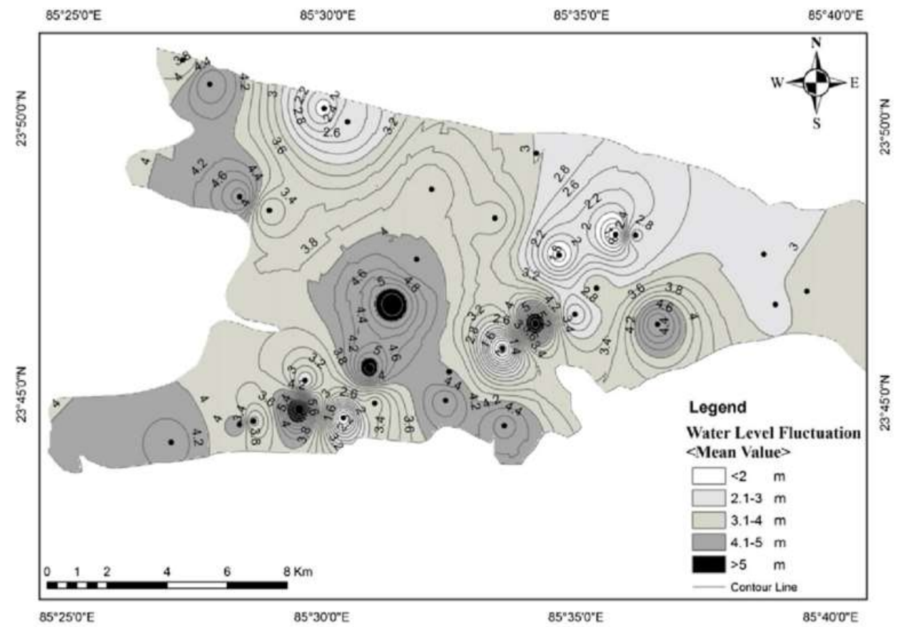
Isopleth map

An isopleth map, also known as a contour map or thematic map, is a type of map that uses lines or areas of equal value to represent a particular variable or data distribution across a geographic area. The word "isopleth" comes from the Greek words "isos" (meaning equal) and "plethos" (meaning value).

In an isopleth map, the variable being represented is typically a continuous numerical data point, such as temperature, precipitation, population density, elevation, or any other measurable quantity. The map uses contour lines or shaded areas to connect points with the same value of the variable, creating regions or patterns that indicate the distribution or variation of the data across the map.

The contour lines on an isopleth map represent points with equal values of the variable being mapped. Each line represents a specific value, and the spacing or density of the lines indicates the rate of change or gradient of the variable. Closer lines indicate a rapid change, while widely spaced lines indicate a more gradual change.

Isopleth maps provide a visual representation of the geographic patterns or trends of the variable being depicted. They allow viewers to identify areas of high or low values, gradients, or clusters of similar values. Isopleth maps are commonly used in various fields, including meteorology, geography, geology, environmental science, and social sciences, to illustrate spatial variations and relationships in data.



Methods of Construction of Isopleth Maps

For construction of isopleth maps, we require a base map of the area with point data (showing values). All the points about which the data are available must be fixed on the map. Here it is worth mentioning that larger the number of points on the map with their respective data, more accurate will be the isopleth map.

(Note: a) Base line map depicting point location of different places.

b) Appropriate data of temperature, Pressure, Rainfall etc. over a definite period of time.

Procedures

1. Mark on the base map your observed values. Values should be located accurately at the exactly position you collected the data or value, locate as more points of value as you can to make accuracy at the end result.

2. Decide the suitable value or number for the isoclines by looking the range you have collected. Here, you work out on how many lines will fit properly on the map between your maximum for and minimum values, but making a fixed interval is most important.

3. Join all places or points of equal value with smooth line in accordance to the interval you have chosen. It is necessary to determine the values of intermediate points through which the Isoline will pass using "logical interpolation".

4. Check the accuracy of the construction quickly to see if there is no point omitted.

5. Show the key appropriate. And title to assist interpretation. Note, always a key used when different shades or colour has been used.

Choosing the Interval of Isopleth

Isopleth are drawn at a fixed interval i.e. interval between all the Isopleth lines should be same. The location of isopleth indicates gradient i.e., when the isopleths on a map are located close to one another, the gradient is steep. On the contrary, the gradient is gentle, when the isopleth are distant apart. Therefore, the interval of the isopleths should be selected carefully.

Rules to be followed, while selecting the interval of Isopleths

1. Determine the minimum and maximum values given on the map.

2. Calculate the range of the value i.e., Range = maximum – minimum value.

3. Based on range, determine the interval in which number like 5, 10, 15 etc.

4. The exact point of drawing an isopleth is determined by using the following

Formulae:

$$\textbf{Point of isopleth} = \frac{\textbf{Distance between two points in cm}}{\textbf{Difference between the values of corresponding points}} \times \textbf{Interval}$$

Applications:

Isopleth maps have several practical applications in various fields. Here are some common uses of isopleth maps:

- **Weather and Climate Analysis:** Isopleth maps are frequently used in meteorology to represent weather variables such as temperature, precipitation, wind speed, and atmospheric pressure. These maps help meteorologists analyze weather patterns, identify weather systems (such as fronts and pressure systems), and forecast conditions based on the spatial distribution of the variables.
- **Topographic Mapping:** Isopleth maps are used in cartography to depict elevation and terrain features. Contour lines on a topographic map represent points of equal elevation, enabling readers to understand the shape and relief of the land. Isopleth maps also assist in identifying mountain ranges, valleys, and other geographic features.
- **Population and Demographic Analysis:** Isopleth maps are employed to visualize population density, population distribution, and demographic variables such as age, ethnicity, or socioeconomic indicators. These maps aid in identifying densely populated areas, urban clusters, and patterns of demographic characteristics across regions.
- **Environmental Studies:** Isopleth maps are valuable in environmental sciences to illustrate the distribution of environmental variables like pollution levels, air quality, soil characteristics, or biodiversity. They help identify areas with high or low concentrations of pollutants or ecological diversity, assisting in environmental monitoring and decision-making.
- **Resource Management:** Isopleth maps are useful in managing natural resources such as water, minerals, or agricultural land. For example, maps representing groundwater levels or soil fertility can aid in determining suitable locations for wells or optimal agricultural practices based on the spatial distribution of these resources.
- **Market Analysis:** Isopleth maps are employed in business and marketing to analyze customer demographics, market saturation, and demand patterns. These maps can help identify potential areas for expansion, target specific customer segments, or understand market competition based on the distribution of consumer data.
- **Geology and Geophysics:** Isopleth maps are utilized in geology and geophysics to represent variables like rock formations, seismic activity, or mineral concentrations. These maps assist in identifying areas with similar geological characteristics or predicting subsurface structures.

Isopleth maps provide a visual representation of data patterns and spatial relationships, enabling researchers, scientists, and decision-makers to gain insights, identify trends, and make informed decisions based on the geographic distribution of the variables being studied.

Isopleth maps, also known as contour maps, have several advantages and disadvantages. Let's explore them:

Advantages of Isopleth Maps:

- **Visual Representation:** Isopleth maps provide a visual representation of spatial patterns and variations in data. By using contour lines or colour gradients, they allow for quick interpretation of data values across a geographic area.
- **Simplicity:** Isopleth maps simplify complex data by representing it through continuous lines or shaded areas. This simplification makes it easier to understand the general trends and patterns in the data.
- **Interpolation:** Isopleth maps use interpolation techniques to estimate values between data points. This allows for the creation of a smooth, continuous surface, even if the original data is sparse or unevenly distributed.
- **Comparison:** Isopleth maps enable comparisons between different regions or areas within a single map. By examining the spacing and density of contour lines or colour gradients, it is possible to compare data values and identify areas of higher or lower values.

Disadvantages of Isopleth Maps:

- **Subject to Interpretation:** Isopleth maps require interpretation, and different users may interpret them differently. The choice of contour intervals or colour scales can impact how the data is perceived, leading to potential subjectivity in the interpretation.
- **Data Smoothing:** Isopleth maps smooth out data variations between contour lines or colour gradients. This smoothing can result in the loss of localized or small-scale variations, leading to potential inaccuracies or misrepresentations of the data.
- **Sensitivity to Data Distribution:** Isopleth maps are sensitive to the distribution and density of data points. Sparse data or data gaps may result in unreliable interpolation between points, potentially leading to inaccurate representations of the data.
- **Difficulty in Representing Discontinuous Data:** Isopleth maps struggle to represent data that is inherently discontinuous or does not exhibit a clear spatial pattern. Categorical data or data with abrupt changes may be challenging to depict accurately using contour lines or colour gradients.

It is important to consider these advantages and disadvantages when deciding to use isopleth maps and to use them in conjunction with other visual representations and analysis techniques to gain a more comprehensive understanding of the data.

5. Thematic mapping of Data- Symbols, Dots, Choropleth, Isopleth and Flow diagrams, and their interpretation. Include data from both physical and human geography.

Representation of area data refers to the visual depiction or presentation of data that pertains to specific geographical areas or regions. It involves using graphical or visual methods to represent data values, patterns, or relationships across different areas on a map or spatial framework.

Choropleth:

A choropleth map is a type of thematic map that uses different colours or patterns to represent different values or categories of a variable across predefined geographic regions. The regions, such as countries, states, or districts, are typically delineated by boundaries on the map.

In a choropleth map, each region is filled or shaded with a colour or pattern based on the value or category of the variable being represented. The colour or pattern intensity represents the magnitude or intensity of the variable in that region. Darker or more intense colours usually indicate higher values or greater prevalence of the variable, while lighter or less intense colours represent lower values or lesser prevalence.

Choropleth maps are commonly used to represent various types of data, including population density, average income, unemployment rates, election results, and any other variable that can be categorized or measured at a regional level.

Method of Construction

The first and the foremost thing in drawing choropleth maps is to obtain an outline map of the concerned area along with its administrative boundaries. It is also necessary to obtain data according to administrative divisions. Suppose, if we want to show the density of population of Midnapore city according to 2011 census figure. So, for this purpose, we will have to obtain an outline map of Midnapore city with district boundaries along with district-wise data of density of population. Similarly, if we are supposed to show the density of population in the whole India, then the states are treated as units for showing the density of population. If on the other hand, we have to show the density of population in a district then tehsil can be taken as the units.

Steps to be followed

a) Arrange the data in ascending and descending order.

b) Group the data into 5 categories (or 3 categories, depending upon the data range) to represent very high, high, medium, low, very low concentration.

c) The interval between the categories may be identified on the following formula i.e.; Range/5 (in case of 5 categories) and Range = Maximum – Minimum value.

d) Patterns, Shades or Colure to be used to depict the chosen categories should be marked in an increasing or decreasing order.

Applications:

Choropleth maps have a wide range of applications across various fields. Here are some common uses of choropleth maps:

- **Demographic Analysis:** Choropleth maps are widely used in demographic studies to visualize population characteristics and distributions. They can represent variables such as population density, age groups, ethnic composition, or socioeconomic indicators. Choropleth maps help identify areas with specific demographic patterns, such as urban centres, ethnic enclaves, or regions with high poverty rates.
- **Economic Analysis:** Choropleth maps are useful for representing economic data, such as GDP, income levels, unemployment rates, or industry-specific metrics. They can help identify regions with economic disparities, growth hotspots, or areas with high economic activity. Choropleth maps assist in economic planning, resource allocation, and policy decision-making.
- **Health and Epidemiology:** Choropleth maps are employed in public health and epidemiological studies to represent disease prevalence, mortality rates, or health outcomes across regions. They help identify disease hotspots, areas with high health disparities, or regions in need of targeted interventions. Choropleth maps aid in understanding health patterns and informing public health strategies.
- **Environmental Analysis:** Choropleth maps are useful for visualizing environmental data, such as air quality, water pollution levels, or biodiversity hotspots. They can help identify areas with environmental concerns, regions with high ecological value, or sites for conservation efforts. Choropleth maps support environmental monitoring, resource management, and conservation planning.
- **Policy and Planning:** Choropleth maps are valuable tools for policymakers and urban planners to visualize and analyze data relevant to their work. They can represent variables such as land use, transportation networks, crime rates, or education indicators. Choropleth maps help identify areas in need of infrastructure development, areas with high crime rates, or regions with educational disparities.
- **Election Analysis:** Choropleth maps are commonly used in political science and election analysis to represent voting patterns and election results. They help visualize political affiliations, party support, or voter turnout across regions. Choropleth maps provide insights into electoral trends, swing regions, or areas with strong support for particular candidates or parties.
- **Market Analysis:** Choropleth maps are employed in business and marketing to analyze market penetration, customer demographics, or sales data. They help identify target markets, areas with high demand, or regions with low market saturation. Choropleth

Advantages of Choropleth Maps:

- **Clear Data Patterns:** Choropleth maps provide a clear visual representation of data patterns by using different colours or patterns to represent different data categories or ranges. This makes it easier to understand the spatial distribution and variations of data across geographic regions.
- **Effective Communication:** Choropleth maps are widely recognized and understood by a broad audience, making them an effective tool for communicating data insights. The use of colour gradients or distinct shades allows for quick interpretation of relative differences or intensities in the data.

Disadvantages of Choropleth Maps:

- **Data Misinterpretation:** Choropleth maps can be prone to misinterpretation if the map reader does not fully understand the data categories or the legend used. Incorrect interpretation of colours or categorization can lead to misleading conclusions or misrepresentation of the data.
- **Arbitrary Boundary Effects:** Choropleth maps are sensitive to the chosen geographic boundaries or units. Different boundaries can lead to variations in data representation and potentially affect the interpretation of data patterns. The use of predefined administrative boundaries may not align with the natural spatial distribution of data.

Dot map

A dot map is a method of representing area data by using individual dots or markers to represent a specific quantity or count of the variable being depicted. Each dot on the map represents a fixed amount or a certain number of occurrences of the variable within a given area or region.

In a dot map, the dots are distributed across the map in locations corresponding to the specific areas or regions to which they belong. The density or concentration of dots in a particular area reflects the higher values or greater occurrences of the variable in that area, while sparser areas indicate lower values or occurrences.

Dot maps are particularly useful when displaying discrete or countable data, such as population counts, crime incidents, disease outbreaks, or the occurrence of specific events. They provide a visual representation that allows viewers to quickly understand the spatial distribution, patterns, and density of the variable of interest across different areas.

When creating a dot map, it is essential to carefully choose the dot size, colour, or other visual attributes to ensure clarity and readability. It is also important to consider any potential biases or limitations of the data and communicate the appropriate scale or legend to interpret the dot representation accurately.

Dot maps can be a powerful tool for visualizing and analysing area data, providing insights into spatial patterns and helping to identify hotspots, clusters, or areas of interest related to the variable being represented.

Flow Maps/Chart

Flow chart is a combination of graph and map. It is drawn to show the flow of commodities or people between the places of origin and destination. It is also called Dynamic Map. Transport map, which shows the number of passengers, vehicles, etc., is the best example of a flow chart. These charts are drawn using lines of proportional width. Many government agencies prepare flow maps to show density of the means of transportation on different routes. The flow maps/ charts are generally drawn to represent two the types of data as given below:

1. The number and frequency of the vehicles as per the direction of their movement

2. The number of the passengers and/or the quantity of goods transported. Requirements for the

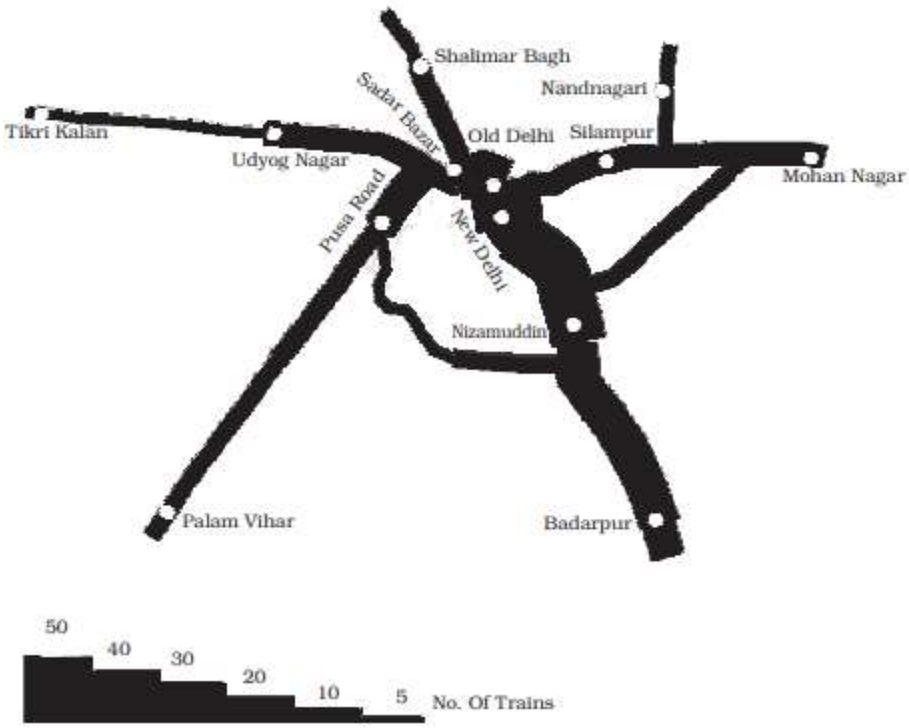
Preparation of a Flow Map

(a) A route map depicting the desired transport routes along with the connecting stations. (b) The data pertaining to the flow of goods, services, number of vehicles, etc., along with the point of origin and destination of the movements. (c) The selection of a scale through which the data related to the quantity of passengers and goods or the number of vehicles is to be represented.

Example:

Construct a flow map to represent the number of trains running in Delhi and the adjoining areas as given in the Table. Construction (a) Take an outline map of Delhi and adjoining areas, in which railway line and the nodal stations are depicted. (b) Select a scale to represent the number of trains. Here, the maximum number is 50 and the minimum is 6. If we select a scale of 1cm = 50 trains, the maximum and minimum numbers will be represented by a strip of 10 mm and 1.2 mm thick lines, respectively, on the map. (c) Plot the thickness of each strip of route between the given rail route.

S. No.	Railway Routes	No. of Trains
1.	Old Delhi – New Delhi	50
2.	New Delhi-Nizamuddin	40
3.	Nizamuddin-Badarpur	30
4.	Nizamuddin-Sarojini Nagar	12
5.	Sarojini Nagar – Pusa Road	8
6.	Old Delhi – Sadar Bazar	32
7.	Udyog Nagar-Tikri Kalan	6
8.	Pusa Road – Pehladpur	15
9.	Sahibabad-Mohan Nagar	18
10.	Old Delhi – Silampur	33
11.	Silampur – Nand Nagari	12
12.	Silampur-Mohan Nagar	21
13.	Old Delhi-Shalimar Bagh	16
14.	Sadar Bazar-Udyog Nagar	18
15.	Old Delhi – Pusa Road	22
16.	Pehladpur – Palam Vihar	12


Shalimar Bagh
Nandnagari
Sadar Bazar
Tikri Kalan
Old Delhi
Silampur
Udyog Nagar
Mohan Nagar
Pusa Road
New Delhi
Nizamuddin
Palam Vihar
Badarpur
50
40
30
20
10
5
No. Of Trains

******

MIDNAPORE CITY COLLEGE

Department of Pure and Applied Sciences

B.Sc. Honours Major in Geography

Semester: IV

Paper: Major 7P

Topographical Map (Practical)

MJ-7P: Topographical Map (Practical) Credit 01

1. Topographical map: Numbering system, Broad Physiographic Division, Serial Profile: Superimposed, Projected, Composite.

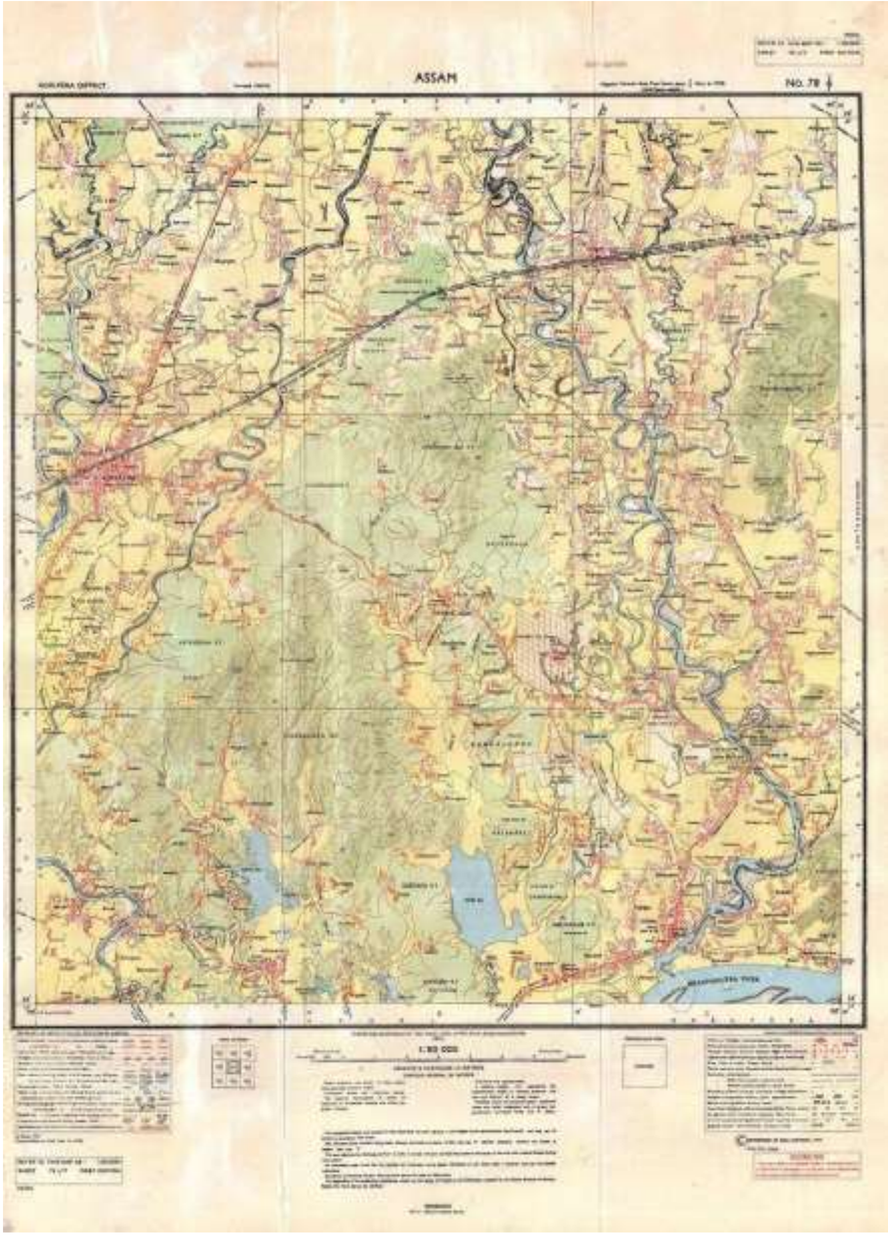
2. Extraction of cultural features from toposheet; Relation between physical & cultural features: Transect Chart.

3. Annual Trend of Production of Mineral Resources by time series analysis.

Maps which represent a symbolic or conventional picture of the physical and cultural maps or topo-landscape of small area on very large scale are known as Topographical sheets.

Map on Globe

- These maps are based on actual survey of the area.
- The scale of the maps is large enough to show the physical and cultural features in detail.
- These features are represented by specific symbols, signs and colours.
- Topo sheets are available on scale of 1:250000 and 1:50000 & 1:25000.



Topo Sheet

'Topographic sheet' contains information about an area like roads, railways, settlements, canals, rivers, electric poles, contours/levels and important land marks etc. According to their usage, they are available at different scales (e.g. 1:250000, 1: 50000 and 1:25000 etc, where the former is a small scale as compared to the latter). They are made on a suitable projection for that area and contain lat-long information at the corners. Thus, any point on it can be identified with its corresponding lat-long, depending upon the scale (i.e. if the scale is large, more accurate lat-long).

‘Survey of India, The National Survey and Mapping Organization of the country under the Department of Science & Technology, is the OLDEST SCIENTIFIC DEPARTMENT OF THE GOVT. OF INDIA. It was set up in 1767. In its assigned role as the nation's Principal Mapping Agency, Survey of India bears a special responsibility to ensure that the country's domain is explored and mapped suitably, provide base maps for expeditious and integrated development and ensure that all resources contribute with their full measure to the progress, prosperity and security of our country now and for generations to come.

INFORMATION ON TOPOGRAPHICAL MAPS

- Name of State and District
- Location in terms of latitude and Longitude
- Scale
- Magnetic declination
- Conventional signs
- Date of issue and revision of toposheet.
- Type of landforms such as general slope, hills, valleys etc.
- Drainage – Important rivers and tributaries, drainage pattern
- Vegetation – Type of forest and type of trees and their distribution.
- Forest location and area covered
- Wild life sanctuaries and area covered
- Land Use cultivated land, waste land and other uses
- Means of irrigation – Canal, wells and tanks etc
- Communication – Railway, roadways, Bridges, cart track, Telephone
- Transmission lines, airport, seaport etc.
- Settlement – Urban centers, their sizes, rural settlement their pattern

The numbering system of topographical maps (Topo maps) refers to how map sheets are organized and identified, especially in a grid system such as those used by national survey departments like the Survey of India (SOI). Here's an overview of the Topographical Map Numbering System, particularly as followed by SOI and most common mapping authorities:

1. Topographical map: Numbering system.

1. Series Level (1:1,000,000 scale)

- The Earth is divided into blocks of **4° latitude × 4° longitude**.
- Each block is assigned a number (in India, from 1 to 136).
    - For example: **55** (central India region)

2. Degree Sheet Level (1:250,000 scale)

- Each 1:1,000,000 map is divided into **16 parts**.
- Each part is **1° × 1°** in size.
- These sheets are denoted by adding a capital letter (A to P) to the series number.
    - For example: **55D**, **55H**

3. Toposheet Level (1:50,000 scale)

- Each 1° × 1° sheet (e.g., 55D) is further divided into **16 sheets**, each of size **15′ × 15′ (minutes of latitude and longitude)**.
- These are labeled with numbers **1 to 16**, from **top-left to bottom-right** in a **4×4 grid**.

Example:

- **55D/7** → Toposheet number 7 in the 55D block (covers a 15′ × 15′ area)

4. Larger Scale (1:25,000 or 1:10,000)

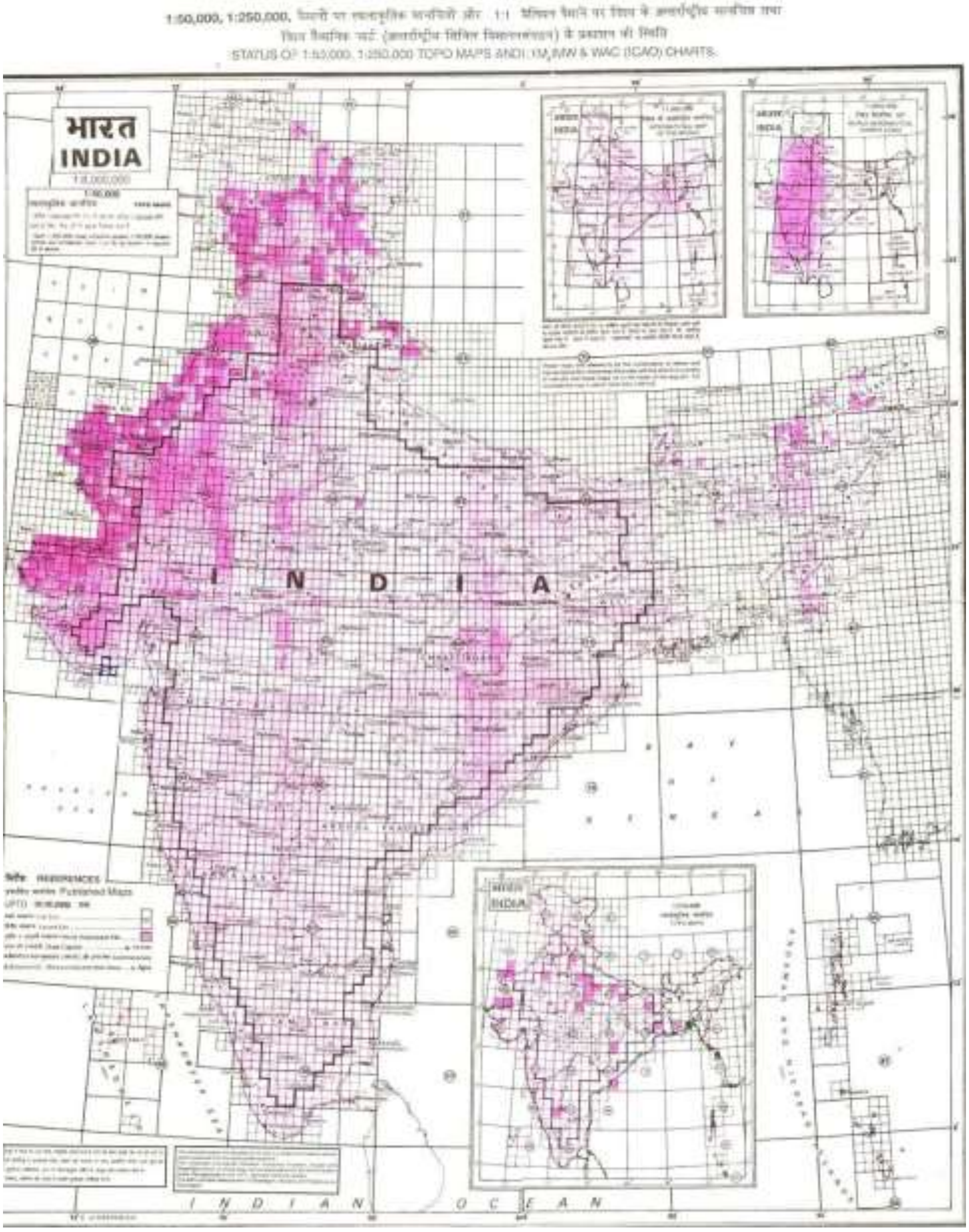
- Each 1:50,000 sheet can be divided further into **four 7.5′ × 7.5′** sheets:
    - **55D/7 NW**, **55D/7 NE**, **55D/7 SW**, **55D/7 SE**
- Or, for 1:10,000 scale, even finer subdivisions are made.

Summary Table:

Scale	Division Size	Notation Example
1:1,000,000	4° × 4°	55
1:250,000	1° × 1°	55D
1:50,000	15′ × 15′	55D/7
1:25,000	7.5′ × 7.5′	55D/7 NW

Number of map (example)	Name	Number of Divisions	Scale in Degrees	Scale in Inches	Scale in Centimeters	Contour interval in ft.
53	Million Sheet	136	4° latitude × 4° longitude	1 in = 16 mile	1cm = 10 km	500
53 C	Degree or Quarter	16 (A to P)	1° latitude × 1° longitude	1 in = 4 mile	1cm = 2.5 km	250
53 C/NE	Half Inch	4 (NE, SE, NW, SW)	30'× 30'	1 in = 2 mile	1cm = 1.25 km	100
53 C/8	Inch	16 (1 to	15' × 15'	1 in =	1cm = 0.5	50

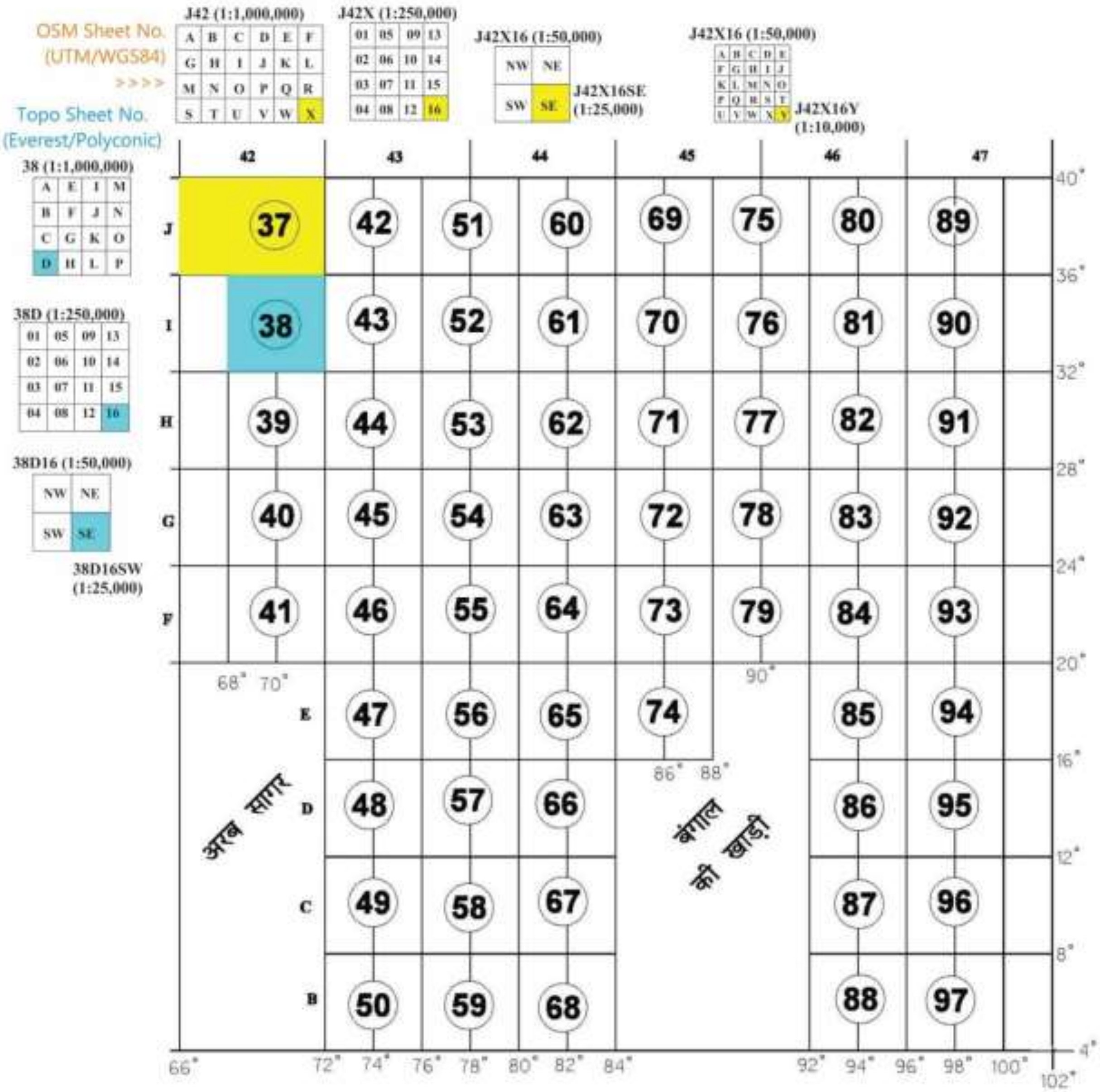
Characteristics of Different Scales SOI Toposheet

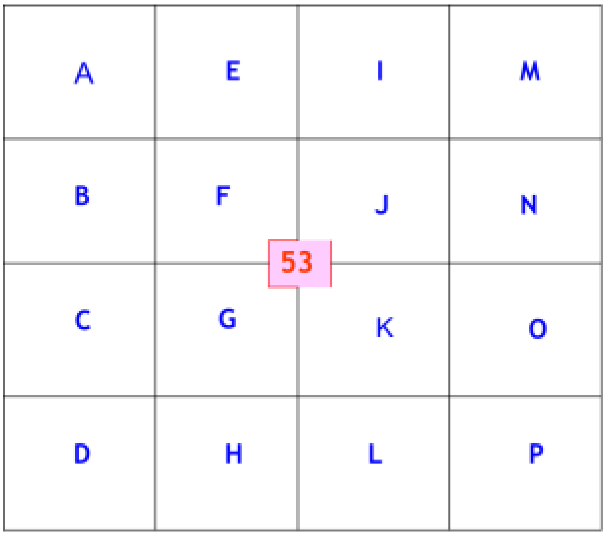


Topo Sheet Grid

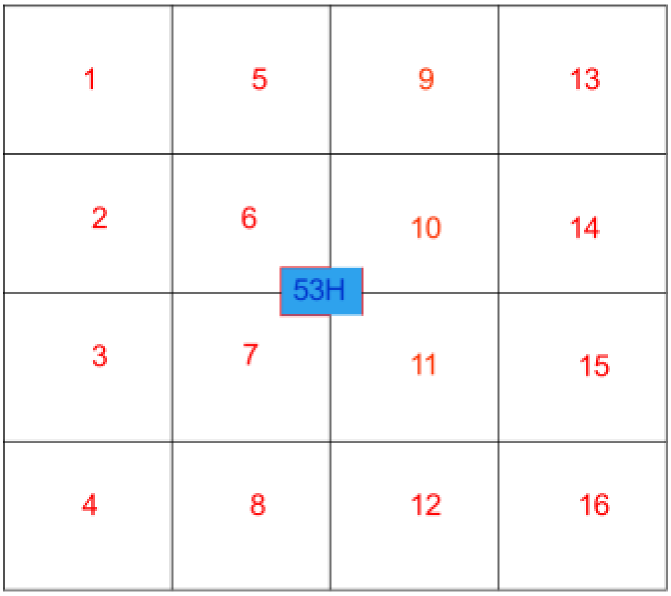

INDEX TO THE SHEETS OF THE
INDIA AND ADJACENT COUNTRIES SERIES

Index for conversion of Topo Sheet No. to OSM Sheet No.

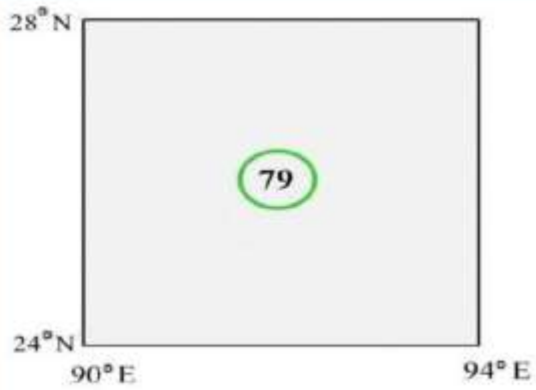




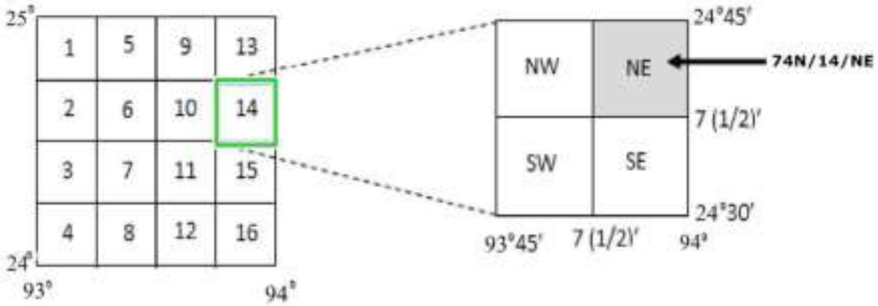
TOPOGRAPHICAL MAPS SCALE 1:250000 (Each sheet cover area equal to 1 degree x 1 degree)



TOPOGRAPHICAL MAPS SCALE 1:50000 (Each sheet cover area equal to 15 Minutes x 15 Minutes)



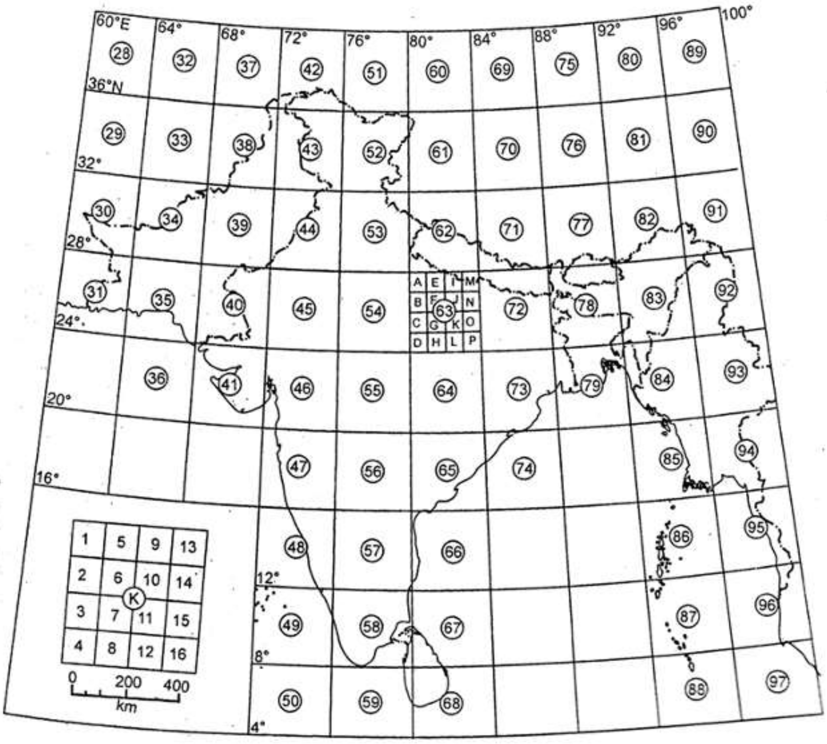
A Sheet of 4° x 4° (Scale: 1:1,000,000)

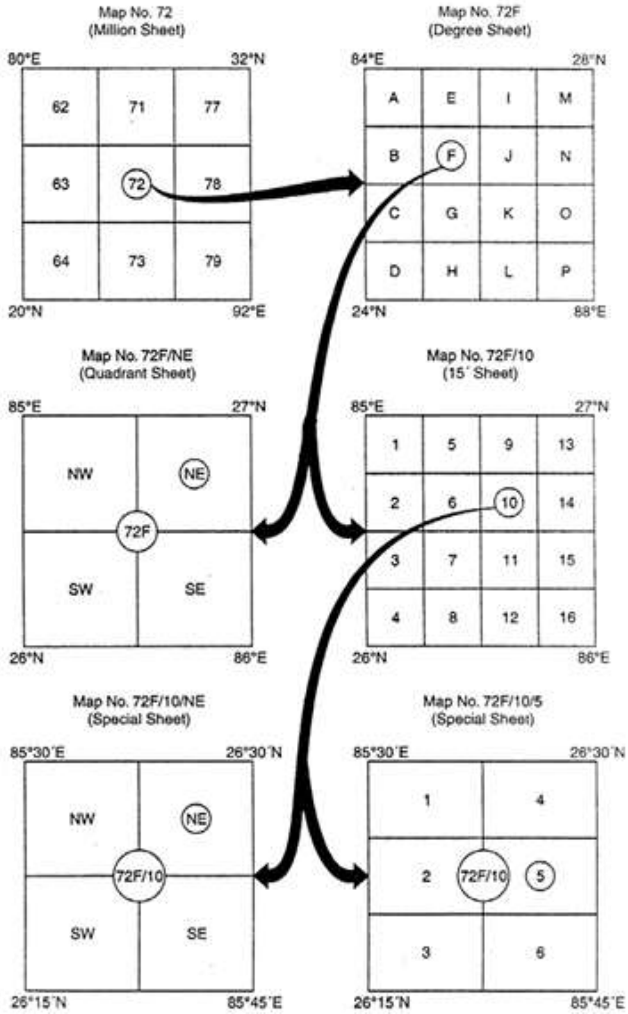


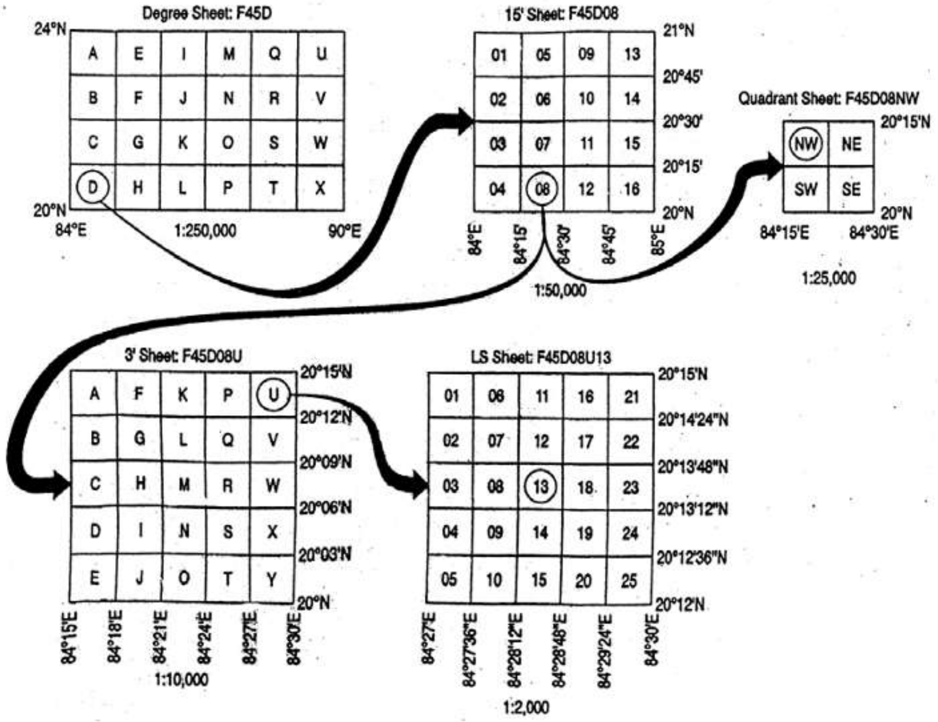
A Sheet of 1° x 1° (Scale : 1:250,000) A Sheet of 7(1/2)′ x 7(1/2)′ (Scale : 1:25,000)

Topographical maps with scales

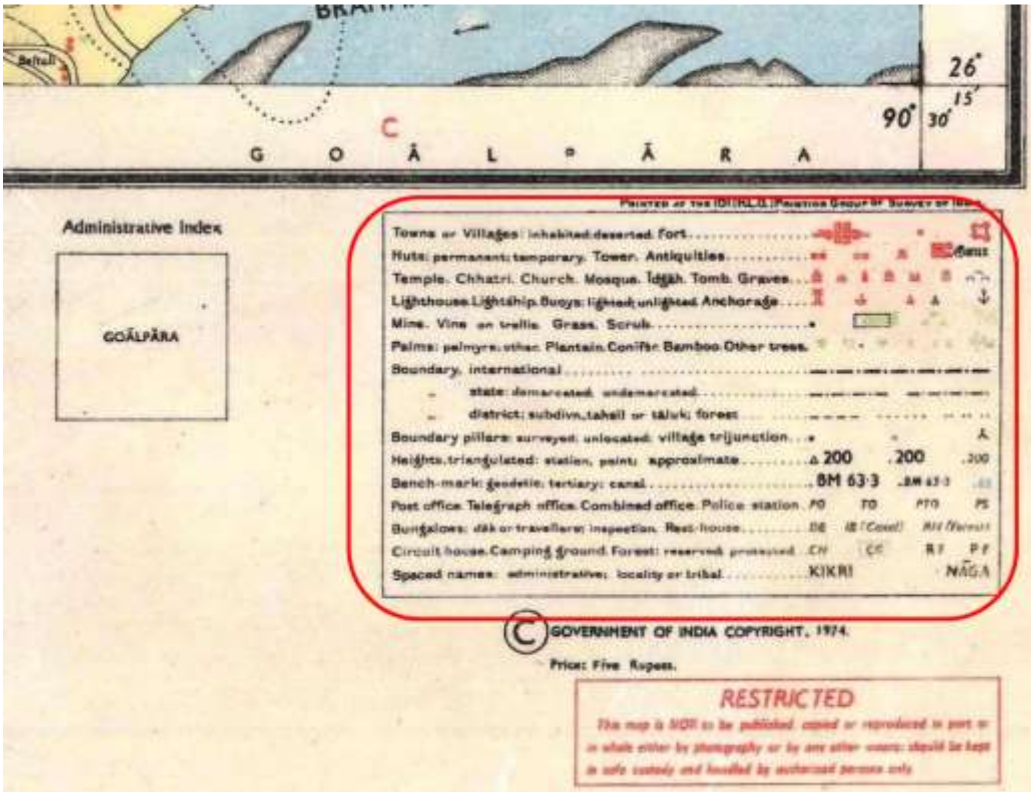
1″ to 16 miles	1″ to 4 miles	1″ to 2 miles	1″ to 1 miles	1″ to ½ miles
↓	↓	↓	↓	↓
1:1000,000	1:2500,000	1:125,000	1:50,000	1:25,000


60°E
64°
68°
72°
76°
80°
84°
88°
92°
96°
100°
36°N
32°
28°
24°
20°
16°
12°
8°
4°
0 200 400
km

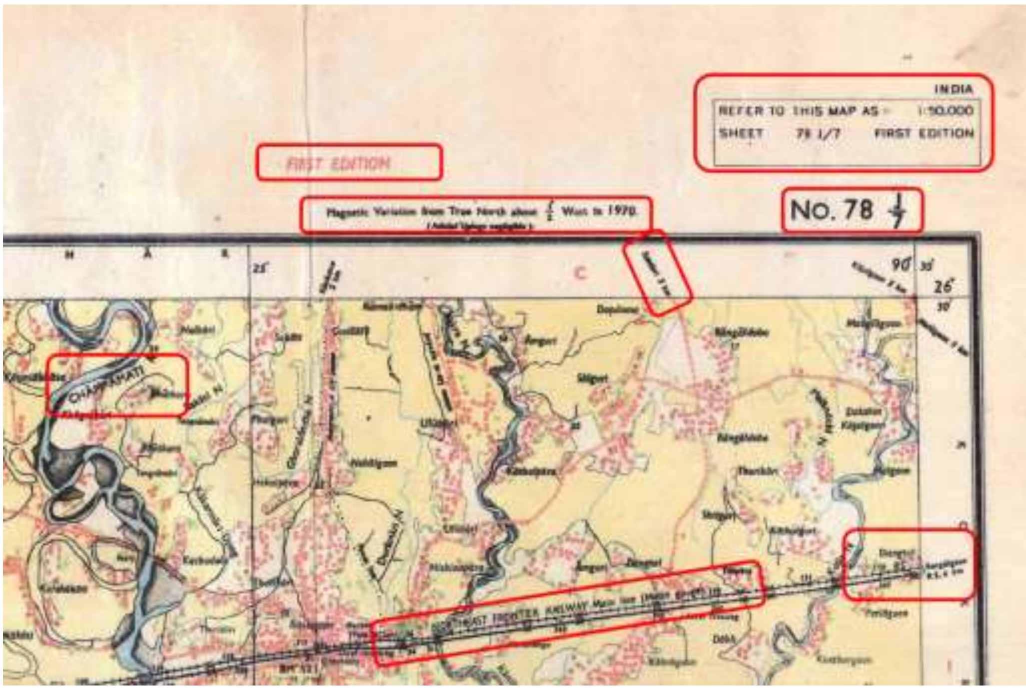

Map No. 72
(Million Sheet)
80°E
32°N
62 71 77
63 72 78
64 73 79
20°N
92°E
Map No. 72F
(Degree Sheet)
84°E
28°N
A E I M
B F J N
C G K O
D H L P
24°N
88°E
Map No. 72F/NE
(Quadrant Sheet)
85°E
27°N
NW NE
72F
SW SE
26°N
86°E
Map No. 72F/10
(15´ Sheet)
85°E
27°N
1 5 9 13
2 6 10 14
3 7 11 15
4 8 12 16
26°N
86°E
Map No. 72F/10/NE
(Special Sheet)
85°30´E
26°30´N
NW NE
72F/10
SW SE
26°15´N
85°45´E
Map No. 72F/10/5
(Special Sheet)
85°30´E
26°30´N
1 4
2 72F/10 5
3 6
26°15´N
85°45´E



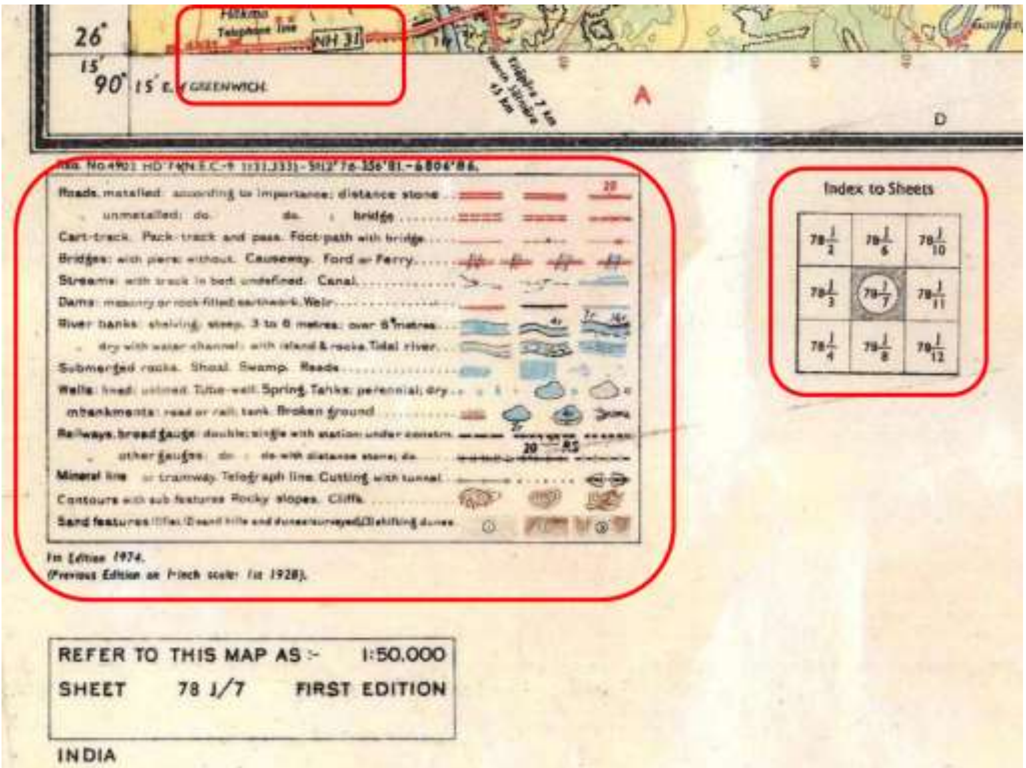
Open Scales Map: Dimension and Scale



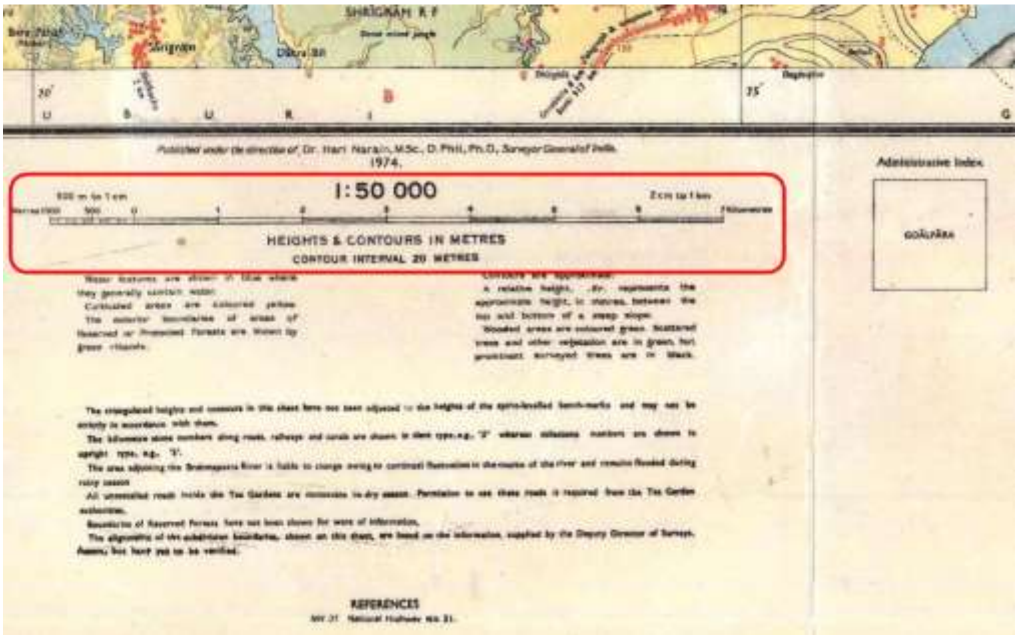
Topo Sheet Reading



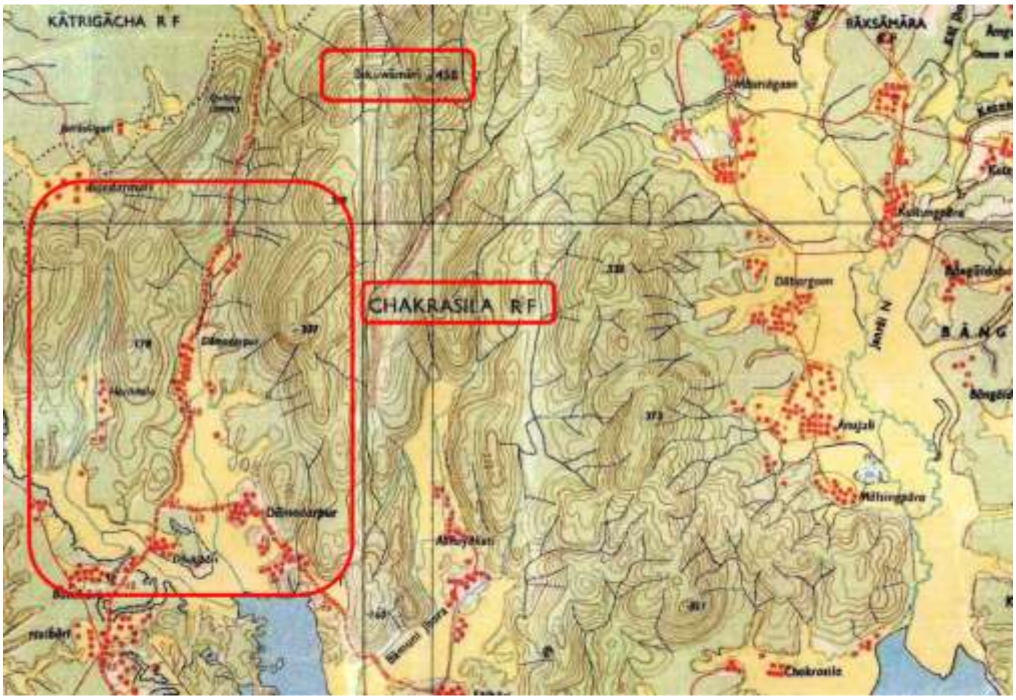
Topo Sheet Reading



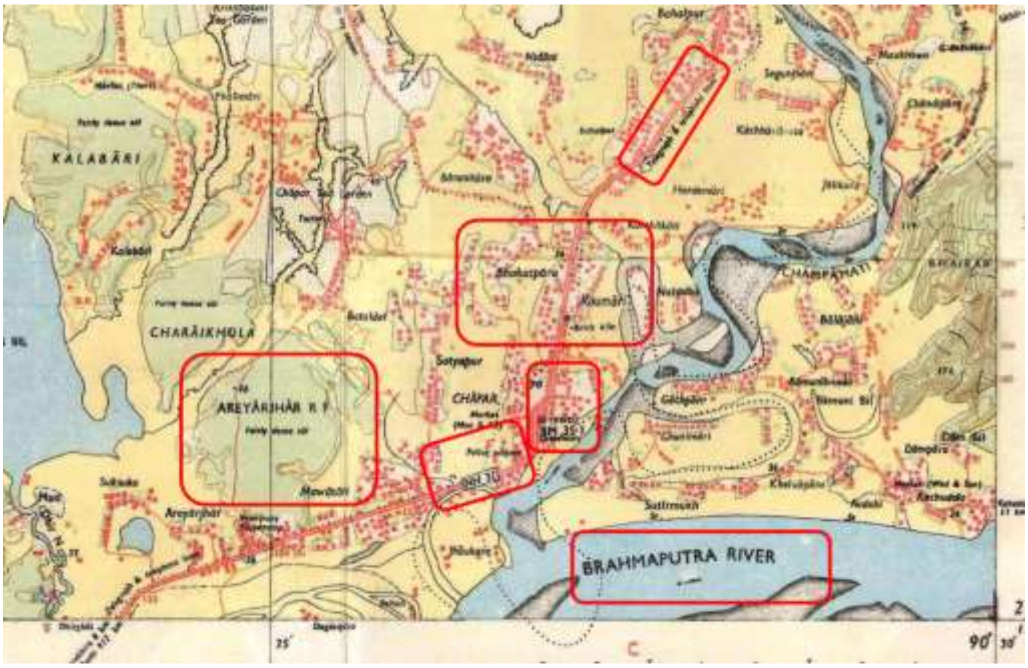
Topo Sheet Reading



Topo Sheet Reading

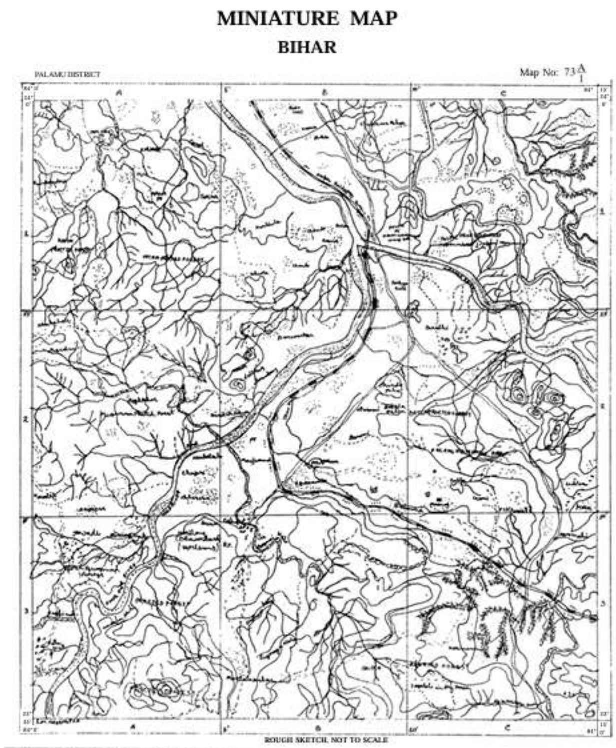


Topo Sheet Reading



Topo Sheet Reading

Broad Physiographic Division



Topographical Map Interpretation of Sheet No. 73A/1

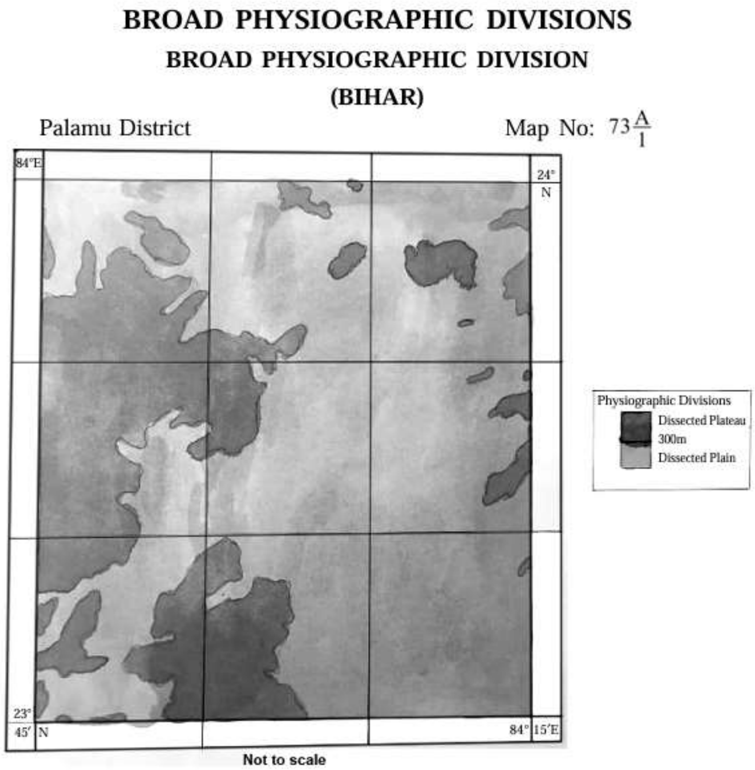
1. Introduction

The topographical sheet numbered 73A/1 represents a part of the Palamu district in Bihar. This map has a scale of 1:50,000, meaning 2 cm on the map represents 1 km on the ground. The contour interval is 20 meters, and the area was surveyed during 1979–1980. The region spans from 23°45′ N to 24°00′ N latitude, and 84°00′ E to 84°15′ E longitude.

2. Physiographic Divisions

The region lies in a dissected plateau landscape, shaped by the North Koel River and its tributaries. The area consists of elongated flat-topped ridges, isolated conical hills, and deeply incised valleys. Elevations range between 240 m and 500 m. The general slope of the region is from southwest to north, as inferred from the flow direction of the North Koel River.

The physiography is broadly classified into **three zones**:



2.1. Dissected Plateau (Zone I)

- Elevation: Above 300 m, with highest points like Baduentani (500 m), Lahara Pahar (498 m), Ranimai Pahar (464 m), and Budhubean Pahar (587 m).
- Location: Found in western, southwestern, and parts of the eastern region.
- Characteristics:
    - Densely forested (mainly sal).
    - Inaccessible terrain.
    - Hills are separated by deep valleys.
    - Relative relief: 150–200+ meters.

    - Slope: Generally >15°.

2.2. Dissected Plain (Zone II)

- Elevation: Below 300 m.
- Location: Found in northern, northeastern, central, and patchy southeastern parts.
- Characteristics:
    - Formed along valleys of the North Koel, Anunaga rivers, and their tributaries.
    - Includes the interfluvial zones between streams like Jungle, Khuli, Denis, and Crobours Nala.
    - A badland area is observed in the southern extremity.
    - Relative relief: 50–150 meters.
    - Slope: 5°–15°, steeper at transitions to Zone I.

2.3. Low-lying Undulating Plain (Zone III)

- Elevation: 140–200 m.
- Location: Adjoining rivers in the south-eastern, northern, and western parts.
- Characteristics:
    - Gently undulating to flat terrain.
    - Includes lower parts of Khalkalia Nala, Champal Nadi, and Karandi Ghar.
    - Widely spaced contours and 3rd or 4th order streams.
    - Relative relief: <50 meters.
    - Slope: <5°, due to fluvial planation.

3. Typical Physiographic Features

- Escarpments: Found in the southeastern corner near Jal Reserved Forest, with steep vertical falls to the south.
- Elongated ridges: Present in the north-western region near Landakat Reserved Forest.
- Conical hills:
    - Identified by concentric contours.
    - Notable examples: W-N-W sector and near Rampur Reserved Forest in the southeast.

    - Formed due to erosional dissection of former ridges.

- Steep-sided ridges:
    - Located in the northern and eastern parts.
    - Narrow, dissected by 1st order streams, act as watersheds.
- Concave slopes:
    - Observed in the western region.
    - Higher elevations have closely spaced contours, lower elevations show wider spacing—indicative of concave slope patterns.

Conclusion

The topographical sheet 73A/1 illustrates a complex landscape of the Palamu district, shaped by fluvial processes and differential erosion of the plateau. The three physiographic zones exhibit clear differences in elevation, slope, vegetation, and drainage, making the region a classic example of a dissected plateau terrain.

1. Serial Profile: Superimposed, Projected, Composite.

In a continuous landscape one may be interested to visualize the general sky line for an area along a selected path. Profile or a section is a method which helps to visualize the relief feature for a larger area drawn along a selected base line.

Types of Profiles

Profiles drawn for three or four selected individual base line are called **Serial profiles**. When profile sections of all serial profiles are drawn on a same vertical baseline it is named as **superimposed profile**. When one of the serial profile is kept as a base and the elevated portions of successive profiles are drawn it is known as **projected profile**. The line joining the topmost elevated portions of all the serial profiles drawn on a same base line gives the sky line or summit line for that region. This is termed as **composite profile**.

Steps to Draw Profiles

Step 1: Trace the contours in the toposheet for a size of 10 cm by 10 cm with the contour height.

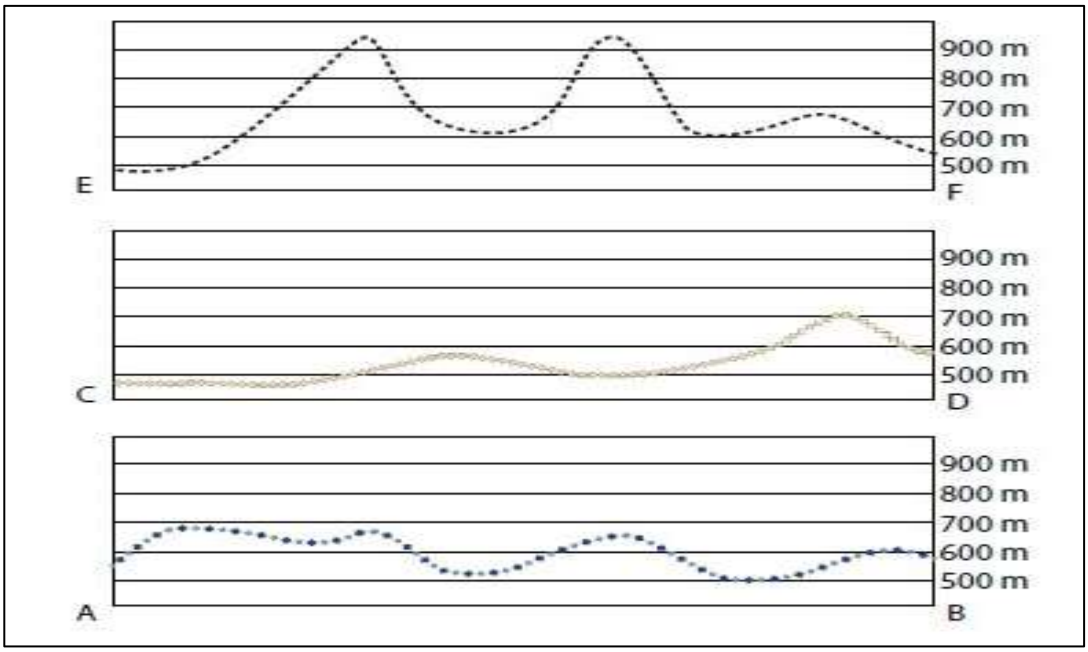
Step 2: Select four base lines at a distance of 2.5 cm each. Name them as AB, CD and EF.

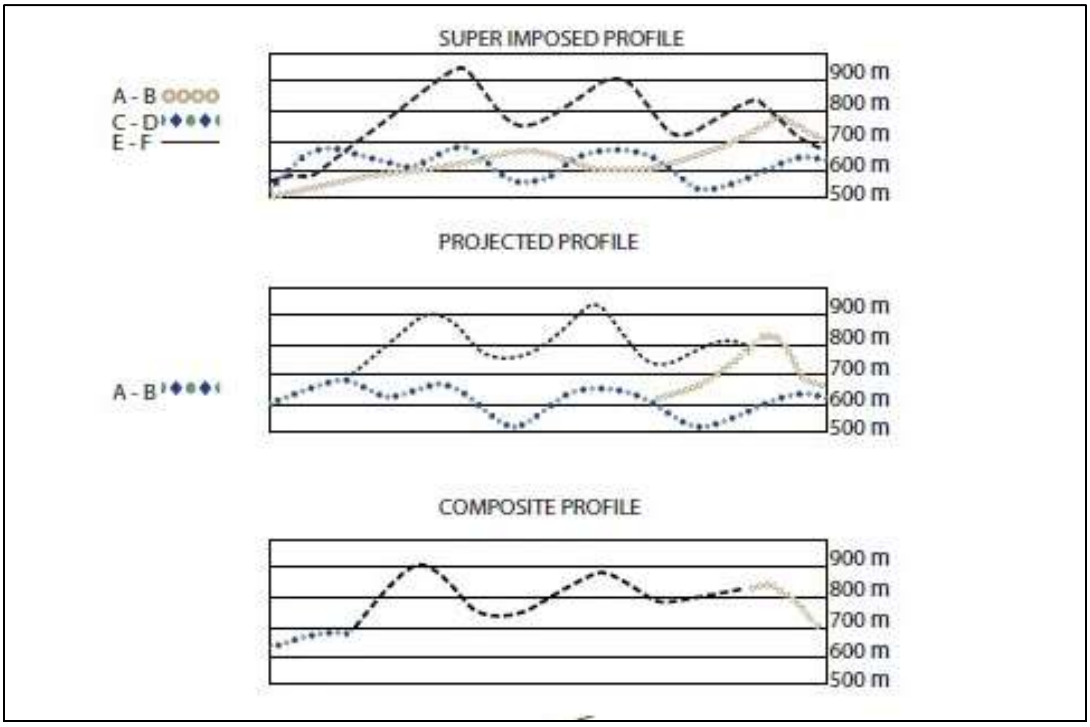
Step 3: Draw the horizontal lines to represent contour with suitable vertical exaggeration.

Step 4: On this vertically exaggerated figure carefully draw cross sections separately for all the selected lines (AB, CD and EF) as described in the previous section. They are named as **serial profile**. Draw each section in different colour for better visualisation.

Step 5: For **super imposed profile** draw the sections of each line on one vertically exaggerated line with the same colours used as before.

Step 6: Draw a common vertically exaggerated base line. First draw the cross section of AB line. Next while drawing the cross section of CD line draw only those parts which are the higher than AB line. Next draw the cross section of line EF which lies above the CD line.





2. Relation between physical & cultural features: Transect Chart.

The marginal information of the given topographical map is:

MARGINAL INFORMATION	WHOLE TOPOSHEET
Reference No	73 1/6
Geographical location	Lat: 22°30’ N - 22°45’ N Long- 86°15’E- 86°30’ E
Administrative location	State: Bihar, Dist: Singhbhum, State: W.B. Dist: Puruliya
Area	708.24 sq.km
Scale	1:50000
Contour interval	10 m
Surveyed	1976-77
Published	1978
Published under	SOI

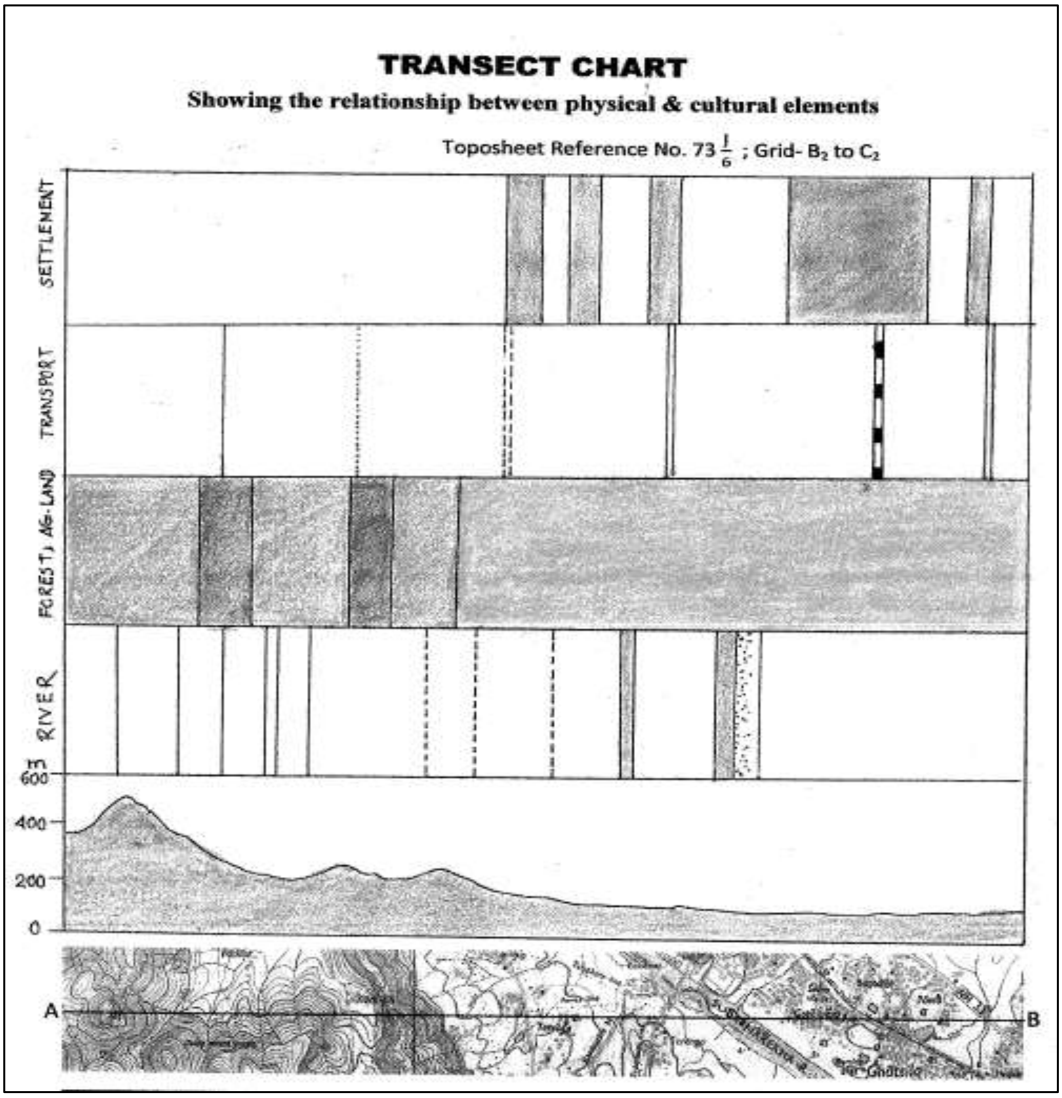
Interpretation

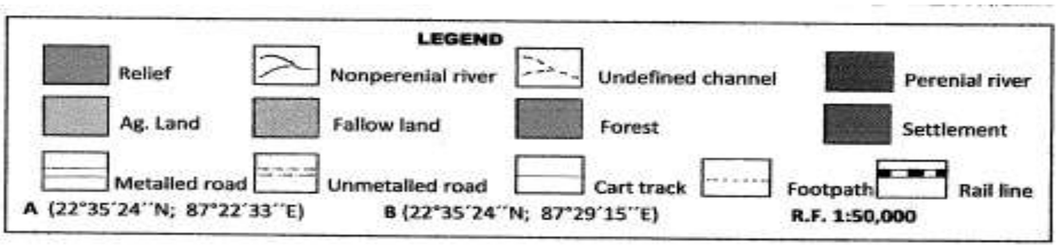
From the transect chart it is clearly found that the physical and cultural features of the region is strongly correlated.

The highland of this area (plateau) plays a vital role in controlling the flow direction, drainage pattern and valley shape of these rivers of this area. Forests are dense over the plateau proper and relatively less dense over the erosional plain. In high altitude area of plateau forest are dense because of less expansion of agriculture and settlement and on the other hand in plain areas there are no forest zones due to more expansion of agriculture and settlement.

There is a negative relationship between relief and settlement. The number of settlement decrease with increasing altitude and vice versa. Dispersed type of settlements is common in plateau region and erosional plain areas are densely populated because of the development of agriculture, transport and communication system.

Developed transport and communication system are found in plain areas compared to plateau area due to flat surface and low altitude. In plateau areas footpath, cart tracks, un metaled road etc. are found. In plain areas developed transport and communication system like railways and metaled road etc. are found.





DISCLAIMER

This self-learning material is based on different books, journals and web sources.