Lesson - 6

Climate of Bharat

Bharat is characterized by climatic diversities due to its vast expansion and variations of relief. But despite climatic diversities, unity is apparent in the country due to monsoonal effect everywhere. Therefore, climate of Bharat is called as **Monsoon Climate**.

Various geographical factors affect the climate of Bharat. It is necessary to have a detailed study of these factors to better comprehend the climate of our country.

Factors Affecting Climate

1. Elevation above Sea Level - Temperature is negatively correlated with it. Normally there is a decrease of 1°C. per 165 metres height. It explains why the higher slopes of Himalayas are snow covered. Despite the location on the same latitude, variations in temperature are observed due to difference in heights of Mussourie with 24°C., Dehradun 32°C. and Ambala with 40°C.

2. Distance from Sea - Maritime effect is humid and equable. Its effect can be observed in the form of minimum range of temperature and humid climate of coastal cities. Extremities, range of temperature and aridity increases with increasing distance from sea. Annual rainfall averages 200 cms. in western coastal areas, while it diminishes to only 5 cms. in Jaisalmer.

3. Distance from Equator - It is the basic factor affecting temperature. It decreases with higher latitudes due to increasing obliquity of sun's rays. It affects the amount of insolation. For this reason, height of snow line is more on the southern slopes of Himalayas and lesser on the northern slopes or towards Tibet. Tropic of cancer passes through the middle of Bharat. Hence, northern Bharat is included in the temperate zone and southern Bharat in the torrid zone.

4. Location of Mountains - It is also an important factor affecting the climate. Western Ghat is located close to the western coast. Therefore, its western slopes receive plentiful rain from south-west monsoon, while its leeward slopes and peninsular plateau come under rain shadow effect.

5. Direction of Mountains - Climate of Bharat is moderate only due to the location and direction of Himalayas. Himalayas protect Bharat from the cold Siberian winds. Besides, the mountains also effectively check the summer monsoon and force it provide rain in Bharat. Similarly, the main reason for scanty rain in western Rajasthan is the parallelism of south-western monsoon with Aravallis. Hence, Aravallis are not effective barriers in the way of these winds.

6. Direction of Winds - Winds bring with them the characteristics of their source region and their path of travel. Summer monsoon is warm and humid because its source region is Indian Ocean. Source region of winter monsoon is continental and cold, hence, it is cold and dry.

7. Upper Air Circulation - Latest researches have proved that upper air circulation and monsoon are deeply related. Monsoonal climate of Bharat is greatly affected by the movements in the troposphere. Uncertainties of monsoonal period

and quantity of rain also depend upon the conditions of upper air circulation.

Besides, amount of cloudiness, vegetative cover, ocean currents etc. also affect the climate of Bharat partially.

Climatic Conditions

Meteorological department of Government of Bharat has divided the year into the following seasons keeping in view the monsoon period -

(A) North-eastern or Winter Monsoon period -
1. Winter season - December to February
2. Summer season - March to mid-June.

(B) South-western or Summer Monsoon period-
3. Rainy season - mid-June to mid-September.
4. Autumn season - mid-September to December.

(A) North-Eastern or Winter Monsoon Period

1. Winter Season

Winter season prevails from December to February in Bharat. Sky remains clear in this season. Main characteristics of the season are that winds blow slowly and bear little moisture.

Temperature - Temperature increases from north to south in this season. Average temperature ranges from 8°C to 21°C in northern Bharat and from 21°C to 26°C in the south. There is a speedy loss of temperature during nights due to terrestrial radiation in western Rajasthan, hence, temperature drops below freezing point in its various parts. Lowest winter temperatures are recorded on the higher slopes of Himalayas, in Jammu-Kashmir, Punjab and Himachal Pradesh.

Pressure - Intense high pressure develops over land due to the prevailing very low temperatures on the Bhartiya sub-continent in winters. Considering the pressure system over the whole of Asia, the highest pressure is observed near Lake Baikal. Second centre of high pressure prevails near Peshawar in Pakistan and the third one in western Rajasthan. Oceanic areas in this season remain warmer, hence low pressure prevails over Indian Ocean.

Winds - Winds blow from high pressure to low pressure. Therefore, winds blow from land to

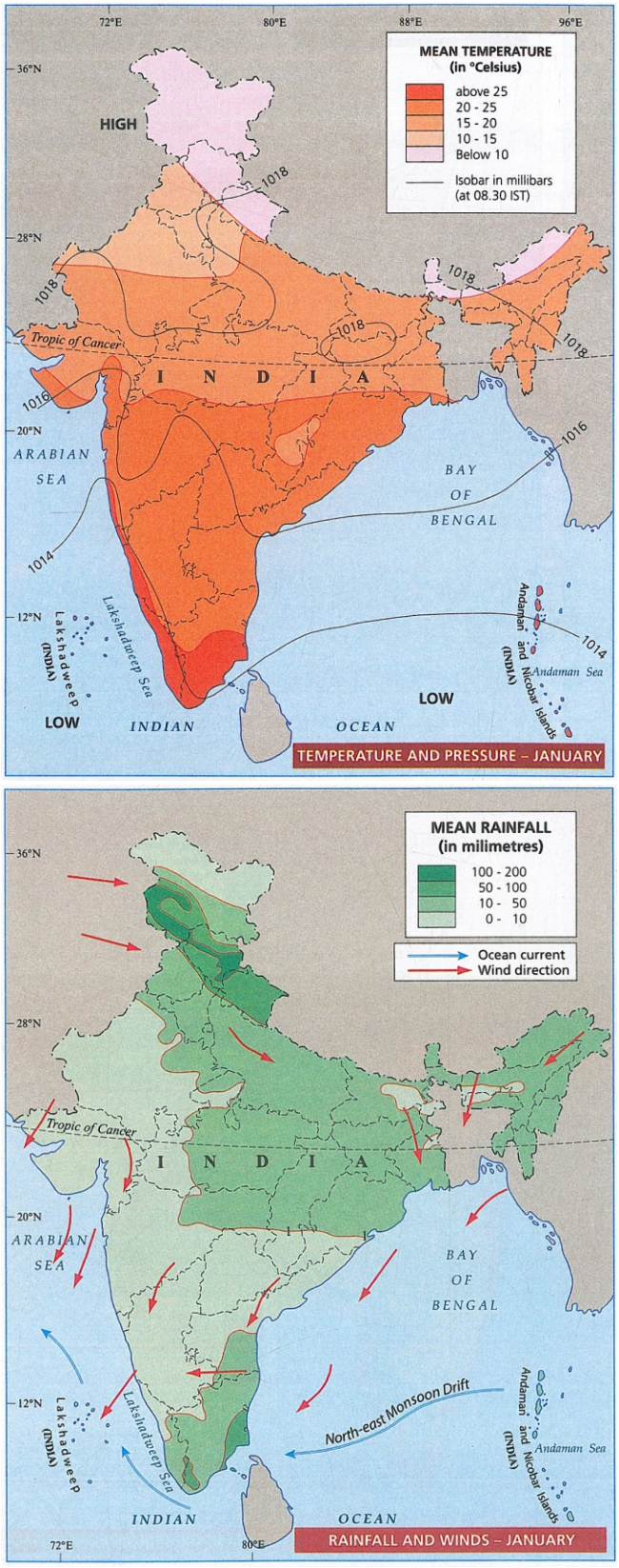

Fig. 6.1 : India : Temperature, Rainfall and Pressure (January)

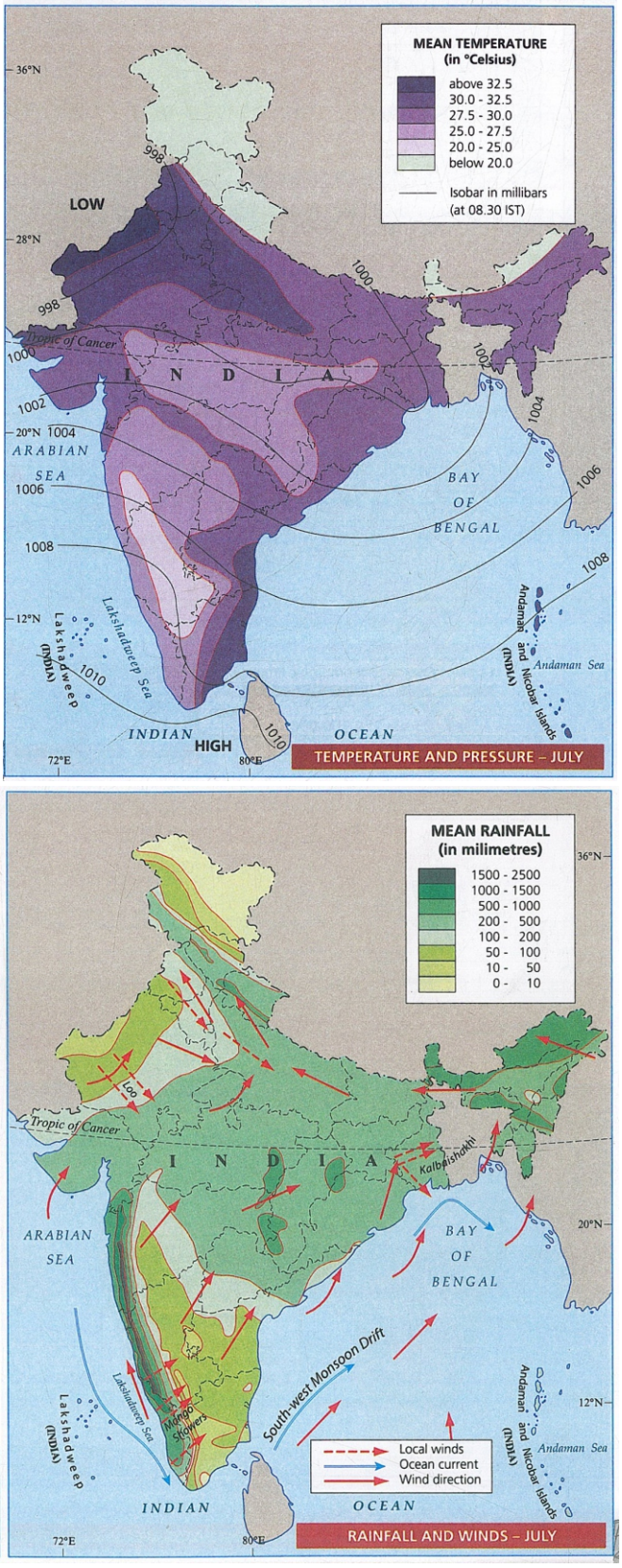

Fig. 6.2 : India : Temperature, Rainfall and Pressure (July)

sea in this season in Bharat. These winds blow from the north-west towards Ganga-Sutlej plain. After crossing the plain, the winds start blowing from the north-east. These winds are known as North-East Monsoon. In this season, a tongue-shaped high pressure area develops over Europe, where prevailing planetary winds are westerlieas. The tongue shaped high pressure area bifurcates the westerlies and related cyclonic depressions. One of the branches reaches north-western part of Bharat after travelling over Mediterranean Sea, Israel, Syria, Jordan, Iraq, Iran, Afghanistan and Pakistan.

Rainfall - Winds in this season are mostly dry because their movement is from land to sea. Therefore, very little rain is provided by these winds in Bharat. A little precipitation is provided by Mediterranean cyclones in Jammu-Kashmir, Himachal Pradesh, Punjab, Haryana, Uttaranchal, Rajasthan and Uttar Pradesh in this season. The rain is locally known as **mawat**. It is very beneficial for the crop. A little rain is also provided by north-east monsoon in the hilly areas of north-eastern Bharat. The winds become drier as these proceed ahead. But these are recharged with moisture while travelling over Bay of Bengal. Tamilnadu is benefitted in the process in the form of winter rains. Hence, the largest part of winter rains is received by Tamilnadu. These conditions have been represented in Fig. 6.1.

2. Summer Season

Its duration is from March to mid-June. May and June are the hottest months of this season. This season is hot and dry. It is characterized by frequent duststorms. These hot and dry winds are known as **Loo**. The volume of wind blown sand and dust is so much that the sky becomes yellowish many times. In northern and western Rajasthan, the duststorms are almost a daily phenomena.

Temperature - Temperature over Bharat starts increasing after March when the sun begins shifting northwards. Increasing trend of temperature tends to reach above 45°C at several places in north-western Bharat. Great plains of northern Bharat also experience very high temperature conditions. Temperatures remain relatively low and mild towards coastal areas. Therefore, southern Bharat experiences lower temperatures due to maritime effect in comparison to the north. Temperatures also remain low in the

Himalayas due elevation above sea level. It has led to the growth and development of several hill stations like Shimla, Mussourie, Nainital, Darjeeling etc. and Mt. Abu in Aravalli hills.

Pressure - High summer temperatures lead to the development of low pressure over northern Bharat. An intense low pressure system develops over Thar desert due to the highest temperatures prevailing there. Pressure increases towards southern Bharat due to lowering of temperatures in that direction. Hence, low pressure prevails over Indian Ocean.

Winds - Temperature rises rapidly in this season as a result of which pressure decreases. The low pressure attracts winds from all sides causing the inset of dust-laden, hot and dry winds, which are known as **Loo**. Maximum effects of the duststorms are observed in Rajasthan, Haryana and Punjab. The duststorms occasionally provide local rains. Winds start blowing from sea to land in coastal regions and southern Bharat. This reversal of winds also causes a little rain in southern Bharat, where it is known as **Mango Showers** and particularly in coffee producing regions as **Blossom Showers**.

(B) South-Western or Summer Monsoon Period

3. Rainy Season

The period of this season extends from mid-June to mid-September. This season is specially important and significant, particularly in an agricultural country like Bharat. It is because wide spread rains occur throughout the country in this season (Fig.6.2 and 6.3).

Pressure, Winds & Rainfall - Pattern of temperature, pressure and winds was explained under the heading of summer season. These conditions become the basis of the inception of winds blowing from sea to land in Bharat. The low pressure of north-western Bharat is so intense that even the south-east trade winds, whose domain lies south of equator, are attracted towards it. After crossing the equator, these winds are deflected towards their right according Ferrel's law. Therefore, these winds become south-westerlies and hence, are known as **South-west Monsoons**. These are humid winds because they blow from sea

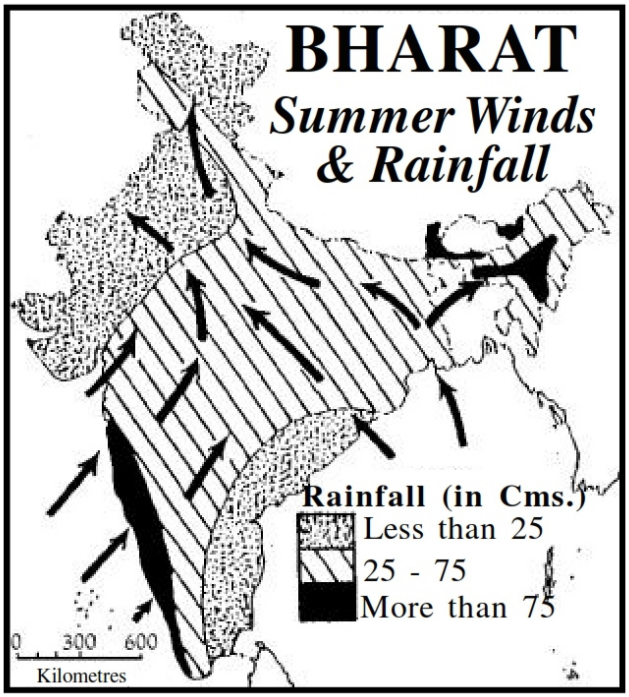

Fig.6.3 : India : Summer Monsoon and Rainfall

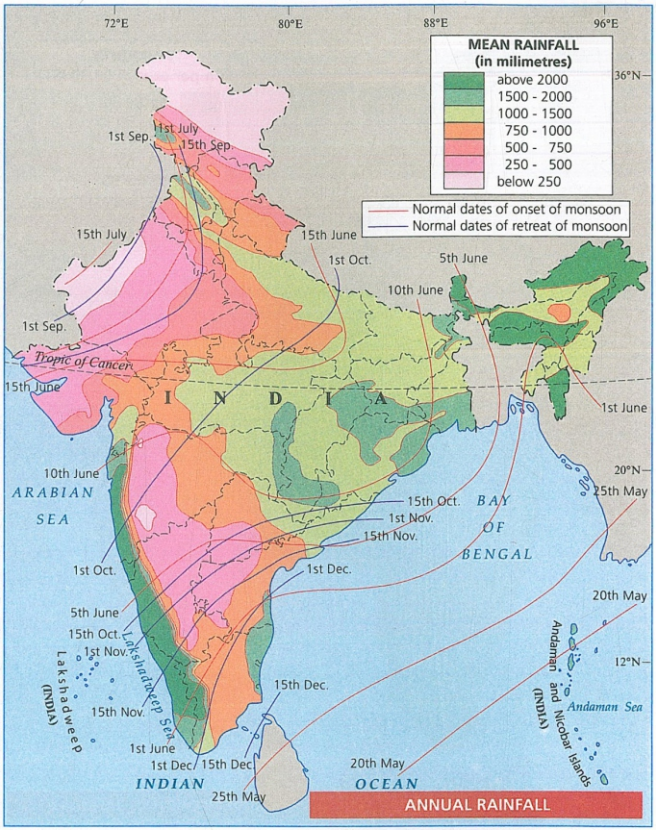

Fig.6.4 : India : Annual Rainfall

to land and provide widespread rains in Bharat. About 90% of the total rains received in Bharat comes in this season. Summer monsoonal winds are bifurcated in two branches due to the shape and location of peninsular Bharat (Fig.6.4) -

(A) Arabian Sea Monsoon and

(B) Bay of Bengal Monsoon.

(A) Arabian Sea Monsoon - Velocity of this branch of monsoon is very high. Therefore, the on-set of monsoonal rain on the Western Ghats occurs very heavily. The heavy on-set of rain is termed as the **Burst of Monsoon**. Velocity of the monsoon is limited only to the western coastal plain and the western slopes of the Western Ghats. The average rainfall is about 250 cms. on the western coast and 500 cms. on the higher windward slopes of the Western Ghats. On crossing the Western Ghats, not only the humidity content in the winds decreases but while descending on the eastern slopes, these winds become warm and dry also. Hence, very less rain is received on the eastern slopes of the Western Ghats and Deccan plateau under rain shadow effect. The average decreases to less than 38 cms. upto Chennai in the east. Thus, the rain shadow effect is apparent in the Deccan Plateau east of Western Ghats (see Fig. 6.5)

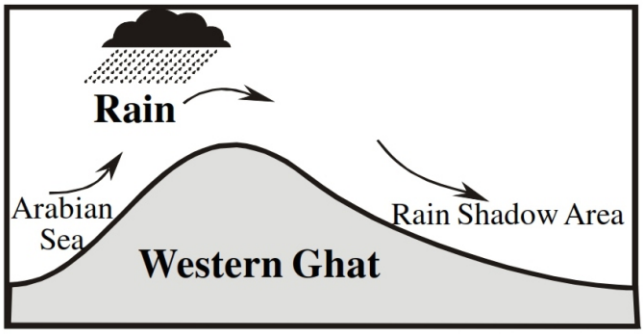

Fig.6.5 : Effect of the Location of Mountains

After crossing the Western Ghats, one branch of Arabian Sea monsoon goes towards Chennai and second branch goes upto Chhota Nagpur plateau following a course between Vindyachal and Satpura ranges. Rainfall average begins at 150 cms. on this track and diminishes to 100 cms. with increasing distance. The third branch of the monsoon provides rain upto Himachal Pradesh in Western Himalayas by following a route through Kutch, Rajasthan, Haryana and Punjab. Rajasthan is not benefitted much by this branch because of its **parallelism with Aravallis**. Rainfall average on this route begins with 50 cms. near Bay of Cambay and diminishes with increasing distance.

(B) Bay of Bengal Monsoon - After originating from Bay of Bengal, its one branch provides very heavy rain in the eastern section of Himalayas. Mausinram, situated in Khasi hills in this section of Himalayas, receive more than 1300 cms. of rainfall. It is the highest rainfall in the world. Another branch goes towards Assam in the east via Brahmputra river valley where it provides plenty of rain. It averages more than 200 cms. The third branch of the monsoon travels westwards parallel to Himalayas through Bihar, Jharkhand, Uttar Pradesh, Uttaranchal, Punjab, Haryana and Rajasthan. Rainfall from this branch decreases with increasing distance from the sea. For example, the average is 170 cms. in Kolkata and it gradually decreases to 120 cms. in Patna, 85 cms. in Allahabad, 70 cms. in Agra, 65 cms. in Delhi, 28 cms. in Bikaner and 5 cms. in Jaisalmer. One more branch of the Bay of Bengal monsoon advances towards Chhota Nagpur plateau and meets with the Arabian sea monsoon branch. Rainfall average rises to 100 cms. in the region due to the meeting of the two branches of monsoons.

4. Autumn Season

The duration of the season is from mid-September to December. It is the season of retreating monsoon.

Temperature - The sun starts shifting southwards in this season, as a result of which temperatures gradually decline in Bharat. Maximum temperatures in the season range between 30° to 35°C which gradually decline to 25°C in coastal and southern Bharat and to 5°C in many parts of northern Bharat. Higher mountainous areas experience temperatures below freezing point.

Pressure & Winds - Pressure also changes in accordance with temperatures. Uncertain state of pressure prevails for some time due to slow decline in temperatures. Gradually, the pressure system reverses from that of the summer season. These conditions lead to the retreat of monsoons.

Rainfall - Amount and areal distribution of rainfall remains limited in this season. A little rain

occurs in Tamil Nadu and a few coastal areas due to retreating monsoon.

Distribution of Rainfall in Bharat

There are widespread variations of rainfall in Bharat, e.g. 1300 cms. in Mausinram and only 5 cms. in Jaisalmer while the average for the country is 110 cms. According to the distributional pattern, Bharat can be divided into four major rainfall regions –

1. Areas with abundant rainfall - The region includes the area receiving rainfall more than 200 cms. Western coastal plain, western/windward slopes of the Western Ghats, eastern Uttar Pradesh, eastern Bihar and Jharkhand, northern part of West Bengal, Assam, Meghalaya etc. are included in this category.

2. Areas with moderate rainfall - The areas receiving rainfall between 100 to 200 cms. are included in this category. The region spreads over the eastern slopes of the Western Ghats, southern part of West Bengal, Orissa, interior areas of Bihar, Chhattisgarh, south-eastern Uttar Pradesh, Haryana and a narrow belt of Himachal Pradesh. These are also termed as **areas with medium rainfall**.

3. Areas with scanty rainfall - Areas receiving 50 to 100 cms. rainfall are included in this category. Deccan plateau, Madhya Pradesh, north-western Andhra Pradesh, Karnataka, eastern Rajasthan, southern Punjab, Haryana and southern Uttar Pradesh are included in the region. The amount of rainfall is scanty with high variability.

4. Areas of insignificant rainfall - The areas receiving less than 50 cms. rainfall are included in this region. It comprises western Rajasthan, western Punjab, Railseema region of Tamil Nadu, Kutch, Laddakh etc.

Characteristics of Bhartiya Rainfall

1. About 90% rainfall in Bharat is received by south-west monsoon in summer season.

2. Monsoonal rain is uncertain in time and period of occurrence. The rain sometimes comes early and sometimes starts late. Sometimes it starts early and ends early or it may stay longer.

3. Spatial distribution is also highly unequal in Bharat.

4. Monsoonal rain does not occur continuously. But it occurs intermittently with a gap of a few days. Occasionally, the gap becomes longer during which crops are dried.

5. In some areas, monsoonal rain occurs in heavy downpours while in some other areas it is received in the form of showers. Heavy rains usually cause soil erosion, leaving the land infertile.

6. Winter season is almost dry. About 10% of the country's rain is received by winter monsoon and cyclones.

7. Number of rainy days in Bharat are few, e.g. 118 days in Kolkata, 55 days in Chennai, 75 days in Mumbai etc. Therefore, irrigation is necessary.

8. The rainfall variability is very high. The areas of Rajasthan, receiving 12 cms. rainfall, have 30% variability. But the variability is 20% in Kanpur and 11% in Kolkata.

Important Points

1. Bharat has monsoon climate.
2. Factors affecting climate of Bharat - elevation above sea-level, distance from sea, distance from equator, location of mountains, direction of mountains, direction of winds, upper air circulation etc.
3. Climatic conditions - (A) North-eastern or Winter monsoon period (winter and summer seasons), (B) South-western or Summer monsoon period (rainy and autumn season).
4. Rainfall distribution is highly unequal; major rainfall regions according to distribution - (i) Areas with abundant rain, (ii) Areas with moderate rain, (iii) Areas with scanty rain and (iv) Areas with insignificant rain.
5. There are many characteristics of monsoonal rain.

Exercise
Multiple Choice Questions

1. Had the equator passed through the middle Bharat, its climate would have been –
   (A) Hot & humid (B) Hot & dry
   (C) Cold & humid (D) Cold & dry

2. In the absence of Western Ghats, the amount of rain in the western coastal region would have been –
   (A) More (B) Lesser
   (C) Nil (D) Uncertain.

3. The group of states having annual rainfall more than 200 cms. is –
   (A) Nagaland, Meghalaya, Manipur & Arunachal Pradesh
   (B) Meghalaya, Manipur, Uttar Pradesh & Madhya Pradesh
   (C) Nagaland, Tamil Nadu, Arunachal Pradesh & West Bengal
   (D) Madhya Pradesh, Manipur, Uttar Pradesh & Meghalaya.

Very Short Answer Type

4. Where is low pressure located in Bharat in summer season?
5. Which winds causes mawat?
6. What is Loo?

Short Answer Type

7. What are the main factors affecting climate of Bharat?
8. How do Mediterranean cyclones originate?
9. How does winter rains occur in Tamil Nadu?

Essay Type

10. Compare summer and winter seasons on the basis of temperature, pressure and rainfall.
11. Describe the distributional pattern of rainfall and its characteristics in Bharat.

Skill

12. Show the annual distribution of rainfall in an outline map of Bharat.
13. Show the pressure conditions and winds of summer season in an outline map of Bharat.

Answer Key

1. (A), 2. (B), 3. (A).