

UNIT 3

DRAINAGE |

Structure

3.1	Introduction Expected Learning Outcomes	3.8	The Peninsular Drainage Systems and its Evolution
3.2	Drainage Systems of India	3.9	The Major River Systems of the Peninsular Drainage
3.3	The Himalayan Drainage Systems	3.10	The Major River Basins of India
3.4	The Evolution of Himalayan Drainage System	3.11	Summary
3.5	The Indus River System	3.12	Terminal Questions
3.6	The Ganga River System	3.13	Answers
3.7	The Brahmaputra River System	3.14	References and Suggested Further Reading

3.1 INTRODUCTION

Indian sub-continent consists of a great diversity of physical features comprising numerous large and small rivers. Rivers in India are one of the important natural resources that provide water for agriculture, industrial activities, domestic use, aquaculture, inland water transport, and production of hydroelectricity etc. Indian rivers carve various forms of geomorphic features such as waterfalls, cliffs, gorges, valleys, flood plains, and deltas etc., along their courses. India receives an average annual rainfall of 120 centimetre. The annual yield of water in Indian rivers is 1,858,100 million cubic metre. Out of the total yield of water, more than one third (33.8 percent) is contributed by the Brahmaputra, followed by Ganga (25.2 percent), Godavari (6.4 percent), Indus (4.3 percent), Mahanadi (3.6 percent), Krishna (3.4 percent), and Narmada (2.9 percent).

This Unit contains discussion on the drainage system of India and its classification as given in Section 3.2. Himalayan drainage system and its evolution have been discussed in Sections 3.3 and 3.4. Elaborate discussion of major river system of Himalayas has been presented in the next Sections of 3.5, 3.6 and 3.7. Further, the Peninsular drainage system and its evolution have been described in Section 3.8 followed by the detailed illustration of major river systems of Peninsular drainage in Section 3.9. Major river basins of India have been identified and discussed in Section 3.10.

Expected Learning Outcomes

After studying this unit, you should be able to:

- identify major river systems of India;
- explain the evolution of Himalayan and Peninsular drainage systems;
- describe the distribution and pattern of Himalayan and Peninsular drainage systems; and
- identify the size and distribution of major river basins of India.

3.2 DRAINAGE SYSTEMS OF INDIA

All of you are familiar with rivers of India which are revered by us since time immemorial and act as lifeline for economic activities. In this Unit, you will learn about these river systems in detail. Drainage systems of India can be broadly divided on many bases. Major classifications can be done based on the following:

1. **Origin:** Based on the origin, Indian rivers are classified into two broad categories (i) The **Himalayan river systems** which include rivers like Ganga, Indus, Brahmaputra and their tributaries. (ii) **The Peninsular river systems** include rivers of India including Narmada, Tapi, Krishna, Mahanadi, Cauvery, Godavari and their tributaries.
2. **Orientation towards the Sea:** The second classification of drainage system of India is based on the rivers' orientation towards the sea i.e., (i) rivers flowing into Bay of Bengal, and (ii) those flowing into Arabian Sea.
Most of drainage of India is oriented towards Bay of Bengal amounting to 77 percent. These comprise large number of rivers such as Ganga, Brahmaputra, Godavari, Krishna, Cauvery, Mahanadi and Penner etc. Whereas, 23 percent of drainage area in India is oriented towards the Arabian Sea. This drainage area is drained by rivers like Indus, Sabarmati, Mahi, Narmada, and Tapi etc.
3. **Size of Catchment Area:** Based on the size of catchment area, Indian rivers are divided into three categories (i) river basins with catchment area of less than 2,000 square kilometre are known as 'Minor river basins', (ii) river basins with catchment area between 2,000 and 20,000 square kilometre are known as 'Medium river basins' and (iii) river basins with catchment area of 20,000 square kilometre and above are known as 'Major river basins'.

Below given Fig. 3.1 depicts the drainage system of India. After studying the classification of drainage systems of India, you will learn about the two major river systems of India in detail in the next Sections.

SAQ I

What are two categories of Indian drainage systems based on orientation towards the sea?

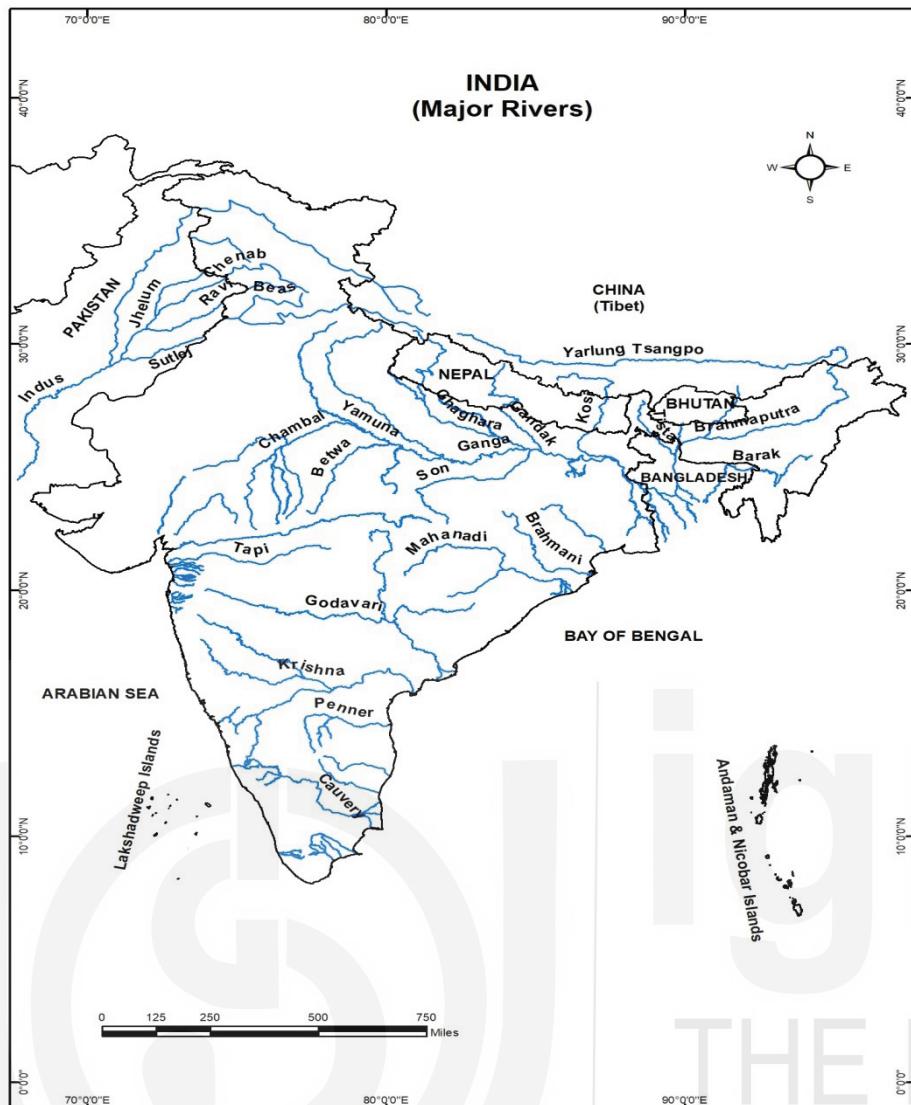


Fig 3.1: Drainage System of India.

(Source: Adapted from Survey of India (2019). Second Edition, *Physical Map of India*)

3.3 THE HIMALAYAN DRAINAGE SYSTEMS

Himalayan river system comprises of Indus, Ganges, and Brahmaputra river systems. As a result of erosional activity carried out in their courses, some of these rivers form rapids, waterfalls, V-shaped valleys, and deep gorges in their upper courses lying in mountains. After entering the plains, these rivers form depositional features like flood plains, oxbow lakes, flat valleys and deltas. These rivers are perennial in character as these get water through snow-melt from glaciers and also from seasonal rainfall. Fig. 3.2 depicts the Himalayan drainage system.

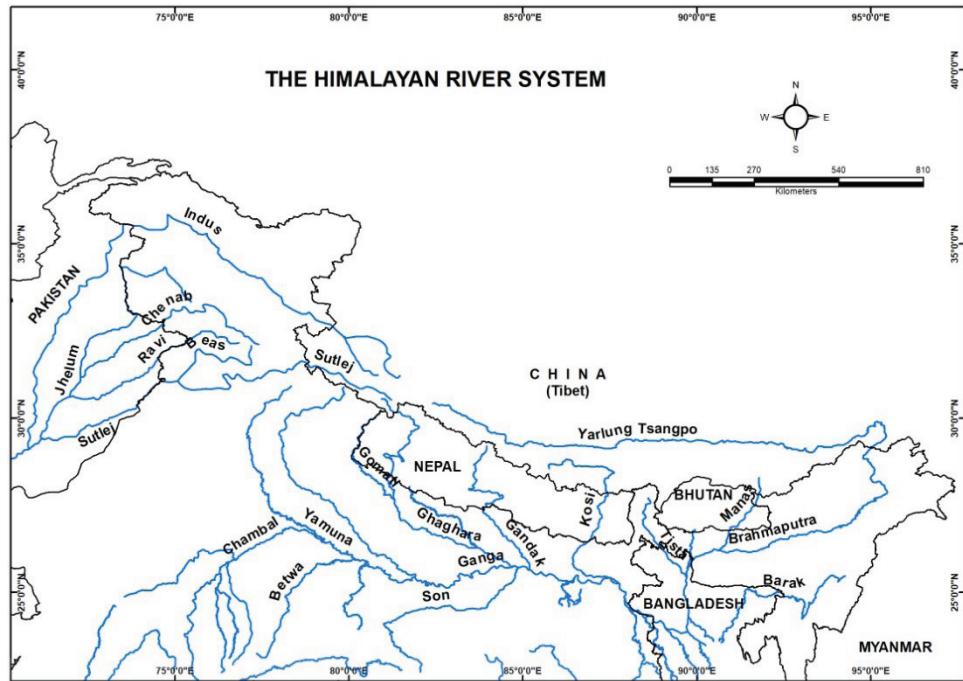


Fig. 3.2: Himalayan Drainage System.

(Source: Adapted from Survey of India (2019). Second Edition, *Physical Map of India*)

3.4 EVOLUTION OF HIMALAYAN DRAINAGE SYSTEM

There are various views about the evolution of Himalayan rivers. Many geologists believe that during Miocene Period a mighty river whom they call *Shiwalik* or *Indo-Brahmaputra* flowed along the entire length of Himalayas from Assam to Punjab, and finally it discharged into Gulf of Sind. It is believed that over the time the river got disjointed into three drainage systems namely: (i) in central part, it formed Ganga and its tributaries (ii) in the eastern part of India, it got disjointed and formed Brahmaputra river system and its tributaries whereas, (iii) in the western part, it disjointed into the Indus with its tributaries. The process of disjoining is ascribed to the upheaval of Himalayas including Potwar plateau during Pleistocene period. The water-divide between rivers Ganga and Indus got formed due to upliftment of Potwar plateau. Whereas, the diverged system of river Brahmaputra and Ganges flow towards Bay of Bengal which is attributed to down thrusting of Malda gap area between Meghalaya plateau and Rajmahal hills during mid-Pleistocene period.

3.5 INDUS RIVER SYSTEM

Indus river rises from glaciers situated on southern flanks of Kailash range in Tibetan plateau at an altitude of 5,182 metre. The total length of Indus river from source to mouth is 2,897 kilometre. Indus is also known as Sindhu and is the westernmost river system of India. It is regarded as the cradle of the Indus valley civilization. You all know that Indus is one of the largest river systems in the world. Entering India at an elevation of 4,206 metre, it continues to flow in the northwest direction between Zanskar range and Ladakh range. Shyok river joins it at an elevation of about 2,700 metre. Dras, Zanskar, Hunza, Shiger and Gorthang are important Himalayan tributaries of Indus which join

the river. Indus is joined by 'Panchnad' which is the name of five rivers namely: Jhelum, Chenab, Ravi, Satluj and Beas after entering the plains. The right bank tributaries of Indus which rise from the Sulaiman range are Sangar, Gomal, Khurramand and Tochi. The Indus finally flows into Arabian Sea after forming a delta in south of Karachi. Its important tributaries are as under:

1. **Jhelum** river originates from Verinag located at the south-eastern part of Kashmir. The total length of Jhelum is 724 kilometre. Catchment area of Jhelum river up to Indo-Pakistan border is 34,775 square kilometre. Jhelum flows from its source to Wular lake and flows further in south-westerly direction to enter Pakistan through a deep narrow gorge forming 170 kilometre of the India-Pakistan boundary. It joins river Chenab at Trimmu in Pakistan.
2. **Chenab** river acquires its name after the confluence of two streams namely Chandra and Bhagga. Chandra originates from Chander Tal and Bhagga from Suraj Tal situated near Bara Lacha Pass from the Great Himalayan range in Lahaul-Spiti district. After the confluence of Chandra and Bhagga at place called Tandi, the river comes to be known as Chandrabhaga and subsequently Chenab. The catchment area of Chenab up to Indo-Pakistan border is 26,155 square kilometre and its total length is 1,180 kilometre. Chandrabhaga the united stream flows in northwest direction parallel to Pir Panjal range through Pang Valley and enters Jammu and Kashmir at an elevation of 1,838 metre as Chenab river. It cuts a deep gorge of about 1000 metre deep near Kistwar and flows for 290 kilometre. After flowing for a distance of about 330 kilometre, it travels westward to enter the plains near Akhnur in Jammu and Kashmir. It joins Panchnad after traversing to southwest through Pakistan Punjab plains for a distance of 664 kilometre and consequently meets Satluj after joining of Jhelum and Ravi.
3. **Ravi** river is an important tributary of Indus river and originates from Bara Bhangal in Kangra district in Himachal Pradesh. The total catchment area of river Ravi is 14,442 square kilometre, of which only 5,957 square kilometre falls in India. From the source, it flows in northwest direction and drains the area between Pir Panjal and Dhauladhar ranges. It cuts a deep gorge in Dhauladhar range after turning in the south-westerly direction. It enters Punjab plains near Madhopur and later enters Pakistan. It flows for 725 kilometer and joins river Chenab near Sarai Sidhu.
4. **Beas** river is a sub-tributary of Indus that originates from Beas Kund on Rohtang Pass at an elevation of about 4,000 metre. Total catchment area of Beas is 20,303 square kilometre. River Beas having a steep upper course crosses Dhauladhar range and cuts a deep gorge of about 900 metre deep from Lorji to Talwara. It turns in south-westerly direction and meets Satluj river in Punjab. It is comparatively small river that flows for a distance of 460 kilometre and lies entirely in India.
5. **Satluj** river originates near Mansarovar and Rakshastal in Tibetan plateau at a height of 4,570 metre. It drains an area of about 25,900 square kilometre and length of course of Satluj is 1,450 kilometre, out of

which 1,050 kilometre lie in Indian territory. Satluj river is the longest tributary of Indus river in India. It flows parallel to Indus river for about 400 kilometre, before entering Punjab plains and it pierces a deep gorge at Naina Devi Dhar. Entering Ropar and after flowing westward river Beas joins it at Harike. Bhakra Nangal project has been built on this river.

SAQ 2

Identify the 'Panchnad' of Indus river system.

3.6 GANGA RIVER SYSTEM

Ganga is one of the most important sacred river systems of India. It has large number of perennial and non-perennial tributaries. Left bank major tributaries of Ganga are Gomati, Ghaghara, Ramganga, Gandak, Kosi, and Mahananda. Whereas, river Yamuna, Son and Damodar are its right-bank tributaries. Its water is extensively utilized for irrigation, industries, hydel power generation and for domestic use. Flood plains of Ganga are identified as granary house of India that support enormous population of the country. Total length of river Ganga is 2,525 square kilometre, that run across the states of Uttarakhand and Uttar Pradesh (1,450 kilometre), Bihar (445 kilometre), and West Bengal (520 kilometre) and remaining 110 kilometre forms boundary between Uttar Pradesh and Bihar. It covers about 8.6 lakh square kilometre basin area in India. Ganga acquires its name after the confluence of Bhagirathi river and Alaknanda river at Devprayag. River Bhagirathi has its origin from Gangotri glacier at Gaumukh (3900 metre), whereas Alaknanda originates from confluence of Satopanth glacier and Bhagirathi Kharak glacier. Ganga upon reaching Haridwar enters the plains, after travelling for a distance of 280 kilometre from its source. It flows south and southeast for a distance of about 770 kilometre and reaches Allahabad where it meets Yamuna river. Yamuna is one of the most important tributaries of Ganga. River Ganga and Brahmaputra forms the largest delta before entering Bay of Bengal as *Sundarban delta* which is characterized by dense forest cover.

1. River **Yamuna** with its length of about 1,384 kilometre, rises from Yamunotri glacier on the western slope of Bandarpunch range at an elevation of 6313 metre. Its water is important for eastern and western Yamuna canals and Agra canal for irrigation. It runs parallel to river Ganga and joins it at Prayag in Allahabad. Its main southern tributaries are Ken, Betwa, Sind, and Chambal, whereas Sasuri Khaderi, Sengar, Hindon, Tons, Baruna and Rind are its northern tributaries.
2. River **Chambal** originates from Signar Chauri peak (843 metre), near Mhow in Madhya Pradesh. It flows for a length of 965 kilometre covering total drainage area of 143,219 square kilometre. It drains through the states of Uttar Pradesh, Madhya Pradesh and Rajasthan to join Yamuna river near Etawah. Its tributaries are Shipra, Prajawati, Banas and Kali Sindh. There are numerous important dams built along the river namely Jawahar Sagar dam, Rana Pratap Sagar dam and Gandhi

Sagar dam which immensely contribute in the generation of hydroelectricity and also provides irrigation facilities.

3. **Ramganga** river originates near Gairsain in the Lesser Himalayas and flows for a distance of 600 kilometre, forming total catchment area of 32,800 square kilometre. Deoha, Gangan, Kosi, Khoh and Aril are its important tributaries. It drains through Jim Corbett National Park and joins Ganga near Forrukhabad.
4. River **Ghaghara** originates from the glaciers of Mapchachungo. Its catchment area is 127,950 square kilometre, out of which only 45 percent lies in India. After joining the waters of Beri, Tila and Seti rivers, Ghaghara carves out deep gorge of about 600 metre deep at Shishapani. It is joined by river Sarda in the plain and further flows in south eastwardly direction before finally merging into the Ganga at Chhapra.
5. **Gandak** river rises near the Nepal Tibet border. Its main tributaries are Bari, Mayangadi, Trishuli, and Kali Gandak. Its total length is 425 kilometre, and joins Ganga near Patna. The total catchment area of Gandak is 48,500 square kilometre, out of which 9,540 square kilometre lies in India.
6. River **Kosi** consists of seven streams of which Arun is the mainstream. It rises to the north of Gosainthan. It has a total length of 730 kilometre, with drainage area of 86,900 square kilometre, out of which 21,500 square kilometre falls in India. It is joined by Tamur Kosi from the east and Sunkosi from the west after crossing Central Himalayas in Nepal. River Kosi forms depositional landforms like alluvial fans while entering plains near Jianagar from Shivalik. Kosi is called 'Sorrow of Bihar' because of frequent floods and shifting of river courses.
7. River **Son** originates from Amarkantak plateau and flows for a length of 780 kilometre, and drains an area of about 71,900 square kilometre. Initially, it flows in northern direction and then bends to north-easterly course and joins Ganga near Ara west of Patna. Son is south bank tributary of Ganga, and important tributaries of Son are Kanhar, North Koel, Gopat, Johilla and Rihand.
8. **Damodar** river originates from the hills of Chotanagpur plateau. It has total length of 541 kilometre. It drains an area of about 22,000 square kilometre. It is known as 'sorrow of Bengal' as it causes disastrous floods during monsoon season. It joins river Hugli 48 kilometre to the south of Kolkatta.

SAQ 3

Name right bank tributaries and left bank tributaries of Ganga river.

3.7 BRAHMAPUTRA RIVER SYSTEM

Brahmaputra river is also known as *Tsangpo* in Tibet. It is one of the important rivers of India. It has a total length of 2480 kilometre, out of which 1,346 kilometre falls in India. It covers a total drainage area of 5,80,000 square kilometre, out of which 2,58,008 square kilometre lies in India. Brahmaputra has its source in Chemayungdung glacier of Kailash range. The river flows eastward for nearly 1,200 kilometre, almost parallel to the Great Himalayan range and makes sharp southward bend and creates deep gorge at Namcha Barwa. It is known by the name Siang or Dihang here, flowing further southwest, it is joined by left bank tributaries, i.e., Lohit and Dibang or Sikang near Sadiya in Arunachal Pradesh, making it to be known as the Brahmaputra. River Brahmaputra flows in Assam for a distance of 720 kilometre. A large number of tributaries from north and south join the major river here. The streams that merge with Brahmaputra from north are Raidak, Nyera Ama, Kameng, Tista, Dhansiri (north), Champaman, Subansiri, Gangadhar, Dharla and Belsiri. Streams joining in from south are Dikshu, Kalang, Dhansiri (south), Burhi Dihing, Noa Dihing, and Dibru. Brahmaputra carries enormous silt and is characterized by excessive meandering. It is 13 to 16 kilometre wide in Dibrugarh forming many riverine islands. The most famous one being Majuli island covering an area of about 1,250 square kilometre. Enormous water quantity of Brahmaputra results in disastrous floods during monsoon season almost every year. Brahmaputra river enters Bangladesh near Dhubri after traversing Garo hills in Meghalaya.

3.8 PENINSULAR DRAINAGE SYSTEMS

Peninsular drainage systems are much older and comprise numerous important rivers such as Krishna, Cauvery, Subarnarekha, Mahanadi, Godavari, Brahmani, Penner, and Tamraparni, which are oriented towards Bay of Bengal forming deltas. Rivers such as Chambal, Ken, Sind, Betwa, and Son have their origin in northern part of Peninsular India and are part of Ganga river system. Peninsular rivers except Narmada and Tapi mostly flow from west to east direction. Peninsular rivers possess low gradients which results in low water velocity and sediment carrying capacity. Therefore, these rivers are characterized by large deltas at their mouth. However, river course of Peninsular rivers remains devoid of meanders. These rivers dry out during summer or carry lesser amount of water due to lack of perennial sources.

Evolution of Peninsular Drainage System

Past geological events have been responsible for shaping drainage system of Indian Peninsula. Geologists suggest that (i) The subsidence of western side of Peninsula during early tertiary period led to subsidence below sea, disturbing symmetrical form of rivers on both sides of the original watershed. (ii) The upheaval of Himalayas took place when northern side of peninsular block underwent subsidence and resulted in trough faulting through which now main west-flowing rivers Narmada and Tapi flow and fill the original cracks with their residual materials. Therefore, there is a lack of presence of alluvial and delta formation on the western coast. (iii) Tilting of Peninsular

block towards southeastern direction resulted in the alignment of its rivers towards Bay of Bengal.

3.9 RIVERS OF PENINSULAR DRAINAGE

Important rivers of Peninsular India are:

1. **Godavari** is the largest Peninsular river and originates near Trimbak plateau in Nasik district of Maharashtra. It flows for a total length of 1,465 kilometer. It runs through states of Maharashtra, Chattisgarh, Odisha, Madhya Pradesh, Telangana and Andhra Pradesh. Its important tributaries are Pranhita, Purna, Penganga, Manjra, Wainganga, Pravara, Wardha, Maner, Indravati Sabari and Pench. It has total catchment area of 3,12,812 square kilometre.
2. **Narmada** originates from Amarkantak plateau in Madhya Pradesh which lies at an elevation of about 1057 metre, above mean sea level (MSL). Total length of the river is 1,312 kilometre, with a catchment area of about 98,795 square kilometre. It flows in a rift valley with Satpura in the south and Vindhyan range in the north. The river cascades into marble rock gorge and forms Dhuandhar waterfalls near Jabalpur. It meets Arabian Sea after traversing for 1,312 kilometre and forms 27 kilometer long estuary. Sardar Sarovar Project for irrigation, drinking water, hydropower generation and canal network purposes has been built on this river.
3. River **Tapi** originates from a place called Multai situated in Satpura range in Betul district of Madhya Pradesh. It is one of the important westward flowing rivers. Its length is 700 kilometre, and catchment area is about 65,145 square kilometre. Around 6 percent of its basin area lies in Gujarat, 15 percent in Madhya Pradesh, whereas a large part of 75 percent lies in Maharashtra.
4. **Sabarmati** river originates from Dhebar lake (Mewar hills) and flows to Gulf of Khambat. Its important tributaries are Harnav, Vatrak, Wakul, Sedhi and Meshwa. It has a total length of 371 kilometre and is the third-largest westward flowing river of Peninsular India. It has a catchment area of 21,895 square kilometre.
5. **Mahanadi** has its source near Sihawa at an elevation of 442 metre in Raipur district of Chattisgarh. It flows for a distance of 858 kilometre. Its left bank tributaries are Ib, Mand, Hasdeo, and Seonath. Its right bank tributaries include Tel, Ung and Jonk. It covers catchment area of about 1,41,589 square kilometre.
6. River **Brahmani** with a length of 800 kilometre is formed due to the confluence of Sankh and Koel rivers near Rourkela in Odisha. Its drainage area is 39,033 square kilometre. Its tributaries are Tikra, Kura and Sankhad and it flows through districts of Balasore, Talcher and ultimately drains into Bay of Bengal.
7. River **Subarnarekha** originates from Piska near Ranchi. It is 470 kilometre long and drains an area of 19,296 square kilometre. It flows in an easterly direction through Singhbhum, Mayurbhanj and Medinipur districts.

8. River **Krishna** is the second largest of Peninsular India. It is 1300 kilometre long with a drainage basin of 2,58,948 square kilometre, which is shared by Andhra Pradesh, Telangana, Karnataka and Maharashtra. Major tributaries of Krishna are Yerla, Koyna, Panchaganga, Varna, Ghatprabha, Dudhganga, Bhima, Tungabhadra, Malprabha and Musi.
9. **Penner** river originates from Nandi hills in Chikballarpur district of Karnataka. Its total length is 560 kilometre, and occupies a catchment area of 55,213 square kilometre between Krishna and Cauvery. Its main tributaries are Kendura, Sagileru, Jayamangali, Chitravati, Cheyyeru and Papaghni. It forms a gorge near Gandikota Cuddapah district and merges into sea near Nellore town.
10. **Cauvery** river originates from Brahmagiri range in Kodagu district at an elevation of 1,342 metre. It flows for 805 kilometre. Srimsha, Lokpavani, Herangi, Arkavati, and Hemaati are its northern tributaries and Amravati, Suvarnavati, Lakshmatirtha, Bhawani and Kabana are its southern tributaries. Cauvery drains a catchment area of 81,155 square kilometre, out of which 55 percent lies in Tamil Nadu, 41 percent in Karnataka and 3 percent lies in Kerela. River Cauvery carries plenty of water throughout the year as it receives rainfall during both northeast and southwest monsoon seasons. Finally, it joins sea at a place named Kaveripatnam in Tamil Nadu.
11. **Luni** originates at Pushkar valley of Aravallis at an elevation of 550 metre. Its total length is 495 kilometre, and covers a drainage area of 37,363 square kilometre. In its upper course, the river is known as Sagarmati. It runs west of Aravallis and ends in marshes near north of Rann of Kachchh. Its tributaries are Bundi, Sarsuti, Sukri and Jawai etc.

The river system of Peninsular drainage can also be studied on the basis of its direction of flow as East flowing river system and West flowing river system. The East flowing rivers of Peninsular river system drains into Bay of Bengal while the West flowing river drains into Arabian Sea as shown in Fig. 3.1. On the basis of their direction of flow, following are the major east flowing rivers:

1. Godavari
2. Krishna
3. Kaveri
4. Mahanadi
5. Pennar
6. Damodar
7. Subarnarekha

The west flowing rivers that drains itself into Arabian Sea are:

1. Narmada
2. Tapi
3. Sabramati

4. Luni
5. Mahi
6. Sharavati

So far, you have learnt about the major river systems of both Himalayas and Indian peninsula along with their tributaries. Now, you will study about major river basin of India in brief.

SAQ 4

Identify the east flowing rivers and west flowing rivers of Peninsular drainage system.

3.10 MAJOR RIVER BASINS OF INDIA

A river basin is defined as the land area drained by main river and its tributaries. Based on the size of their catchment area, some of the major river basins of India are Brahmaputra, Indus, Ganga, Cauvery, Sabarmati, Tapi, Mahi, Mahanadi, Krishna, Narmada, Luni, Brahmani, Penner and Godavari etc.

Major river system of India can be divided into following two major types as Himalayan river basin and Peninsular river basin. Indus, Ganga, and Brahmaputra river basin has been discussed as Himalayan river basin and Mahanadi, Krishna, Kaveri, Godavari, Narmada, Tapti and Luni has been detailed below as Peninsular river basin.

Himalayan River Basin

- 1. Indus River Basin:** The Indus river originates near glaciers situated on the southern flanks of Kailash range in Tibetan plateau at an altitude of 5,182 meter. The Indus basin covers an area of 3,21,289 square kilometre in India with a total length of 2,880 kilometre. The entire Jammu and Kashmir state except its northern and northeastern tips, the whole of Punjab, Himachal Pradesh, the northern part of Haryana, and the northern tip of Rajasthan forms the part of Indus river basin. Its major left bank tributaries are the Beas, Chenab, Ravi, Satluj and Jhelum. The total drainage area of Indus is 1,178,440 square kilometre.
- 2. Ganga River Basin:** It has its source from the Gangotri glacier in the western Himalayas. It is the largest basin in India covering an area of about 861,404 square kilometre. It flows through the states of Uttar Pradesh, Uttarakhand, Bihar, Jharkhand, and West Bengal and turns southeast to merge into the Bay of Bengal. Its important tributaries are Kosi, Betwa, Gandak, Son, Yamuna, Ghaghra and Gomti etc. The Ganga basin is shared by several states such as Himachal Pradesh which covers 0.5 percent of its basin area, Haryana covers 4.1 percent, West Bengal covers 8.2 percent, Rajasthan with 13 percent, Bihar and Jharkhand with 16.7 percent, Madhya Pradesh and Chattisgarh with 23.1 percent and Uttarakhand and Uttar Pradesh each covering the largest share of its basin with 34.3 percent.

- 3. Brahmaputra River Basin:** The river Brahmaputra has its source in the Chemayungdung glacier of the Kailash range. Its total drainage area is 2,58,008 square kilometre in India. The total length of Brahmaputra is 2900 kilometre, out of which 916 kilometre is part of India. The drainage area of the Brahmaputra basin lies in the northeastern states of Arunachal Pradesh, Assam and Sikkim including the northern flank of Meghalaya and Nagaland states. Its major tributaries are Tista, Dharla, Lohit, Dibang, Dhansiri, Subansiri, Manas, Sankosh, Gangadhar and Raidak etc. Manipur, Mizoram and Tripura states are in the barak sub-basin area which merges with the combined flow of the Brahmaputra-Ganges in Bangladesh.

Peninsular River Basin

- 1. Mahanadi River Basin:** It has its origin from the Sihawa district of Dandakaranya in the state of Chhattisgarh. After traversing for 857 kilometre, the river joins the Bay of Bengal. Its major tributaries are Jonk, Tel, Org, Seomanth, Hasdeo, Mand and Ib. The total basin area is 141,589 square kilometre (4.3 percent of the total basin area of India).
- 2. Krishna River Basin:** It originates from the Western Ghats near Satara district of Maharashtra. It flows for 1,400 kilometre in the easterly direction and merges into the Bay of Bengal. Its total basin area is 2,58,948 square kilometre, which is the second largest in India (7.9 percent of all India). Its major tributaries are Tungabhadra, Yerla, Koyna, Panchaganga, Varna, Ghatprabha, Dudhganga, Bhima, Malprabha and Musi.
- 3. Godavari River Basin:** It originates from the Trimbak plateau of northwestern Maharashtra. It has a total basin area of 3,12,812 square kilometre (9.5 percent of India). Its important tributaries are Purna, Pravara, Penganga, Manjra, Wainganga, Pranhita, Wardha, Maner, Indravati Sabari, and Pench etc. It runs through the states of Maharashtra, Chattisgarh, Odisha, Madhya Pradesh and Andhra Pradesh.
- 4. Cauvery River Basin:** It originates from the Brahmagiri range of Kodagu district from the Western Ghats in the state of Karnataka. It has a basin area of 87,900 square kilometre (2.7 percent of India) shared by Karnataka and Tamilnadu. Its left bank tributaries are Lokpavani, Shimsa, Hemavati, Arkavati, and Herangi. Whereas, its right bank tributaries are Bhavani, Kabbani, Noyil, Lakshmana Tirtha, Suvarnavati and Amravati.
- 5. Tapi River Basin:** It has its source from Multai located in Satpura plateau in the Betul district of Madhya Pradesh. It has a total basin area of 65,145 square kilometre (2.0 percent of India). Its tributaries are Panjara, Purna, Aner and Girna. It flows for a distance of 700 kilometre and merges into the Arabian Sea.
- 6. Narmada River Basin:** It originates from the western flanks of the Amarkantak range in Madhya Pradesh. It has a total basin area of 98,795 square kilometre (3.0 percent of all India). Its total length from the source is 1,311 kilometre. Narmada river traverses in the westward direction and eventually enters into the Arabian Sea. It does not have

large tributaries like other river basins and a major part of its basin lies in the state of Madhya Pradesh.

7. Luni River Basin: It originates to the west of Ajmer at an elevation of 550 metre, and flows through the Thar desert, and ends in the marshy area to the north of Rann of Kachchh/Kutch. Its drainage area covers 37,363 square kilometre, and spreads over the states of Gujarat and Rajasthan.

The river basin of India can be divided on the basis of size of their basin area in India from the largest to the smallest. Following are the rivers on the basis of size of their basin:

Rank	River Basin
1	Ganga
2	Indus
3	Godavari
4	Krishna
5	Brahmaputra
6	Mahanadi
7	Narmada
8	Kaveri
9	Tapi
10	Luni

SAQ 5

What is a river basin? Identify and describe the largest river basins of India.

3.11 SUMMARY

In this Unit, you have learnt the following:

- India with its diverse physical features possesses a diverse range of large and small rivers which are important natural resources for various developmental purposes.
- India receives an average annual rainfall of 120 centimetre. The annual yield of water in the Indian rivers is 1,858,100 million cubic metres.
- The drainage system of India is broadly classified based on its (i) origin (ii) orientation to the sea and, (iii) size of the catchment area.
- Himalayan and the Peninsular drainage systems are the most important drainage systems of India.
- The Himalayan drainage system comprises the largest rivers in India namely Brahmaputra, Indus and Ganga etc. These rivers are characterized by large tributaries.
- The Peninsular drainage system is much older than the Himalayan drainage system. However, the river course of the Peninsular drainage is devoid of meanders.

- River basin is part of the land area being drained by the main river and its tributaries.

3.12 TERMINAL QUESTIONS

1. Identify the drainage systems of India and give the broad classification of this system.
2. Describe the evolution of the Himalayan drainage system. Give a detailed account of any one river systems of the Himalayan drainage.
3. Explain the important features of the river system of Ganga.
4. Identify the major river basins of India and explain any five major basins in detail.
5. Describe the three factors identified by geologists in the formation of drainage systems of the Indian Peninsula.

3.13 ANSWERS

Self-Assessment Questions (SAQ)

1. Based on the orientation of the sea, the Indian drainage is broadly classified into two systems i.e., (i) the Bay of Bengal drainage system e.g., Ganga, Brahmaputra, Godavari, Krishna, Mahanadi, Cauvery and Penner etc., and (ii) the Arabian Sea drainage system e.g., Indus, Narmada, Tapi, Sabarmati and Mahi etc.
2. The 'Panchnad' of the river Indus are Ravi, Satluj, Beas, Chenab and Jhelum.
3. The left bank tributaries of the Ganga are Gomati, Ghaghara, Ramganga, Gandak, Kosi and Mahananda whereas, the river Son, Yamuna and Damodar are the right bank tributaries.
4. The major east flowing rivers of Peninsular drainage systems are Mahanadi, Godavari, Krishna, and the Cauvery whereas the west-flowing rivers are Narmada and Tapi.
5. A river basin is defined as a part of the land area drained by the main river and its tributaries. The Ganga basin with its catchment area of 861,404 square kilometer is the largest in India. Important rivers are Subarnarekha, Mahanadi, Godavari, Brahmani, Penner, Krishna, Cauvery and Tamraparni. These rivers flow into the Bay of Bengal forming a delta. Peninsular rivers except for Narmada and Tapi, mostly flow from west to east direction.

Terminal Question

1. To answer this question, you have to identify the drainage systems of India and include the broad classification. Refer to Sections 3.1 and 3.2.
2. Your answer should include description of the evolution of Himalayan drainage system and also a detailed account of any one river systems of the Himalayan drainage. Refer to Sections 3.3 to 3.7.

3. You have to include the explanation of the important features of the river system of Ganga. Refer to Section 3.6.
4. Your answer should incorporate the identification of the major river basins of India along with explanation of any five major basins. Refer to Section 3.10.
5. You should include description of three factors as identified by the geologists in the formation of drainage systems of the Indian Peninsula. Refer to Section 3.8.

3.14 REFERENCES AND SUGGESTED FURTHER READING

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