

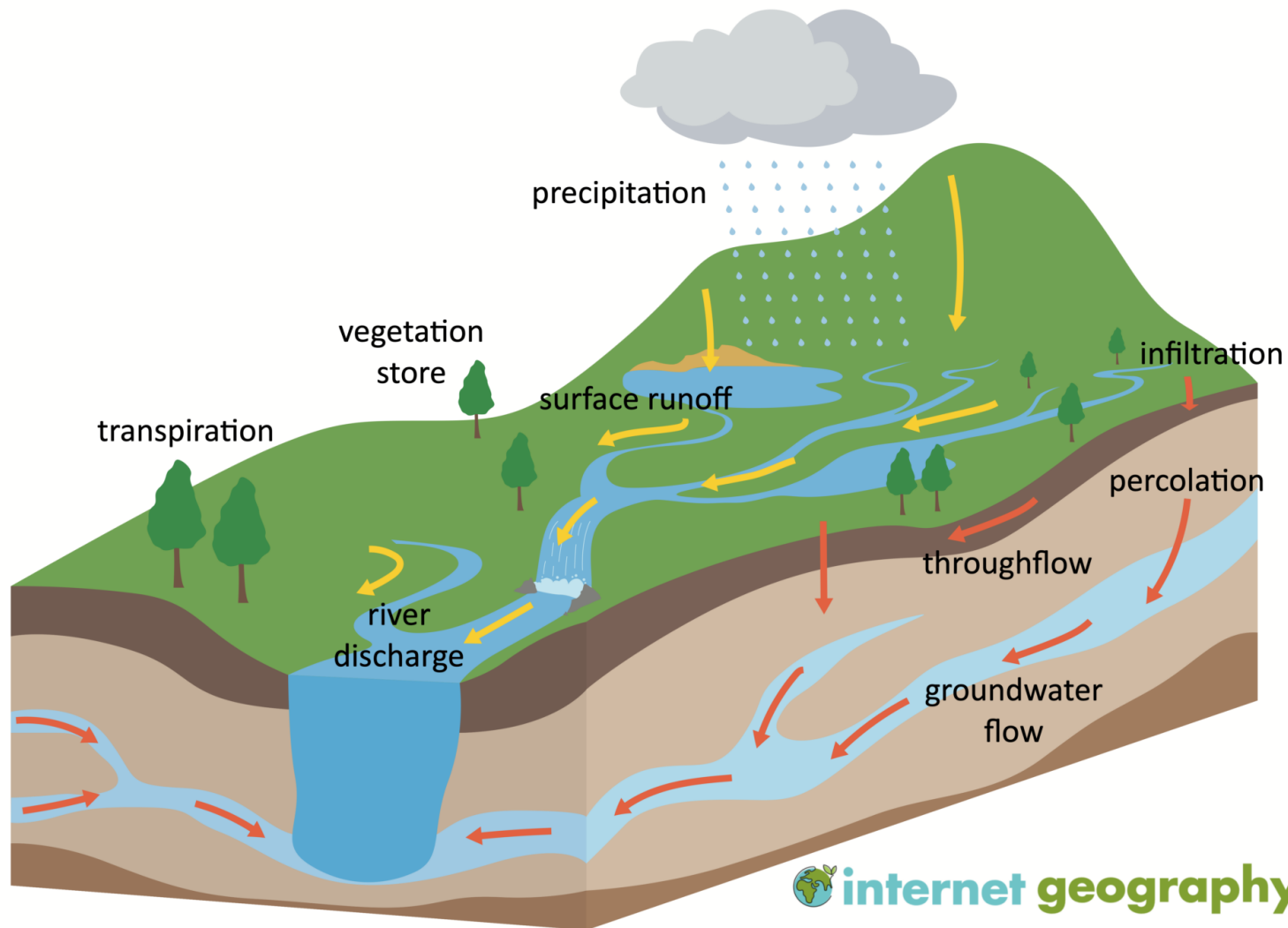
PART B - Chapter 4: Drainage System of India

भारत की नदी प्रणाली

1. Introduction / परिचय

- **Drainage system** = pattern formed by rivers & their tributaries.
- नदी प्रणाली = नदियों और उनकी सहायक नदियों द्वारा बना जाल।
- India has **two main river systems**:
 1. **Himalayan Rivers** (हिमालयी नदियाँ) → perennial (snow + rain-fed).
 2. **Peninsular Rivers** (प्रायद्वीपीय नदियाँ) → seasonal (rain-fed, some perennial with dams).





2. Drainage Terminology / नदी तंत्र की शब्दावली

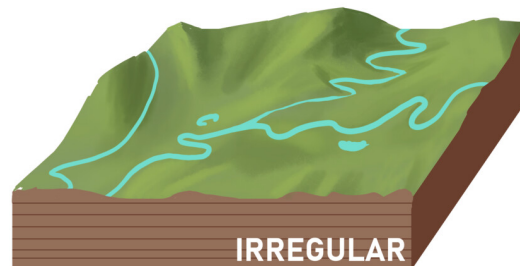
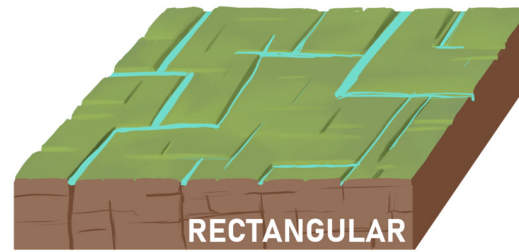
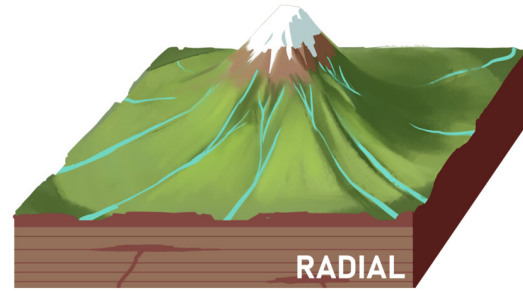
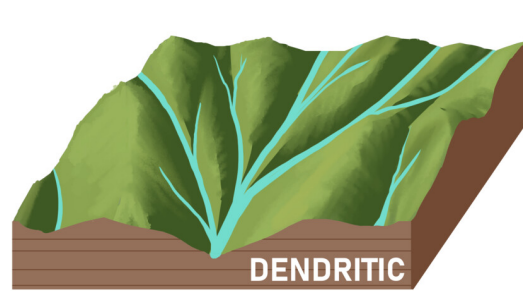
- **Drainage Basin** (अपवाह द्रोणी): Area drained by a river + its tributaries.
- **Watershed** (जलसंग्रहण सीमा): Boundary separating two basins.
- **Catchment Area** (आग्रह क्षेत्र): Area from where rainfall drains into river.



Drainage Patterns / अपवाह प्रतिरूप

1. **Dendritic** (वृक्षाकार): Tree-like branching (e.g., Ganga, Indus).
2. **Radial** (अरीय): Outward from central high point (e.g., Narmada from Amarkantak).
3. **Centripetal** (अभिकेंद्री): Flow towards depression (e.g., Loktak Lake, Manipur).
4. **Trellis** (जालीनुमा): Tributaries join at right angles.

DRAINAGE PATTERNS

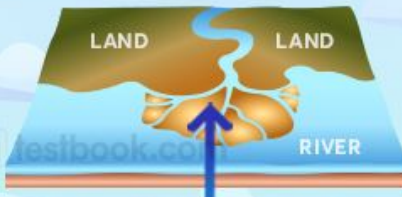
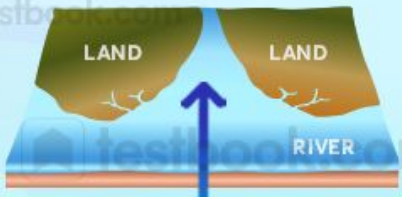


Delta (डेल्टा) vs. Estuary (ज्वारनदमुख):

- **Delta:** नदी के मुहाने पर अवसादों के जमाव से बना एक त्रिभुजाकार या पंखे के आकार का भूभाग। यह कम ज्वार (low tides) वाले क्षेत्रों में बनता है और बहुत उपजाऊ होता है। Ganga, Godavari, Krishna, Mahanadi, Kaveri
- **Estuary:** नदी का वह मुहाना जहाँ मीठा पानी समुद्र के खारे पानी से मिलता है। यह उच्च ज्वार (high tides) और दरार घाटियों (rift valleys) वाले क्षेत्रों में बनता है और यहाँ उपजाऊ भूमि नहीं होती है। Narmada, Tapi, Mandovi

DIFFERENCE BETWEEN A DELTA & AN ESTUARY

The basic difference between estuary and delta is that the former is a tidal mouth of the river, where it meets the sea, whereas the latter is nothing but the wetland, formed as a result of the accumulation of sediments carried by the river when it joins a standing waterbody.

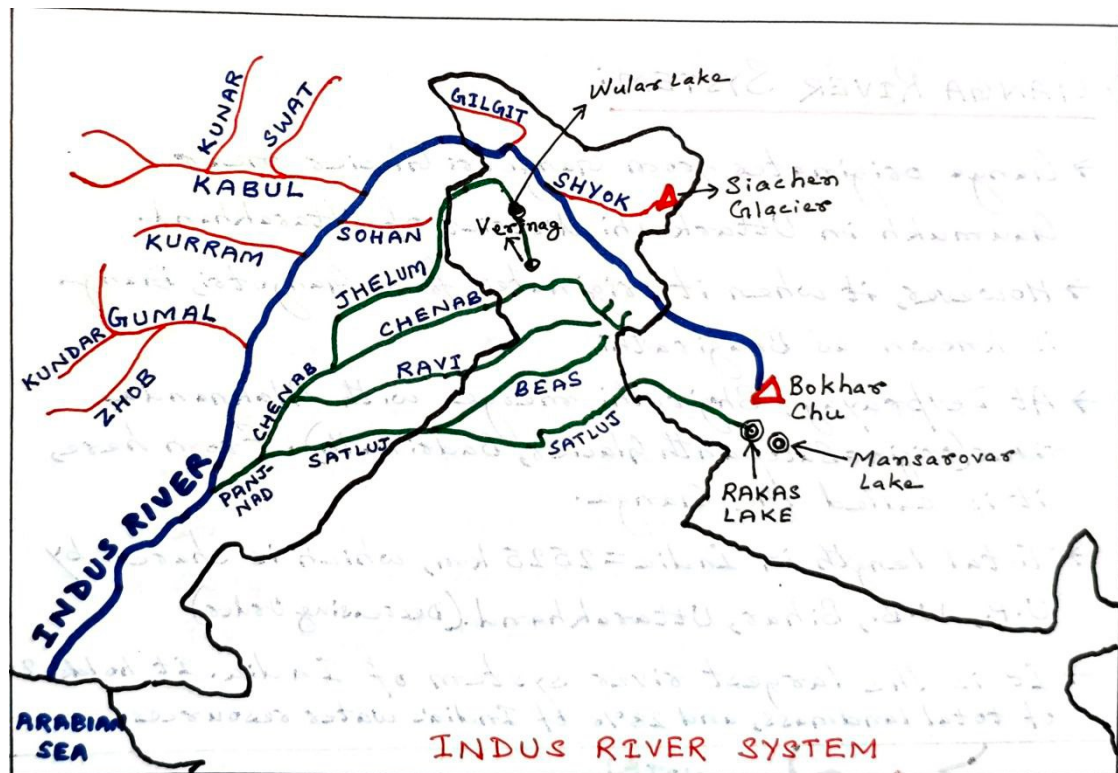
DELTA	ESTUARY
 The triangular deposits made by the rivers at their mouth form Delta.	 The sharp edged mouth of rivers, devoid of any deposits is known as Estuary.
Deltas are formed in the regions of low tides and coastal plains.	Regions of high tides and rift valleys witness Estuaries.
Deltas are fertile lands.	Estuary does not have fertile lands.
Ganga and Brahmaputra, Krishna, Kaveri and Mahanadi form delta.	Narmada and Tapi rivers form Estuaries.

3. Himalayan Rivers / हिमालयी नदियाँ

- Long, perennial, youthful, erosional features (gorges, V-shaped valleys).
- **Sources:** Glaciers + rainfall.

(a) Indus River System / सिंधु नदी प्रणाली

- Origin: **Mansarovar Lake (Tibet).**
- Length: ~2880 km (in India ~1114 km).
- Flows through Ladakh, J&K → Pakistan → Arabian Sea (Karachi).
- Tributaries:



- **Jhelum** – Verinag (Kashmir).
- **Chenab** – Chandra + Bhaga at Keylong (HP).
- **Ravi** – Kangra (HP).
- **Beas** – Rohtang Pass (HP).
- **Sutlej** – Rakshastal lake (Tibet).
- Treaty: **Indus Water Treaty (1960)** – India uses Ravi, Beas, Sutlej.

→ सिंधु नदी – मानसरोवर झील से उद्गम; सहायक – झेलम, चिनाब, रावी, ब्यास, सतलुज।

(b) Ganga River System / गंगा नदी प्रणाली

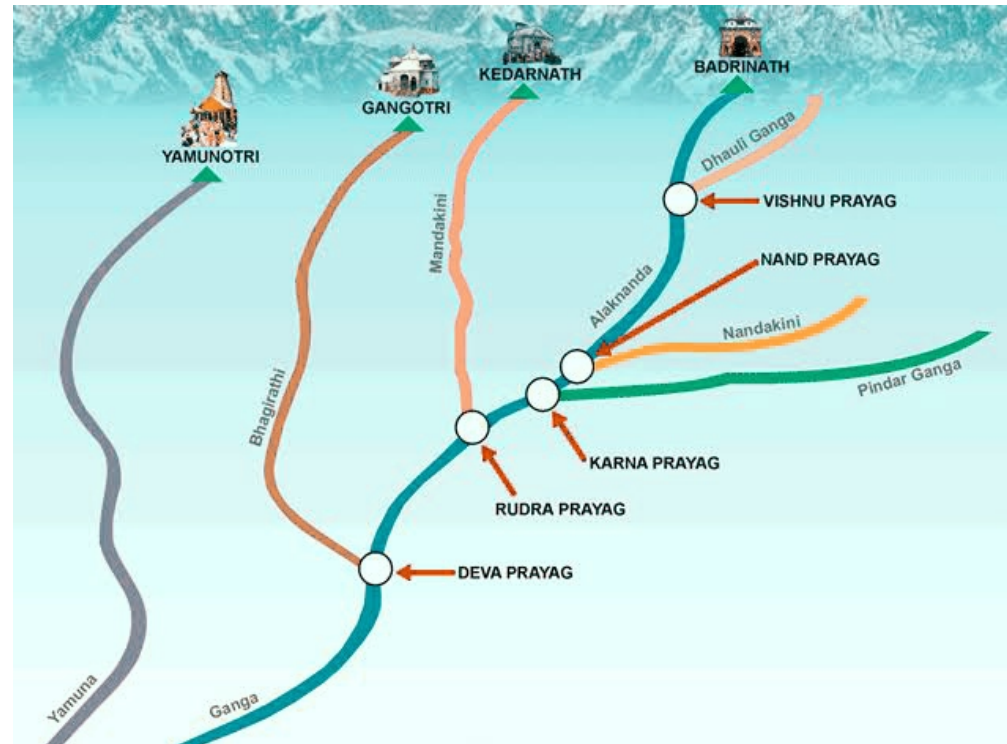
- Origin: **Gangotri Glacier (Bhagirathi).**
- Length: 2525 km (largest in India).

- **Origin (Complex Mergers in Uttarakhand - "Devbhoomi"):**

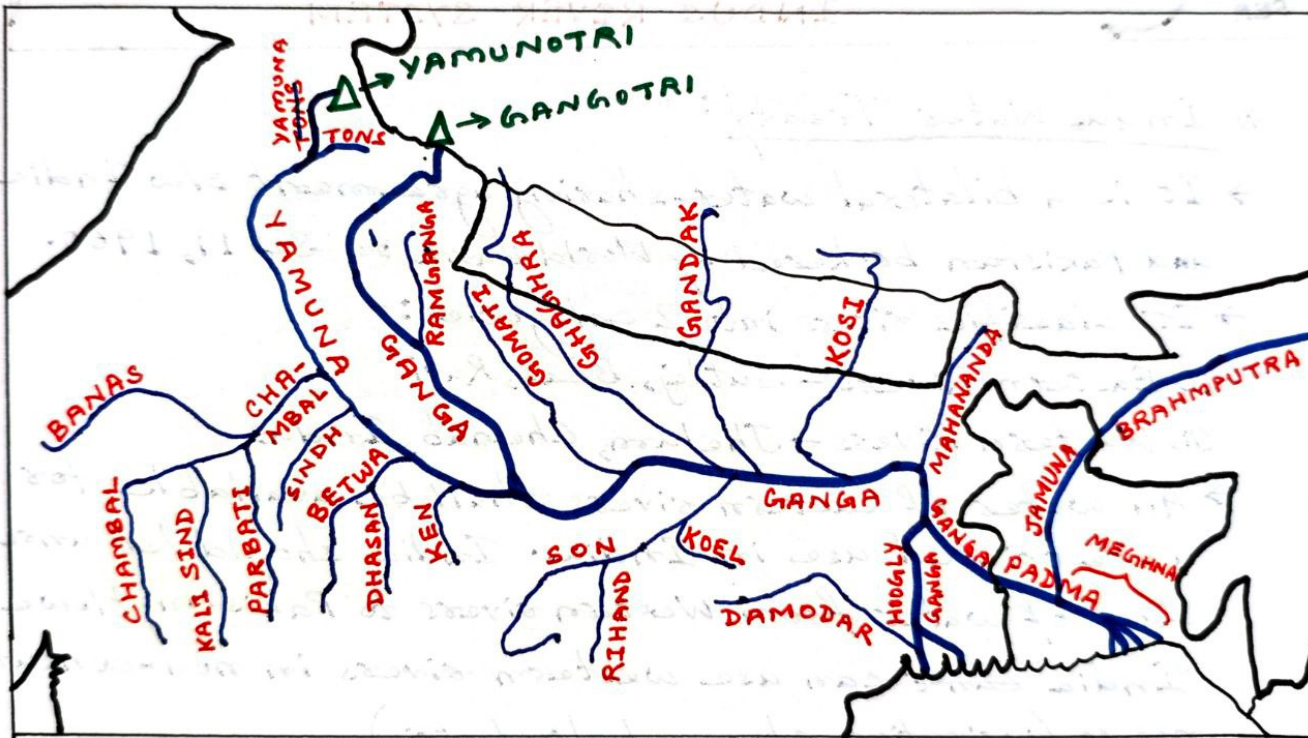
- Alaknanda (from Badrinath) + Dholi Ganga = **Vishnuprayag.**
- Alaknanda + Nanda = **Nandprayag.**
- Alaknanda + Pinder Ganga (Pinder Glacier) = **Karnaprayag.**
- Alaknanda + Mandakini (from Kedarnath) = **Rudraprayag.**
- **Alaknanda + Bhagirathi (from Gangotri) = Devprayag (forms the Ganga).**

- **Tributaries:**

- Right bank: **Yamuna, Son.**

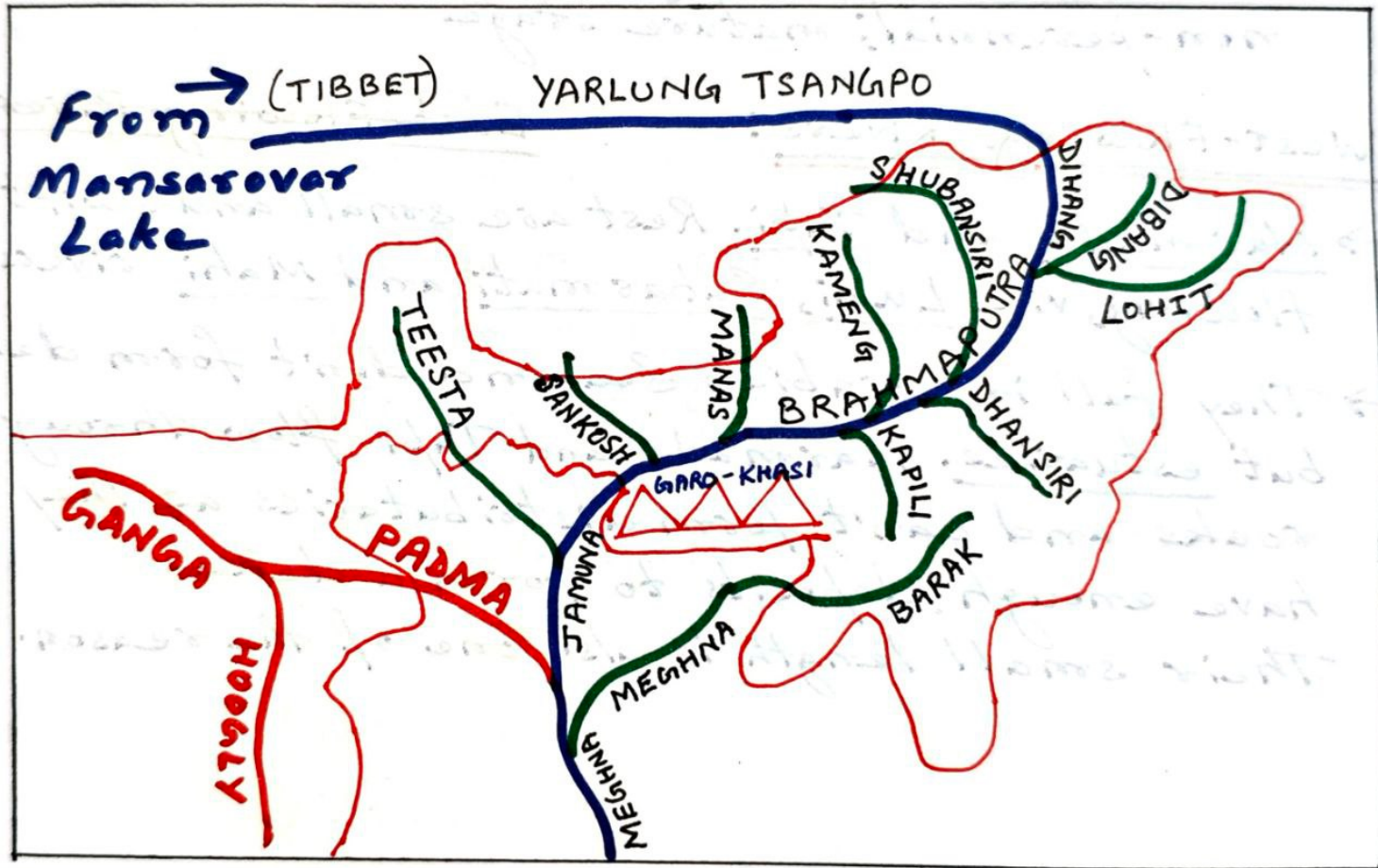


- Left bank: **Ghaghra, Gandak, Kosi.**
- Forms **Sundarbans Delta** – world's largest delta.
- Important cities: Haridwar, Kanpur, Allahabad (Prayagraj), Varanasi, Patna, Kolkata.



→ गंगा – गंगोत्री हिमनद से उद्गम; प्रमुख सहायक – यमुना, घाघरा, गंडक, कोसी; सुंदरबन डेल्टा।

(c) Brahmaputra River System / ब्रह्मपुत्र नदी प्रणाली



- Origin: Chemayungdung Glacier, Tibet (as Tsangpo).

- Enters India via **Dihang Gorge (Arunachal Pradesh)**.
- Length: ~2900 km (India: 916 km).
- Known for floods, braided channels, **Majuli island** (Assam).
- Tributaries: Subansiri, Dibang, Dhansiri, Manas, Teesta.

→ ब्रह्मपुत्र – तिब्बत में त्सांगपो, भारत में दिहांग दर्रे से प्रवेश; प्रसिद्ध माजुली नदी द्वीप।

4. Peninsular Rivers / प्रायद्वीपीय नदियाँ

- Old, stable landmass rivers.
- Mostly **seasonal** (rain-fed), but some perennial with dams.
- Flow mainly **eastwards into Bay of Bengal** (form deltas).
- Few **west-flowing rivers** drain into Arabian Sea (form estuaries).



(a) East-Flowing Rivers (Bay of Bengal) / पूर्वाभिमुख नदियाँ

1. Godavari – “Dakshin Ganga” / “Vridhdha Ganga”

- Origin: Nasik (Maharashtra).
- Length: 1465 km (longest Peninsular river).
- Tributaries: Indravati, Manjira, Sabari.
- Forms large delta in Andhra.

2. Krishna

- Origin: Mahabaleshwar (Maharashtra).
- Tributaries: Bhima, Tungabhadra, Musi.
- Flows through Maharashtra, Karnataka, Telangana, AP.

3. Kaveri (Cauvery)

- Origin: Talakaveri (Karnataka, Brahmagiri Hills).

- Tributaries: Hemavati, Kabini, Bhavani, Amravati.
- Forms fertile delta in Tamil Nadu.

4. Mahanadi

- Origin: Sihawa (Chhattisgarh).
- Length: ~860 km.
- Tributaries: Seonath, Jonk, Hasdeo.
- Delta in Odisha.

➔ प्रमुख पूर्वाभिमुख नदियाँ – गोदावरी (दक्षिण गंगा), कृष्णा, कावेरी, महानदी।

(b) West-Flowing Rivers (Arabian Sea) / पश्चिमाभिमुख नदियाँ

1. Narmada

- Origin: Amarkantak Plateau (MP).

- Flows through rift valley between Vindhya & Satpura ranges.
- Famous sites: Marble Rocks (Jabalpur), Dhuandhar Falls.
- Estuary in Gulf of Khambhat.

2. Tapi (Tapti)

- Origin: Satpura ranges (Betul, MP).
- Flows parallel to Narmada, into Gulf of Khambhat.

3. Mandovi, Zuari (Goa); Sharavathi (Jog Falls); Periyar (Kerala) – short but important.

➡ प्रमुख पश्चिमाभिमुख नदियाँ – नर्मदा, तापी, मांडवी, शरावती, पेरियार।

(c) Inland Drainage / अंतर्देशीय जल निकास

- Rivers that do not reach sea, end in desert or lakes.
- **Luni River (Rajasthan):** Flows into Rann of Kachchh.

- Inland streams in Ladakh, Rajasthan desert.
➡ अंतर्देशीय नदी – लूणी (कच्छ के रण में विलीन)।

6. Important Dams of India / भारत के प्रमुख बाँध

North India / उत्तरी भारत

- **Bhakra Nangal Dam** – Sutlej River, Himachal Pradesh–Punjab border.
भाखड़ा नंगल बाँध – सतलुज नदी, हिमाचल-पंजाब।
 - **Tehri Dam** – Bhagirathi River, Uttarakhand (Highest dam in India – 260 m).
टिहरी बाँध – भागीरथी नदी, उत्तराखंड (भारत का सबसे ऊँचा बाँध)।
 - **Rihand Dam (Govind Ballabh Pant Sagar)** – Rihand River (Son tributary), Uttar Pradesh.
रीहन्द बाँध – रीहन्द नदी (सोन की सहायक), उत्तर प्रदेश।
 - **Salal Hydrel Project** – Chenab River, Jammu & Kashmir.
सलाल जलविद्युत परियोजना – चिनाब नदी, जम्मू-कश्मीर।
 - **Baglihar Dam** – Chenab River, J&K.
बगलिहार बाँध – चिनाब नदी, जम्मू-कश्मीर।
 - **Uri Project** – Jhelum River, J&K.
उड़ी परियोजना – झेलम नदी, जम्मू-कश्मीर।
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Eastern India / पूर्वी भारत

- **Hirakud Dam** – Mahanadi River, Odisha (Longest dam in India, 25 km).
हीराकुंड बाँध – महानदी नदी, ओडिशा (भारत का सबसे लंबा बाँध)।
 - **Farakka Barrage** – Ganga River, West Bengal (diverts water to Hooghly).
फरक्का बैराज – गंगा नदी, पश्चिम बंगाल।
 - **Maithon & Panchet Dams** – Damodar River, Jharkhand/West Bengal.
मैथन व पन्चेत बाँध – दामोदर नदी।
 - **Subansiri Project** – Subansiri River, Arunachal Pradesh/Assam.
सुबनसिरी परियोजना – सुबनसिरी नदी, अरुणाचल-असम।
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Western India / पश्चिमी भारत

- **Sardar Sarovar Dam** – Narmada River, Gujarat.
सरदार सरोवर बाँध – नर्मदा नदी, गुजरात।
 - **Ukai Dam** – Tapi River, Gujarat.
उकाई बाँध – तापी नदी, गुजरात।
 - **Kota Barrage** – Chambal River, Rajasthan.
कोटा बैराज – चंबल नदी, राजस्थान।
 - **Mahi Bajaj Sagar Dam** – Mahi River, Rajasthan.
माही बजाज सागर बाँध – माही नदी, राजस्थान।
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South India / दक्षिण भारत

- **Nagarjuna Sagar Dam** – Krishna River, Telangana/Andhra Pradesh (world's largest masonry dam).
नागार्जुन सागर बाँध – कृष्णा नदी, तेलंगाना/आंध्र प्रदेश।
 - **Srisailem Dam** – Krishna River, Andhra Pradesh.
श्रीशैलम बाँध – कृष्णा नदी, आंध्र प्रदेश।
 - **Krishna Raja Sagar (KRS) Dam** – Kaveri River, Karnataka.
कृष्णराज सागर बाँध – कावेरी नदी, कर्नाटक।
 - **Mettur Dam** – Kaveri River, Tamil Nadu.
मेट्टूर बाँध – कावेरी नदी, तमिलनाडु।
 - **Idukki Dam** – Periyar River, Kerala (Arch Dam).
इडुक्की बाँध – पेरियार नदी, केरल (आर्च बाँध)।
 - **Sabarigiri & Idamalayar Projects** – Kerala.
सबरीगिरी व इडमालायर परियोजनाएँ – केरल।
 - **Almatti Dam** – Krishna River, Karnataka.
अलमट्टी बाँध – कृष्णा नदी, कर्नाटक।
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Important One-Liner Facts / महत्वपूर्ण तथ्य

- **Highest Dam in India:** Tehri Dam (Uttarakhand, Bhagirathi).
- **Longest Dam in India:** Hirakud Dam (Odisha, Mahanadi).
- **Largest Masonry Dam:** Nagarjuna Sagar (Telangana/AP, Krishna).
- **Oldest Dam in India:** Kallanai / Grand Anicut (Tamil Nadu, Kaveri; built ~2nd century by Cholas).

- **Only Arch Dam in India:** Idukki (Kerala, Periyar).
 - **Asia's largest multipurpose river valley project:** Bhakra Nangal.
 - **Damodar Valley Project (DVC):** "Ruhr of India" (Jharkhand–WB).
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7. Exam-Oriented Quick Facts / महत्वपूर्ण तथ्य

- Longest river in India (within India) → **Ganga (2525 km)**.
 - Longest Peninsular river → **Godavari**.
 - Largest delta in world → **Sundarbans (Ganga-Brahmaputra)**.
 - Largest river island → **Majuli (Brahmaputra, Assam)**.
 - Sorrow of Bihar → **Kosi River**.
 - Sorrow of Bengal → **Damodar River**.
 - Only west-flowing rivers forming estuaries → **Narmada & Tapi**.
 - Ganga bifurcates at Farakka into: **Hooghly (India) & Padma (Bangladesh)**.
 - **Five rivers of Punjab (Panjnad):** Sutlej, Beas, Ravi, Chenab, Jhelum.
 - **Panch Prayag (5 confluences of Alaknanda):** Vishnuprayag, Nandprayag, Karnaprayag, Rudraprayag, Devprayag.
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Difference Between Himalayan and Peninsular Rivers:

Feature	Himalayan Rivers	Peninsular Rivers
Place of Origin	Himalayan Mountains (covered with glaciers)	Peninsular Plateau and Central Highlands
Nature of Flow	Perennial (fed by glaciers and rainfall)	Seasonal (dependent on monsoons/rainfall)
Type of Drainage	Antecedent and Consequent (often Dendritic patterns)	Superimposed and Rejuvenated (Trellis, Rectangular, Radial, Annular patterns common due to varied hard/soft rocks)
Nature of Course	Long course	Relatively smaller courses
Catchment Area	Very large	Small
Age of River	Youthful stage (active erosion, gorge formation, steep slopes, high speed)	Relatively older stage (less steep slopes, depositional activities, old rock topography)
Erosion Extent	Larger, due to soft sedimentary rocks and steep slopes	Less, due to hard rocks and gentler slopes