IAS WITH DR RAVI · APPSC GROUP 1

Day 30
English Revision Notes

1,000 Topics in 100 Days

Topics 291–300

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Badami Chalukya art and architecture: Aihole, Badami and Pattadakal

Concept in one line

The Badami Chalukyas, who ruled from the middle of the 6th to the middle of the 8th century, left rock-cut cave temples at Badami and stone temples at Aihole and Pattadakal, all three in Bagalkot district of Karnataka. The exam asks which temple stands at which site, who built it, what inscription it carries and in which style it is built.

Revision notes

2.1 The three sites

- **Recall from Topic 11:** Pulakesin I turned the hill of Vatapi (Badami) into a fortress in 543; Ravikirti, the court poet of Pulakesin II, composed the Aihole inscription of Saka 556 (634-35 CE); Pulakesin II stopped Harsha on the Narmada; the Pallavas held Vatapi from 642 to 654-55; Vikramaditya II occupied Kanchi about 740.
- The Archaeological Survey of India (ASI) describes Chalukya temple building as "a series of experimentations that commenced at Aihole" and reached its height at Pattadakal.

Site	Setting	What is there	Period (as the sources date it)
Badami (Vatapi)	A town among sandstone hills, on the west bank of the man-made Agastya Teertha lake; Pulakesin I's fort and his cliff inscription of 543	Four rock-cut cave temples: three Hindu and one Jain	ASI: 6th to 7th century; George Michell: from the late 6th century

Site	Setting	What is there	Period (as the sources date it)
Aihole	The valley of the Malaprabha river	Over 120 stone and cave temples, among them the Lad Khan, the Durga, the Meguti and the Ravana Phadi cave	6th to 8th century in the dates of the ASI and Michell; older views put some temples in the 5th century (see 2.3)
Pattadakal	West bank of the Malaprabha, where the river turns north; 22 km north-east of Badami (ASI)	Nine Hindu temples and a Jain temple	7th to 8th century (Sangameshvara 696 to 733, Virupaksha about 740); the Jain temple is of the 9th century

2.2 Badami: the cave temples

- The four caves are cut into the soft sandstone of the hill. The ASI dates them to the 6th and 7th centuries and says they were cut for both Hindu and Jaina deities.
- Each cave has three basic parts: a pillared veranda, a columned hall and a sanctum cut deep into the rock.
- **Cave 1:** dedicated to Shiva. It has the dancing Shiva as Nataraja, a figure with 18 arms.
- **Cave 2:** dedicated mainly to Vishnu.
- **Cave 3:** dedicated to Vishnu, and the largest of the four. An inscription in it records the dedication of the shrine by Mangalesa (also spelt Mangalesha) in Saka 500, that is, 578 CE; Michell gives the day as the full moon of 1 November 578. Mangalesa became king only in 597-98 (Topic 11); in 578 his elder brother Kirtivarman I was on the throne.
- **Cave 4:** Jain, dedicated to the Tirthankaras. It is later than the other three: the later 7th century, or the 8th century in the view of some scholars.

2.3 Aihole: the experimental ground

- Aihole, with Badami, is often called a cradle of experimentation in temple architecture; UNESCO and art historians such as J.C. Harle are cited for this view. The ASI says the experiments began here and reached their height at Pattadakal.
- **Lad Khan temple:** a square hall of 16 pillars in four rows, with a rectangular pillared porch; the sanctum is built against the back wall of the hall, and a second, smaller shrine stands on the roof. The roof is of sloping slabs in two tiers; pierced stone screens light the hall; the river goddesses Ganga and Yamuna are carved at the entrance. It is named after a Muslim commander who used it as his base (Michell). **Date:** the ICOMOS (International Council on Monuments and Sites) evaluation of 1987 for UNESCO lists it as of about 450; the ASI now dates it to the 7th to 8th century.
- **Durga temple:** the largest and most richly decorated temple at Aihole (ASI). Its apsidal plan, with one end rounded, imitates the Buddhist rock-cut chaitya halls. An open pillared passage runs round it, and a curvilinear shikhara (tower) rises over the apsidal roof. Panels of Harihara, Narasimha and Mahishamardini suggest that it was a Vaishnava temple. The name does not come from the goddess Durga; one view links it with a fort (durg). **Date:** early scholars placed it in the 5th century; later studies put it between the late 6th and the early 8th century, and the ASI gives the 7th to 8th century.
- **Meguti temple:** a Jain temple. The ASI says it was completed around 634, according to the inscription on its eastern wall, and that it marks the culmination of Early Chalukya temple building at Aihole. The inscription is Ravikirti's prasasti of Saka 556 (634-35 CE) in praise of Pulakesin II; the ASI notes that it is the earliest inscription to mention the poets Kalidasa and Bharavi.
- **Ravana Phadi:** a rock-cut cave temple of the 6th century (Michell), with a Shiva linga in its inner hall and a dancing Shiva (Nataraja) with Parvati.

2.4 Pattadakal: the coronation site

- **Name:** the ASI says the Chalukya kings were crowned here, which gives the place its name: Pattada-Kisuvolal or Pattadakal, "the place of coronation". Accounts that cite the ASI name the coronation of Vinayaditya. The ICOMOS evaluation renders the name as "City of the Crown Rubies".

- **UNESCO:** the "Group of Monuments at Pattadakal" was inscribed on the World Heritage List in 1987 on criteria (iii) and (iv), the criteria the ICOMOS evaluation recommended.
- **Layout (ICOMOS):** eight Hindu temples dedicated to Siva form the main group; a ninth, the Papanatha, stands apart towards the village, along with a Jain temple.
- **Virupaksha:** built about 740 by Lokamahadevi, chief queen of Vikramaditya II (733 to 744-45), to commemorate his victory "over the Pallava and other sovereigns of southern India" (ICOMOS). Its original name was Lokeshvara (ASI). ICOMOS calls it "the masterpiece of Chalukya art" and says the king brought an architect and sculptors from the South. It is a dravida temple and resembles the Kailasanatha temple at Kanchipuram, the Pallava capital. Topic 11 records that Vikramaditya II, when he occupied Kanchi, returned the gold of that Kailasanatha temple. Studies of Ellora hold that its Kailasa temple, cut later in the 8th century, drew on the Virupaksha as its model (Ellora is Topic 572).
- **Mallikarjuna:** stands beside the Virupaksha; a dravida temple, built from 733 to 744 (ICOMOS). It was built by Trailokyamahadevi, another queen of Vikramaditya II, and was first called Trailokeshvara (Bagalkot district administration; Karnataka Tourism).
- **Sangameshvara:** a dravida temple; the ASI calls it the earliest datable structure in the group. ICOMOS dates it to 696 to 733, the reign of Vijayaditya (Topic 11). The Bagalkot district administration says it was built by Vijayaditya and first called Vijayeshvara after him; Michell adds that Vijayaditya died before it was finished, and it was left incomplete.
- **Galaganatha:** a fully developed temple in the northern rekha-nagara style (ASI). The ASI dates it to the middle of the 8th century; Michell dates it to the late 7th century and calls it almost an exact copy of the Svarga Brahma temple at Alampur.
- **Papanatha:** the sources differ on its style. ICOMOS sees in it "the incorporation of two different styles", and Michell calls it a novel mixture of dravida and nagara; the ASI Dharwad Circle's own page lists it with the rekha-nagara temples.
- **Jain temple:** probably built in the 9th century, in the reign of the Rashtrakuta king Krishna II. It is not a Chalukya temple.

2.5 The styles side by side

Style	What the sources say	Examples in this topic
Nagara	The northern style; the ASI calls the form at Pattadakal rekha-nagara prasada, and ICOMOS speaks of design "strongly influenced by the architecture of northern India"	Galaganatha, Kashi Vishveshvara, Jambulinga and Kadasiddheshvara at Pattadakal
Dravida	The southern style; the ASI calls it dravida vimana, and ICOMOS describes the roofs as "the complex, storied type found in southern architecture"	Virupaksha, Mallikarjuna and Sangameshvara at Pattadakal
Vesara or mixed	NCERT: in Karnataka, a hybridised style that seems to have become popular after the mid-seventh century "is known in some ancient texts as vesara"; some scholars treat vesara as an independent style made by mixing nagara and dravida. NCERT calls hybridisation "the hallmark of Chalukyan buildings"	Papanatha at Pattadakal, in the view of ICOMOS and Michell

- The ICOMOS evaluation for UNESCO describes the two styles side by side at Pattadakal: the Galaganatha and the Kashi Vishveshvara on the northern side, the Sangameshvara and the Mallikarjuna in "pure Dravidian style". Where a question names a style for a single temple, the safe answers are dravida for the Virupaksha and nagara for the Galaganatha.

2.6 Sculpture

- **Badami:** the 18-armed Nataraja of Cave 1; in Cave 3, large figures of Trivikrama, Anantasayana (Vishnu lying on the serpent), Varaha, Narasimha and Harihara, and Vishnu seated on the serpent Shesha.
- **Aihole:** Harihara, Narasimha and Mahishamardini on the Durga temple; Ganga and Yamuna on the Lad Khan; the dancing Shiva with Parvati in the Ravana Phadi.

- **Pattadakal:** friezes from the Ramayana and the Mahabharata on the Virupaksha (Michell); the Ramayana on the Papanatha (ICOMOS), which also has scenes from the Kiratarjuniya.
- **Later topics (other days):** Eastern Chalukya Telugu literature (451), Rashtrakuta art and Ellora (572), Chola art (522), the Kalyani Chalukyas (661), the Hoysalas (801) and Gupta art (952).

Extra section: chronology of the Badami Chalukya monuments

Year (CE)	Event
543	Pulakesin I fortifies the hill of Badami; his cliff inscription is the earliest record of the fort
578 (Saka 500)	Mangalesa dedicates Cave 3 at Badami, in the reign of his brother Kirtivarman I
6th century	Ravana Phadi cave at Aihole (Michell)
634-35 (Saka 556)	Ravikirti's prasasti on the Meguti temple at Aihole
642 to 654-55	The Pallavas hold Badami (Topic 11)
7th to 8th century	Lad Khan and Durga temples at Aihole, in the ASI's dating (older views: the 5th century)
696 to 733	Sangameshvara at Pattadakal built, in the reign of Vijayaditya (ICOMOS)
733 to 744	Mallikarjuna at Pattadakal built (ICOMOS)
About 740	Virupaksha at Pattadakal built by Queen Lokamahadevi; Vikramaditya II occupies Kanchi (Topic 11)
757	Badami ceases to be the Chalukya royal seat (ASI)
9th century	Jain temple at Pattadakal, in the Rashtrakuta period

Year (CE)	Event
1987	Pattadakal inscribed on UNESCO's World Heritage List

Three common exam traps

1. **"The Lad Khan at Aihole is a 5th-century temple."** That is the older view: the ICOMOS evaluation of 1987 still lists it as of about 450. The ASI now dates both the Lad Khan and the Durga temple to the 7th to 8th century, and the Durga temple, also once placed in the 5th century, has been redated to between the late 6th and the early 8th century. Give the ASI date unless a question names the older view. Neither name tells you the founder: the Lad Khan is named after a later Muslim commander, and the Durga temple is not named after the goddess.
2. **"Every temple at Pattadakal is a Chalukya temple, and every one fits one neat style."** The Jain temple there belongs to the Rashtrakuta period (9th century). The Papanatha is a mixed temple for ICOMOS and Michell but a rekha-nagara temple on the ASI Dharwad Circle's page, so do not treat it as a fixed textbook example of any one style.
3. **Three inscriptions, three dates.** The Badami cliff inscription of 543 records Pulakesin I's fort. The Cave 3 inscription of Saka 500 (578) is of Mangalesa, made about twenty years before he became king. The Aihole prasasti of Ravikirti is dated Saka 556 (634-35) and praises Pulakesin II. None of the three mentions the Pallava capture of Badami in 642.

Article 32 and the five writs

Concept in one line

Article 32 guarantees the right to move the Supreme Court for the enforcement of the Fundamental Rights and gives the Court the power to issue directions, orders and writs, five of which it names. The examination asks for the words of its four clauses, what each writ does and where it lies, how Article 32 differs from Article 226, and what happens to the remedy during an Emergency.

Revision notes

2.1 Where Article 32 stands

- Article 32 is in Part III. Its marginal heading is "Remedies for enforcement of rights conferred by this Part." The text below is the official text as on 1 May 2024; the four clauses read the same as in 1950.
- **Recall, Topic 62:** Article 12 says what "the State" means in Part III, and Article 13 makes a law void to the extent that it is inconsistent with the Fundamental Rights.
- **Recall, Topic 112:** Article 32 is the Supreme Court's writ jurisdiction for the Fundamental Rights only. A High Court may issue writs "for the enforcement of any of the rights conferred by Part III and for any other purpose", so Article 226 is wider.

2.2 Article 32, clause by clause

Clause	Words of the Constitution	What it does
(1)	"The right to move the Supreme Court by appropriate proceedings for the enforcement of the rights conferred by this Part is guaranteed."	It makes the remedy itself a Fundamental Right; that makes it more important, not wider
(2)	"The Supreme Court shall have power to issue directions or orders or writs, including writs in the nature of habeas corpus, mandamus, prohibition, quo warranto and certiorari, whichever may be appropriate, for the enforcement of any of the rights conferred by this Part."	It names five writs. The word "including" means the Court is not limited to them: it may also issue directions and orders
(3)	"Without prejudice to the powers conferred on the Supreme Court by clauses (1) and (2), Parliament may by law empower any other court to exercise within the local limits of its jurisdiction all or any of the powers exercisable by the Supreme Court under clause (2)."	Parliament may give the writ power of clause (2) to another court, but only within that court's local limits, and without taking anything away from the Supreme Court
(4)	"The right guaranteed by this article shall not be suspended except as otherwise provided for by this Constitution."	The right can be suspended only in a way the Constitution itself provides. That way is Article 359 (2.6)

- **Article 139:** "Parliament may by law confer on the Supreme Court power to issue directions, orders or writs, including writs in the nature of habeas corpus, mandamus, prohibition, quo warranto and certiorari, or any of them, for any purposes other than those mentioned in clause (2) of article 32." So the Supreme Court's writ power for other purposes needs a law of Parliament; a High Court's power under Article 226 comes from the Constitution itself.

2.3 "The very soul of the Constitution": Ambedkar and the Supreme Court

- Article 32 was Draft Article 25, debated in the Constituent Assembly on 9 December 1948.
- **Ambedkar that day:** no other Article was more important; it was "an article without which this Constitution would be a nullity". "It is the very soul of the Constitution and the very heart of it and I am glad that the House has realised its importance."
- The writs "are prerogative writs" and "can be sought for by an aggrieved party without bringing any proceedings or suit". "Hereafter it would not be possible for any legislature to take away the writs which are mentioned in this article", unless the Constitution itself is amended.
- **NCERT (Class XI, chapter 2):** "Right to constitutional remedies is the means through which this is to be achieved", that is, the rights realised in practice. It puts Ambedkar's view as "heart and soul of the constitution": NCERT's words, not his.
- **Romesh Thappar v. State of Madras (26 May 1950):** the State argued that the petitioner should first have gone to the Madras High Court under Article 226. The Court rejected the objection: "This Court is thus constituted the protector and guarantor of fundamental rights", and it "cannot, consistently with the responsibility so laid upon it, refuse to entertain applications seeking protection against infringements of such rights."
- **State of Madras v. V.G. Row (31 March 1952; five judges):** the "sentinel" phrase belongs to this judgment: "This is especially true as regards the "fundamental rights", as to which this Court has been assigned the role of a sentinel on the qui vive."
- **L. Chandra Kumar v. Union of India (18 March 1997; seven judges):** the power of judicial review over legislative action vested in the High Courts under Article 226 and in the Supreme Court under Article 32 "is an integral and essential feature of the Constitution, constituting part of its basic structure" (Topic 123).

2.4 The five writs

Writ	What the court orders (NCERT)	Where it lies and its limits (as the courts have held)
Habeas corpus ("that you have the body")	The arrested person must be presented before the court; the court can set him free if the manner or grounds of arrest are not lawful or satisfactory	The remedy against unlawful detention, by the State or by a private person: Tejaswini Gaud v. Shekhar Jagdish Prasad Tewari (2019) held it maintainable where the "detention of a minor child by a parent or others was illegal". ADM Jabalpur (1976) held it suspendable during the Emergency; since overruled (2.6)
Mandamus ("we command")	It is issued when an office holder is not doing a legal duty and so infringes the right of an individual	It needs a public duty: "The Writ of Mandamus lies to secure the performance of a public or a statutory duty" (Binny Ltd. v. V. Sadasivan, 2005). It lies against a private body only when that body discharges a public function, and writ jurisdiction cannot be used "to enforce purely private contracts". Under Article 361 the President and a Governor are not answerable to any court for the exercise of the powers and duties of their office, though proceedings may be brought against the Government of India or of a State; yet the Supreme Court's opinion of 20 November 2025 allows a limited direction to a Governor whose inaction is prolonged, unexplained and indefinite (Topic 4)
Prohibition	A higher court issues it when a lower court has taken up a case going beyond its jurisdiction	It lies "when the proceedings are to any extent pending". It can be issued to courts and to all authorities exercising judicial or quasi-judicial functions (Hari Vishnu Kamath)

Writ	What the court orders (NCERT)	Where it lies and its limits (as the courts have held)
Certiorari ("to be informed")	The court orders a lower court or another authority to transfer a matter before it to the higher court or authority	It issues "for quashing after they have terminated in a final decision": for want or excess of jurisdiction, for a breach of natural justice, or for a manifest error apparent on the face of the proceedings. Like prohibition, it goes to courts and to all authorities exercising judicial or quasi-judicial functions (Hari Vishnu Kamath). In A.K. Kraipak v. Union of India (1969) the Court said the line between administrative and quasi-judicial power "is quite thin", applied natural justice to an administrative selection and set the selections aside
Quo warranto ("by what warrant")	If a person holds an office that he is not entitled to hold, the court restrains him from acting in it	It calls on a person who holds "an independent substantive public office" to show by what right he holds it. The petitioner must show that the office is a public office "held by a usurper without legal authority" (University of Mysore v. C.D. Govinda Rao, 1963). The office must be public, "created by a statute or by the constitution itself", and substantive, not mere employment at another's pleasure (M.A.M. Raja, Madras High Court, 2022). Strict locus standi is relaxed: "any concerned person can file a writ petition"; the petitioner need not be personally aggrieved, but must come with bona fides (B. Srinivasa Reddy, Supreme Court, 2006)

- **Timing:** NCERT's short description of certiorari speaks of a matter "pending" before the lower court; remember Hari Vishnu Kamath's broad rule: prohibition while proceedings are pending, certiorari to quash a final decision.

2.5 Article 32 and Article 226 compared

Point	Article 32	Article 226
Court	The Supreme Court	Every High Court

Point	Article 32	Article 226
Rights enforced	The Fundamental Rights only	"the rights conferred by Part III and for any other purpose"
Territorial reach	The Article sets no territorial limit	"throughout the territories in relation to which it exercises jurisdiction"; under clause (2), also where "the cause of action, wholly or in part, arises" within those territories, even if the seat of the Government or the residence of the person is outside
Right or discretion	A Fundamental Right under clause (1); the Court cannot refuse to entertain such applications (Romesh Thappar)	A power of the Court; in K.K. Kochunni (1959), as a LiveLaw column records, the Supreme Court said a High Court may weigh an adequate alternative remedy
Choice of court	A petitioner may come straight to the Supreme Court, though in Union of India v. Paul Manickam (2003) two judges said detention challenges filed directly under Article 32 are "to be discouraged" unless reasons are given for not going to the High Court first	Clause (4): the High Court's power "shall not be in derogation of the power conferred on the Supreme Court by clause (2) of article 32"

- Article 226(1) opens with "Notwithstanding anything in article 32".
- **PIL and locus standi:** in S.P. Gupta (30 December 1981) Justice Bhagwati held that where those who suffer a legal wrong cannot approach the court because of poverty, helplessness, disability or a disadvantaged position, "any member of the public can maintain an application for an appropriate direction, order or writ", under Article 226 or, for a Fundamental Right, under Article 32. Public interest litigation (PIL) is taught in Topic 883.

2.6 Article 32 during an Emergency

- **Article 359(1):** while a Proclamation of Emergency is in operation, the President may by order suspend the right to move any court for the enforcement of the Part III rights mentioned in the order, "(except articles 20 and 21)".
- **Who put the words in:** clause (1A) was inserted by section 7 of the Thirty-eighth Amendment Act, 1975. Section 40 of the Forty-fourth Amendment Act, 1978 then added "(except articles 20 and 21)" to both clause (1) and clause (1A) (Topic 282). The 1950 text had neither these words nor clause (1A).
- This is the "otherwise provided" of Article 32(4). Because Article 359 speaks of "any court", it reaches the High Courts as well as the Supreme Court.
- **ADM Jabalpur v. Shivkant Shukla (28 April 1976; five judges, 4 to 1; Justice H.R. Khanna dissenting):** the majority held that the right to move a court against unlawful detention (habeas corpus) could be suspended during the Emergency. **K.S. Puttaswamy (24 August 2017; nine judges)** overruled it; the leading opinion, by Justice D.Y. Chandrachud, called the four majority judgments of 1976 "seriously flawed".

Extra section: Article 32 and the writs in the Constituent Assembly and the Supreme Court, 1948 to 2025

Date	Event	What to remember
9 December 1948	Draft Article 25 debated	Ambedkar: "the very soul of the Constitution and the very heart of it"
26 May 1950	Romesh Thappar	"Protector and guarantor of fundamental rights"; no need to go to the High Court first
31 March 1952	V.G. Row	"A sentinel on the qui vive"

Date	Event	What to remember
9 December 1954	Hari Vishnu Kamath	Prohibition while proceedings are pending; certiorari after a final decision
1959	K.K. Kochunni	An adequate remedy may weigh with a High Court under Article 226
26 August 1963	University of Mysore v. C.D. Govinda Rao	Quo warranto for an independent substantive public office held without legal authority
28 April 1976	ADM Jabalpur	Habeas corpus held suspendable during the Emergency (4 to 1)
1978	Forty-third Amendment Act in force (13 April) and Forty-fourth Amendment Act	Article 32A omitted; Articles 20 and 21 placed outside Article 359
30 December 1981	S.P. Gupta	Any member of the public may move the court for those unable to do so
18 March 1997	L. Chandra Kumar	Judicial review under Articles 226 and 32 part of the basic structure
2003	Paul Manickam	Detention challenges filed directly under Article 32 "to be discouraged" without reasons
24 August 2017	K.S. Puttaswamy	ADM Jabalpur overruled

Date	Event	What to remember
20 November 2025	Opinion on Governors and Bills	A limited direction to a Governor for prolonged, unexplained and indefinite inaction

- The pattern: the Court called itself the guardian of the Fundamental Rights from 1950; the Emergency judgment of 1976 was the low point; the Forty-fourth Amendment and Puttaswamy repaired it.

Three common exam traps

1. **Misquoting the two famous phrases.** Ambedkar's own words on 9 December 1948 were "the very soul of the Constitution and the very heart of it"; "heart and soul" is NCERT's short form. He spoke of Draft Article 25, which became Article 32. "A sentinel on the qui vive" comes from V.G. Row (1952), not Romesh Thappar (1950); Romesh Thappar called the Court "the protector and guarantor of fundamental rights".
2. **"During an Emergency every Fundamental Right can be switched off, as in ADM Jabalpur."** Since the Forty-fourth Amendment Act, 1978, an order under Article 359 cannot suspend the right to move a court for Articles 20 and 21. ADM Jabalpur (1976) was overruled by the nine judges of K.S. Puttaswamy (2017).
3. **"Mandamus can never touch a Governor" or "mandamus lies against anyone".** Article 361 protects the President and a Governor personally: they are not answerable to any court for the exercise of the powers of their office. But the 2025 opinion still allows a limited direction to decide within a reasonable time, without saying what to decide. On the other side, mandamus needs a public duty: it is not a remedy against a person who owes none.

Make in India and the Production Linked Incentive scheme

Concept in one line

Make in India, launched on 25 September 2014, is the Government of India's initiative to build India into a manufacturing hub, and the Production Linked Incentive (PLI) schemes, begun in 2020, pay eligible firms an incentive linked to their incremental sales of goods made in India. The examination asks about the pillars, sectors and goals of Make in India, how the PLI works, its sectors and outlay, and what its results so far show.

Revision notes

2.1 The starting point (Topic 155)

- From Topic 155: under the Statement on Industrial Policy of 24 July 1991, industrial licensing was abolished for all industries except those specified, and approval would be given for direct foreign investment up to 51 per cent foreign equity in high-priority industries. Make in India and the PLI build on that opening.

2.2 Make in India: launch, pillars and sectors

- **Launch:** by Prime Minister Narendra Modi on 25 September 2014 (Ministry of Commerce and Industry, "10 Years of Make in India", September 2024).
- **Aim (PIB, February 2021):** facilitating investment, fostering innovation and building best in class manufacturing infrastructure, together with easier business and better skills.

The four pillars, as the Ministry's ten-year document gives them:

Pillar	What it covers
New Processes	Ease of doing business, seen as the key to encouraging entrepreneurship

Pillar	What it covers
New Infrastructure	Industrial corridors, smart cities, high-speed communication, simpler registration, stronger intellectual property rights, skills matched to industry
New Sectors	Foreign direct investment (FDI) opened up in defence production, insurance, medical devices, construction and railway infrastructure
New Mindset	The Government acts as a facilitator rather than a regulator and works as a partner of industry

- **Sectors at launch:** 25 industry sectors (Make in India website).
- **Make in India 2.0:** 27 sectors (Lok Sabha written reply, published by PIB on 3 February 2021). The Department for Promotion of Industry and Internal Trade (DPIIT) coordinates the action plans for 15 manufacturing sectors, for example aerospace and defence, automotive and auto components, pharmaceuticals and medical devices, electronics system design and manufacturing, and textiles and apparels. The Department of Commerce coordinates 12 service sectors, for example IT and IT-enabled services, tourism and hospitality, medical value travel and financial services.

2.3 The goals of Make in India

- **Manufacturing share:** the official Make in India website (DPIIT, "About" page) gives the goal of raising the contribution of the manufacturing sector to 25 per cent of GDP by 2020. The page ties this goal to the action plan of a National Workshop held in December 2014.
- **Jobs:** the goal of 100 million additional jobs by 2022, with a 25 per cent manufacturing share, belongs to the National Manufacturing Policy of 4 November 2011 (Topic 155). Many accounts (for example The Hindu, January 2020) list 100 million additional manufacturing jobs by 2022 among the goals of Make in India, with the 25 per cent target moved to 2022 and later to 2025. Give the website's figure when a question names the official site.

2.4 The PLI scheme: from three schemes to 14 sectors

- **The first schemes (March and April 2020):** large-scale electronics manufacturing (mobile phones and specified electronic components; notified on 1 April 2020); critical key starting materials, drug intermediates and active pharmaceutical ingredients (APIs); and medical devices.
- **The Cabinet decision of 11 November 2020** approved PLI schemes for ten more sectors, with an outlay of Rs 1,45,980 crore over five years. Any new sector needs fresh approval from the Cabinet.

Scheme (outlay as approved, Rs crore)	Ministry or department named in 2020
Mobile manufacturing and specified electronic components (40,951; notified earlier)	Ministry of Electronics and Information Technology (MeitY)
Key starting materials, drug intermediates and APIs (6,940; notified earlier)	Department of Pharmaceuticals
Medical devices (3,420; notified earlier)	Department of Pharmaceuticals
Advanced chemistry cell (ACC) battery (18,100)	NITI Aayog and Department of Heavy Industry
Electronic and technology products (5,000)	MeitY
Automobiles and auto components (57,042)	Department of Heavy Industry
Pharmaceutical drugs (15,000)	Department of Pharmaceuticals
Telecom and networking products (12,195)	Department of Telecommunications
Textiles: man-made fibre and technical textiles (10,683)	Ministry of Textiles
Food products (10,900)	Ministry of Food Processing Industries
High efficiency solar PV modules (4,500)	Ministry of New and Renewable Energy

Scheme (outlay as approved, Rs crore)	Ministry or department named in 2020
White goods: air conditioners and LED lights (6,238)	DPIIT
Specialty steel (6,322)	Ministry of Steel

- The three earlier schemes add up to Rs 51,311 crore; with the ten new ones the total is Rs 1,97,291 crore. This is the outlay of about **Rs 1.97 lakh crore** announced in the Union Budget 2021-22.
- **Drones and drone components** came later as the 14th sector, with Rs 120 crore over three years. PIB, the Economic Survey 2025-26 and a Lok Sabha answer of July 2025 all give **14 sectors and Rs 1.97 lakh crore**. In 2026 the Government gives the approved outlay as Rs 1.91 lakh crore: in a Lok Sabha reply of 21 July 2026 (as reported by DD News) and in the DPIIT statement of 25 September 2026 (as reported by the Press Trust of India, PTI). The reports give no reason for the lower figure.
- Outlays of single schemes changed after approval: the automobile scheme, shown at Rs 57,042 crore in November 2020, was approved in September 2021 at Rs 25,938 crore.

2.5 How the PLI incentive works and who runs it

- **The idea:** the incentive is paid on incremental sales, that is, on the rise in a firm's sales of eligible goods made in India over a base year, for a fixed number of years. A firm qualifies only if it crosses thresholds of incremental investment and production.
- **Example, large-scale electronics manufacturing:** the scheme provides 4 to 6 per cent incentives on eligible incremental sales over a base year, under the applicable guidelines. Target segments include mobile phones with invoice value Rs 15,000 and above, mobile phones manufactured by eligible domestic companies, and specified electronic components. The separate domestic-company phone category must not be treated as universally subject to the Rs 15,000 threshold. Its tenure was later extended to 2025-26.

- **Who runs it:** each scheme is run by its line ministry or department, within the approved outlay. The Expenditure Finance Committee appraises each proposal and the Cabinet approves it. An Empowered Group of Secretaries reviews the schemes and may move savings from one approved sector to another. DPIIT answers for the schemes as a whole in Parliament and puts out the combined figures. NITI Aayog was named, with the Department of Heavy Industry, only for the ACC battery scheme.

2.6 What the PLI has delivered: the official figures

Item	Lok Sabha answer, 22 July 2025	Economic Survey 2025-26 (till September 2025)	DPIIT statement reported by PTI, 25 September 2026 (as on 30 June 2026)
Actual investment	Rs 1.76 lakh crore (till March 2025)	Over Rs 2.0 lakh crore	Rs 2.58 lakh crore
Production or sales	Incremental production or sales above Rs 16.5 lakh crore	Incremental production or sales over Rs 18.70 lakh crore	Rs 23.79 lakh crore
Jobs (direct and indirect)	Over 12 lakh	Over 12.60 lakh	Over 14.57 lakh
Incentives disbursed	Rs 21,534 crore in 12 sectors (as on 24 June 2025)	Rs 23,946 crore across 12 sectors	Rs 36,754 crore

- **Exports:** the Survey puts PLI exports at over Rs 8.20 lakh crore till September 2025, driven mainly by electronics, pharmaceuticals, and telecom and networking products.
- **Mobile phones (Lok Sabha, July 2025):** production rose about 146 per cent, from Rs 2,13,773 crore in 2020-21 to Rs 5,25,000 crore in 2024-25. Exports rose about 775 per cent, from Rs 22,870 crore to Rs 2,00,000 crore.

- **Pharmaceuticals:** India moved from a net importer of bulk drugs (minus Rs 1,930 crore in 2021-22) to a net exporter (Rs 2,280 crore) (Lok Sabha, July 2025); PIB (August 2025) dates the Rs 2,280 crore surplus to 2024-25. Sales under the pharmaceuticals scheme in its first three years were Rs 2.66 lakh crore, with exports of Rs 1.70 lakh crore, in the Lok Sabha answer; the Survey gives "crossed Rs 2.63 lakh crore", with exports of Rs 1.69 lakh crore.

2.7 Newer steps

- **National Manufacturing Mission:** announced in the Union Budget 2025-26 (1 February 2025). It covers small, medium and large industries, furthers Make in India, and will also support clean tech manufacturing. The Economic Survey 2025-26 reports its proposed targets for 2035: manufacturing at 25 per cent of GDP (from 12.9 per cent in 2023), 143 million jobs and merchandise exports of US$ 1.2 trillion.
- **Electronics Components Manufacturing Scheme:** launched in April 2025 with an outlay of Rs 22,919 crore. The Budget 2026-27 (1 February 2026) proposed raising it to Rs 40,000 crore, because investment commitments already exceed the target.
- **Semiconductors:** the Semicon India programme was approved in 2021 with Rs 76,000 crore. The Budget 2026-27 announced the India Semiconductor Mission 2.0.
- **Employment Linked Incentive (ELI) scheme:** approved by the Union Cabinet and renamed the PM Viksit Bharat Rozgar Yojana (PM-VBRY), it has an outlay of Rs 99,446 crore and aims to incentivise more than 3.5 crore jobs created between 1 August 2025 and 31 July 2027, with special focus on manufacturing (PIB, 25 July 2025).

2.8 Assessment

Issue	What supporters say	What critics say
Imported components	Rajeev Chandrasekhar, Minister of State for Electronics and IT (June 2023): only about US$ 22 billion of the US$ 32.4 billion of imports cited were linked to mobile phones, and the net outflow was US$ 10.9 billion. The Economic Survey 2025-26 calls India the world's second-largest mobile phone maker	Raghuram Rajan, Rohit Lamba and Rahul Chauhan (May 2023): most components are still imported; assembly is as little as 4 per cent of the manufacturing cost; net exports of phones remained negative. The Survey itself notes reliance on a handful of suppliers for semiconductors
Money paid against outlay	Government (Lok Sabha, July 2025): projects take 2 to 3 years to set up, and claims generally begin only after the first year of production	Disbursement is small against the Rs 1.97 lakh crore outlay: Rs 36,754 crore by 30 June 2026 (DPIIT), less than a fifth
Spread across sectors	Gains outside electronics: bulk drugs turned to net exports; domestic value addition in pharmaceuticals was 83.74 per cent in March 2025 (Survey)	Exports came mainly from electronics, pharmaceuticals and telecom, and payments had reached only 12 of the 14 sectors by September 2025 (Survey)

Issue	What supporters say	What critics say
Manufacturing share of GDP	The Survey presents the National Manufacturing Mission as complementing Make in India, with 25 per cent now proposed for 2035	The 25 per cent goal for 2020 was missed: 12.9 per cent in 2023 (Survey); 15.9 per cent in 2023-24 against 16.7 per cent in 2013-14 (ThePrint, September 2024). The two figures come from different series

- Topics left to other days, in a line each: MSMEs (Topic 385), Startup India and Stand-Up India (Topic 474), industrial corridors of India (Topic 593) and of Andhra Pradesh (Topic 355), and Industry 4.0 (Topic 937). Digital India came in Topic 127.

Extra section: a chronology, 2011 to 2026

Date	Event
4 November 2011	National Manufacturing Policy announced (Topic 155)
25 September 2014	Make in India launched
1 April 2020	PLI for large-scale electronics manufacturing notified
11 November 2020	Cabinet approves PLI schemes for ten more sectors
1 February 2021	Union Budget 2021-22: PLI outlay of about Rs 1.97 lakh crore
3 February 2021	Make in India 2.0 and its 27 sectors set out in a Lok Sabha reply
September 2021	Automobile PLI approved at Rs 25,938 crore

Date	Event
1 February 2025	Union Budget 2025-26 announces the National Manufacturing Mission
April 2025	Electronics Components Manufacturing Scheme launched
22 July 2025	Lok Sabha answer: Rs 1.76 lakh crore invested till March 2025
1 February 2026	Budget 2026-27: ECMS outlay to rise to Rs 40,000 crore; India Semiconductor Mission 2.0
25 September 2026	DPIIT figures as on 30 June 2026: Rs 2.58 lakh crore invested, Rs 36,754 crore disbursed

What the chronology shows:

- Make in India came first and worked through rules, infrastructure and promotion. The money-backed PLI came more than five years later.
- The PLI grew in stages: three schemes in 2020, ten more sectors in November 2020, drones later, making 14.
- From 2025 the focus widened to components and semiconductors (ECMS, India Semiconductor Mission 2.0) and to a mission for the whole of manufacturing.

Three common exam traps

1. **"Make in India and the PLI are the same thing."** Make in India (2014) is a broad initiative of pillars and sectors that works through policy, infrastructure and facilitation. The PLI (2020) is a set of schemes, each with its own budget, that pays money to firms that meet their targets. The PLI is one of the tools used under Make in India; it is not the initiative itself.
2. **"The outlay is the money already paid."** Rs 1.97 lakh crore is the outlay, the ceiling approved for the schemes over their life. What firms have actually received is much smaller: Rs 36,754 crore as on 30 June 2026. Outlays of single schemes also changed (the automobile scheme fell from Rs 57,042 crore to Rs 25,938 crore), and the DPIIT statement of September 2026 gave Rs 1.91 lakh crore as the approved outlay.

3. **"DPIIT or NITI Aayog runs all the PLI schemes."** Each scheme is run by its own ministry or department: MeitY for electronics, the Department of Pharmaceuticals for drugs and devices, the Ministry of Textiles for textiles, and so on. DPIIT itself runs only the white goods scheme, and it collects the combined figures. NITI Aayog was named only for the battery scheme, together with the Department of Heavy Industry.

Factors of industrial location

Concept in one line

Industrial location is the choice of the place where a manufacturing unit is set up, and NCERT says industries should be located where production costs are minimum. The exam asks which factor (market, raw material, labour, energy, transport, government policy or agglomeration) pulls a given industry, what footloose industries are, and the terms of Alfred Weber's least-cost theory.

Revision notes

2.1 Why industries choose different places

- NCERT: "Industries maximise profits by reducing costs." Therefore "industries should be located at points where the production costs are minimum."
- NCERT names seven factors: access to market, access to raw material, access to labour supply, access to sources of energy, access to transportation and communication facilities, government policy, and agglomeration economies.
- Books used: NCERT Class XII *Fundamentals of Human Geography*, chapter 5 "Secondary Activities" (rationalised edition), and NCERT Class X *Contemporary India II*, chapter 6 "Manufacturing Industries". The rationalised Class XII *India: People and Economy* has nine chapters and none of them is on manufacturing, so it is not used here.
- Recall Topic 155: the Statement on Industrial Policy of 1991 ended licensing for most industries and changed the rules on where industry may be located.

2.2 The factors at a glance

Factor	What it means	Example given	Source
Access to market	"The existence of a market for manufactured goods is the most important factor in the location of industries." A market means people who want the goods and have the purchasing power to buy them	Aircraft and arms industries have global markets; densely populated South and South-east Asia is a large market	NCERT Class XII
Access to raw material	Raw material should be cheap and easy to transport. Industries based on cheap, bulky and weight-losing material are located close to its source. Perishability also ties an industry to its source	Steel, sugar and cement industries; agro-processing and dairy products	NCERT Class XII
Access to labour supply	Some types of manufacturing still require skilled labour. Mechanisation, automation and flexible processes have reduced the dependence on labour	Textiles, leather and food processing need large amounts of labour	NCERT Class XII; NIOS
Access to sources of energy	Industries which use more power are located close to the source of the energy supply	The aluminium industry	NCERT Class XII
Access to transportation and communication	"Modern industry is inseparably tied to transportation systems." Communication is needed to exchange and manage information	Western Europe and eastern North America, where transport is highly developed	NCERT Class XII
Government policy	Governments adopt "regional policies" to promote "balanced" economic development and so set up industries in particular areas	Industries set up in tribal and backward areas to reduce regional disparities	NCERT Class XII; NCERT Class X

Factor	What it means	Example given	Source
Agglomeration economies	Benefits that industries get from nearness to a leader industry and other industries; the savings come from the linkages between industries	The finished goods of one industry become the raw material of another	NCERT Class XII; NIOS

- Energy over time (NCERT): earlier coal was the main source of energy; today hydroelectricity and petroleum are also important sources.

2.3 Raw-material-oriented and market-oriented industries

Point	Raw-material-oriented	Market-oriented
Why the pull	The raw material is bulky and loses weight in processing, or it is perishable	The product gains weight in making, for example by adding materials found everywhere (such as water)
In Weber's terms	Material index above 1 (weight-losing materials)	Material index below 1
Examples in the sources	Steel, sugar and cement; agro-processing and dairy products (NCERT Class XII)	Activities that use ubiquitous materials such as water (Weber, in Rodrigue); cotton textiles today (NIOS)

- A material index of exactly 1 (pure materials only) fits neither type: transport cost is the same at the source and at the market (see 2.7).
- **Sugar, the standard case:** NCERT Class X says the raw material "is bulky, and in haulage its sucrose content reduces". NIOS adds that sugarcane is perishable and loses its sucrose after some time. So mills stand close to the cane fields.
- **Perishability:** NCERT Class XII calls it "a vital factor" for locating an industry near its raw material. Agro-processing and dairy products are processed close to the sources of farm produce and milk.

- NCERT's present chapter names no industry as market-oriented. It calls the market the most important factor of all and gives aircraft and arms as goods with global markets.

2.4 Footloose industries

NCERT Class XII describes them in six points:

- "Foot loose industries can be located in a wide variety of places."
- "They are not dependent on any specific raw material, weight losing or otherwise."
- "They largely depend on component parts which can be obtained anywhere."
- "They produce in small quantity and also employ a small labour force."
- "These are generally not polluting industries."
- "The important factor in their location is accessibility by road network."

NCERT gives no example. NIOS gives mobile manufacturing and computer chip production as footloose industries.

2.5 Power, labour, government policy and agglomeration: Indian examples

- **Power (aluminium smelting):** NCERT Class X: "Regular supply of electricity and an assured source of raw material at minimum cost are the two prime factors for location of the industry." Smelters are located in Odisha, West Bengal, Kerala, Uttar Pradesh, Chhattisgarh, Maharashtra and Tamil Nadu. Bauxite, the raw material, is a very bulky rock.
- **Labour (jute mills on the Hugli):** among the factors NCERT Class X gives is cheap labour from West Bengal and the adjoining States of Bihar, Odisha and Uttar Pradesh. The others are nearness to the jute-producing areas, inexpensive water transport backed by railways and roadways, and abundant water for processing raw jute.
- **Government policy (public and joint sector units):** NCERT Class X says the philosophy behind public sector industries and joint sector ventures also aimed at bringing down regional disparities by establishing industries in tribal and backward areas.

- **Agglomeration (Kolkata and the jute mills):** NCERT Class X notes that Kolkata, a large urban centre, provides banking, insurance and port facilities for the export of jute goods. This is the kind of shared service that a cluster of industries gains from.

2.6 Classification of industries

Basis	Classes	Examples in NCERT
Size (Class XII)	Household or cottage; small-scale; large-scale	Household industry is the smallest unit, run by artisans at home; small-scale units work in a workshop outside the home with simple power-driven machines and semi-skilled labour
Raw material (Class XII)	Agro-based; mineral-based; chemical-based; forest-based; animal-based	Sugar, fruit juices and textiles; iron and steel (ferrous), aluminium and copper (non-ferrous), cement and pottery (non-metallic); petrochemicals, synthetic fibre and plastic; furniture, paper and lac; leather and woollen textiles
Output or main role	Basic or key industries; consumer goods industries	Basic: iron and steel, copper smelting and aluminium smelting (Class X). Consumer: sugar, toothpaste, paper, sewing machines and fans (Class X); bread, biscuits, soaps and televisions (Class XII)
Ownership (Class X)	Public; private; joint; cooperative	Public: BHEL, SAIL. Private: TISCO, Bajaj Auto Ltd., Dabur Industries. Joint: Oil India Ltd. (OIL), jointly owned by the public and private sector. Cooperative: the sugar industry in Maharashtra, the coir industry in Kerala
Bulk and weight (Class X)	Heavy; light	Heavy: iron and steel. Light: electrical goods

2.7 Alfred Weber's least-cost theory

Point	Weber's idea
The work	*Über den Standort der Industrien*, written in 1909; English edition, *Alfred Weber's Theory of the Location of Industries*, by Carl J. Friedrich (University of Chicago Press, 1929)
Aim	Find the site where the costs of production are least: hence "least-cost theory"
The three factors	Transport costs, labour costs and agglomeration. Transport is the most important; labour and agglomeration only adjust the least-transport-cost site
Kinds of material	Localised materials are found only at certain places; ubiquities (such as water) are found everywhere. A pure material enters the product with its full weight; a weight-losing material passes only part of its weight into the product
Material index	Weight of localised materials ÷ weight of the product. Above 1: production is pulled to the deposits. Below 1: production is pulled to the place of consumption, that is, the market. Exactly 1 (pure materials only): transport cost is the same at the source, at the market or at any point between, so transport cost alone does not fix the site; the plant may locate anywhere along that line
Locational triangle	Two sources of material and one market form the corners of a triangle; the least-cost factory site is sought in relation to all three
Isodapanes	Lines joining places of equal total transport cost. The critical isodapane is the line where the extra transport cost equals the saving on labour

- **Assumptions (Rodrigue):** an isolated region, transport costs that vary only with distance, and perfect competition.

- **Criticisms in a line:** freight rates are rarely proportional to distance, the land surface is not uniform, and government action through zoning, subsidies and taxes now shapes location (Mapping Around); falling transport costs and global supply chains have made Weber's principles matter much less, though they still fit industries with a high material index (Rodrigue).

2.8 How the factors change over time

- **Cotton textiles:** NCERT Class X says that in the early years the industry was concentrated in the cotton-growing belt of Maharashtra and Gujarat, helped by raw cotton, market, transport including port facilities, labour and a moist climate. The first successful mill was set up in Mumbai in 1854. Today spinning is centralised in Maharashtra, Gujarat and Tamil Nadu, while weaving is highly decentralised (handloom, powerloom and mills). NIOS says that nowadays the market has become the dominant factor in locating the industry. The earlier edition of NCERT Class XII *India: People and Economy* says that cotton is a pure raw material that does not lose weight in manufacturing, so other factors such as power, labour, capital or market may decide the location, and that at present the trend is to locate the industry at or close to markets.
- **Sugar:** NCERT Class X says mills tend to shift to the southern and western States, especially Maharashtra, because the cane there has a higher sucrose content, the cooler climate gives a longer crushing season, and cooperatives are more successful.
- **Energy and labour:** coal has been joined by hydroelectricity and petroleum, and mechanisation has reduced the dependence on labour (NCERT Class XII).
- **Transport:** lower transport costs have weakened the pull that Weber described (Rodrigue).
- **Iron and steel:** NCERT Class XII still lists steel among industries located near raw material, and NCERT Class X says the Chhotanagpur plateau has the maximum concentration of the industry. Its plants and their newer sites come in Topic 306.
- Industrial regions (Topic 416), industries of Andhra Pradesh (Topic 445) and individual industries (Topics 306, 606, 686, 745 and 906) come on other days.

Extra section: worked examples of Weber's material index

Made-up figures for practice. Assume, as Weber does, that the cost of carrying one tonne for one kilometre is the same for every good, and that the source and the market are 100 km apart.

Case	Inputs and output	Material index	Tonne-km if the factory is at the source	Tonne-km if the factory is at the market	Least-cost site
A weight-losing material	5 tonnes of a localised material give 1 tonne of product	5 ÷ 1 = 5	1 × 100 = 100 (carry the product)	5 × 100 = 500 (carry the material)	The source
A ubiquity added	1 tonne of a localised material + 2 tonnes of water give 3 tonnes of product	1 ÷ 3 = 0.33	3 × 100 = 300 (carry the product)	1 × 100 = 100 (carry the material)	The market

What the examples show:

- Water is a ubiquity, so it is not counted in the material index and never needs to be carried. That is why the second index falls below 1.
- A high material index means much weight is lost on the way to the product; carrying the lighter product is cheaper, so the plant goes to the raw material.
- Labour and agglomeration can still draw the plant away from this least-transport-cost site, but only if the saving is larger than the extra transport cost (the critical isodapane).

Three common exam traps

1. **"Footloose means location does not matter at all."** NCERT says footloose industries are not tied to any specific raw material and depend on component parts that can be obtained anywhere, but it names an important factor in their location: accessibility by road network. They employ a small labour force and are generally not polluting.
2. **"Weber's theory dates from 1929."** Weber wrote *Über den Standort der Industrien* in 1909. 1929 is the year of the English edition by Carl J. Friedrich. In questions on the origin of the theory, give 1909.
3. **"Agglomeration is a cost of crowding."** NCERT uses agglomeration economies for the benefits that industries get from nearness to a leader industry and to each other, through the linkages between them. Weber's translator treats the opposite pull separately: deglomerating factors, tied to the rising land rent that comes with agglomeration.

Physical divisions of Andhra Pradesh: coastal plains, Eastern Ghats and Rayalaseema plateau

Concept in one line

Andhra Pradesh has three physical divisions, which run from east to west as the coastal plains, the Eastern Ghats and a plateau that is part of the Deccan. The examination asks you to place each lake, delta, hill range, gorge and cave in its division and to know the State's coastline figures.

Revision notes

2.1 The three divisions at a glance

- **Recall:** Topic 45 took the four rivers (the Godavari, the Krishna, the Penna and the Vamsadhara) from source to sea. Topic 95 placed the hill tribes in the Eastern Ghats and the Nallamala, and the Yanadi in the plains. Topic 216 set the Eastern Ghats beside the Western Ghats. Topic 275 gave the area of the present State as 1,62,970 sq km.
- **Three zones:** the AP Forest Department names three geographical zones: the Coastal Plains, the Eastern Ghats and the Deccan Plateau. Britannica's student encyclopaedia gives the same three, from east to west: a long coastal plain, the mountains of the Eastern Ghats, and a plateau that is part of the Deccan.
- **Region is not division:** Coastal Andhra, Uttarandhra and Rayalaseema are regions made of districts. The physical divisions do not follow district lines. Tirupati district, for example, is counted in the Rayalaseema region, yet it holds Pulicat Lake on the coast.

Division	Extent	Districts or places, as the sources name them	Rocks or soils	Main features
Coastal plains	The eastern strip, between the Bay of Bengal and the Eastern Ghats, from the Odisha border in the north-east to Pulicat on the Tamil Nadu border	The Godavari and Krishna deltas; Kolleru, mostly in Eluru district; Pulicat, mostly in Tirupati district	Deltas built by the east-flowing rivers (NCERT); fertile farm land (Britannica)	The coastline; the two deltas; Kolleru and Pulicat lakes; mangroves
Eastern Ghats	Between the coastal plain and the plateau; a broken line of hills, higher north of the Godavari	The Zoological Survey of India (ZSI, 2014) lists 15 districts of the then undivided State, from Srikakulam to Chittoor	Charnockite, granite, khondalite and quartzite (Wikipedia); the Nallamala of quartzite of the Kadapa system	Araku valley and the highest peaks in the north; the Nallamala, Velikonda, Palkonda, Lankamala, Seshachalam and Erramala ranges in the south
Plateau (Deccan)	The western interior, west of the southern ranges	Rayalaseema region; the Erramala hills in Kurnool and Nandyal districts and at Gandikota in Kadapa district	Mainly granite, with sandy soil and scrub (Topic 136)	The Penna and its Gandikota gorge; the Belum caves; a dry climate

- **ZSI's districts:** of the 15, 12 are now in Andhra Pradesh, named as they then stood: Srikakulam, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasam, Nellore, Kurnool, Cuddapah (Kadapa), Anantapur and Chittoor. The other three (Khammam, Mahabubnagar and Nalgonda) are now in Telangana.

2.2 The coastal plain

- **NCERT on the eastern coastal plain:** compared with the western coastal plain it is broader and an example of an emergent coast. It has well-developed deltas, formed by the rivers that flow east into the Bay of Bengal. Because of its emergent nature it has fewer ports and harbours. The continental shelf extends up to 500 km into the sea, which makes it difficult to develop good ports and harbours.
- **Britannica:** the coastal plain is well watered by rivers that empty into the Bay of Bengal. The principal rivers are the Godavari and the Krishna, and their deltas are fertile farm areas.

Coastline of Andhra Pradesh	Length	Rank among the States	Source and date
Old figure	973.7 km, usually given as about 974 km	2nd, after Gujarat (1,214.70 km); Tamil Nadu was 3rd with 906.9 km	Ministry of Earth Sciences, reply in Parliament, 4 December 2025; the AP State Portal's Fact File (2014) also gave about 974 km, the second longest
Re-measured figure	1,053.07 km	3rd, after Gujarat (2,340.62 km) and Tamil Nadu (1,068.69 km)	National Hydrographic Office with the Survey of India; promulgated by a circular of the Ministry of Ports, Shipping and Waterways dated 29 April 2025; reported by the Ministry of Earth Sciences on 4 December 2025

- The re-measured figure is about 79 km longer than the old one. India's whole coastline went from 7,516.6 km to 11,098.81 km on the same re-measurement.
- **Ranks are among the States.** The Union Territory of the Andaman and Nicobar Islands has a longer coastline than any State (1,962 km old; 3,083.50 km re-measured).

- **The deltas (recall Topic 45):** below Dowleswaram the Godavari divides into the Gautami and the Vasishta, and the delta of these branches is Konaseema. The Krishna reaches the sea at Hamsaladeevi. The AP Forest Department says the Godavari and Krishna estuaries hold the second largest mangrove ecosystem in the country.
- **Kolleru Lake:** a freshwater lake between the Krishna and Godavari deltas, mostly in Eluru district. Seasonal streams such as the Budameru and the Tammileru feed it, and the Upputeru drains it. It was declared a wildlife sanctuary in November 1999 under the Wild Life (Protection) Act, 1972. It was designated a Ramsar site on 19 August 2002, over 90,100 hectares; it is the only Ramsar site of Andhra Pradesh in the Indian Wetlands portal's list as on 21 April 2026.
- **Pulicat Lake:** a brackish-water lagoon; Wikipedia calls it the second largest in India after Chilika. Most of it lies in Tirupati district of Andhra Pradesh and the rest in Thiruvallur district of Tamil Nadu. The barrier island of Sriharikota separates it from the Bay of Bengal. The Andhra Pradesh part became a bird sanctuary in September 1976 (172 sq km), and the Tamil Nadu part in October 1980. Pulicat is not in the list of Ramsar sites as on 21 April 2026.

2.3 The Eastern Ghats in Andhra Pradesh

- **NCERT:** the Eastern Ghats are discontinuous and low hills, highly eroded by rivers such as the Mahanadi, the Godavari, the Krishna and the Kaveri. Among the important ranges NCERT names the Javadi hills, the Palconda range (Palkonda), the Nallamala hills and the Mahendragiri hills.
- **The breaks (recall Topic 45):** the Godavari crosses the Papi hills in a gorge. ZSI adds that the Krishna and the Godavari are separated by a range of low hills.
- **The northern part (ZSI):** north of the Godavari the hills rise unexpectedly and form the boundary between Andhra Pradesh and Odisha. The Vizag hills and the Araku valley lie here.
- **Peaks in one line:** ZSI gives Arma Konda (1,680 m), in Andhra Pradesh, as the highest peak of the Eastern Ghats; NCERT's Class IX book gives Mahendragiri (1,501 m) (Topic 216); heights and the choice of peak differ between sources. The peaks and their heights are Topic 616.

- **The southern part:** ZSI says that north of the Palar river the Eastern Ghats form two parallel ranges running north to south. The higher Palikonda (Palkonda), Lankamalai and Nallamalai ranges are in the west. The lower Yerramalai (Erramala) and Velikonda ranges are in the east.

Range	Where it lies	Point to remember
Nallamala	Runs nearly north to south between the Krishna and the Penna (Wikipedia); lies south of the Krishna (Britannica) and continues to the Krishna (ZSI); on the eastern edge of the Rayalaseema region	Rocks of the Kadapa system, mainly quartzite; average height about 520 m (Wikipedia)
Velikonda	The lower eastern range (ZSI); Nellore district (Wikipedia)	Descends to the coastal plains in northern Nellore district (ZSI). Somasila stands where the Penna leaves it (Topic 45)
Palkonda	The higher western range (ZSI); Kadapa district (Wikipedia)	With the Nallamala, it surrounds Kadapa city on three sides (Kadapa district administration)
Lankamala	The higher western range, with the Palkonda and the Nallamala (ZSI); Wikipedia lists it, with the Seshachalam, in Chittoor, Kadapa and Tirupati districts	ZSI names it with the Palkonda and the Nallamala in the higher western line
Seshachalam	Mostly in Tirupati district, in the Rayalaseema region (Wikipedia)	Tirumala lies on these hills; the State's one biosphere reserve (AP Forest Department), designated in 2010; the Sri Venkateswara National Park

Range	Where it lies	Point to remember
Erramala	On the eastern edge of the Deccan plateau in western Andhra Pradesh, trending north-east to south-west (Britannica); in Kurnool and Nandyal districts (Wikipedia) and at Gandikota in Kadapa district (Kadapa district administration)	It lies between the Krishna basin to the north and the Penna basin to the south (Britannica). The higher Nallamala lies to its east (Wikipedia)

- **The grouping differs between sources.** ZSI puts the Erramala with the Velikonda in the lower eastern line. The Government of India profile of 2015 in Topic 136 put the Erramala, the Seshachalam and the Palakonda on the inner ridge and the Nallamala and the Velikonda on the outer ridge. Wikipedia places the Erramala to the west of the Nallamala. Learn where each range lies and what lies on it; do not rely on the grouping.
- **Where the Erramala sits:** Britannica places the Erramala on the eastern edge of the Deccan plateau, while ZSI groups it with the lower eastern range of the Eastern Ghats. That is why it appears in these notes under both divisions; the Gandikota gorge, between its cliffs, is placed on the plateau.
- **The Nallamala and Srisailam:** Srisailam, on the Krishna, lies in the Nallamala and is the site of a large hydroelectric project; a large part of the Nallamala forest is in the Nagarjunsagar-Srisailam Tiger Reserve. The Gundlakamma is the largest river that rises in these hills (Wikipedia). Tiger reserves are Topic 175.

2.4 The plateau of the interior

- **Part of the Deccan:** Britannica says the State's plateau is part of India's vast Deccan region. The AP Forest Department calls this zone the Deccan Plateau. It lies mostly in the Rayalaseema region, which is why it is commonly named the Rayalaseema plateau.
- **Slope:** NCERT says the general elevation of the Peninsular plateau falls from west to east, which the flow of the rivers proves. The Krishna and the Penna both cross Andhra Pradesh eastwards to the Bay of Bengal (Topic 45).

- **Dry climate, in one line:** the interior is mostly semi-arid in parts of Anantapur, Sri Sathya Sai, Kurnool and Kadapa districts, which lie in the rain-shadow of the Western Ghats (Wikipedia). Climate is Topic 566.
- **The Penna and the Gandikota gorge:** at Gandikota, in Kadapa district, the Penna flows through a gorge about 200 m wide between the cliffs of the Erramala hills (Kadapa district administration); Wikipedia calls these the Gandikota hills. The Gandikota dam lies upstream of the gorge and the Mylavaram dam downstream, as in Topic 45.
- **The Belum caves:** near Belum village, Kolimigundla mandal, Nandyal district. They are about 3.23 km long. They are a karst feature formed through the dissolution of limestone by water. The district administration records a length of 3,229 m.
- **Horsley Hills:** a hill station near Madanapalle, in southern Andhra Pradesh, which Topic 216 placed in the Eastern Ghats at about 1,265 to 1,290 m. ZSI records a collecting site on Horsley Hill at 1,236 m above sea level; heights differ between sources.

Extra section: what lies where

This table places features of the three divisions. It does not repeat Topic 45's table of the rivers.

Feature	What it is	Physical division	Where, as the sources give it
Kolleru	Freshwater lake; wildlife sanctuary and Ramsar site	Coastal plains	Between the Krishna and Godavari deltas; mostly Eluru district
Pulicat	Brackish-water lagoon; bird sanctuary	Coastal plains	Mostly Tirupati district; the rest in Tamil Nadu
Sriharikota	Barrier island	Coastal plains	Between Pulicat and the Bay of Bengal
Mangroves	Second largest mangrove ecosystem of the country (AP Forest Department)	Coastal plains	The Godavari and Krishna estuaries

Feature	What it is	Physical division	Where, as the sources give it
Araku valley	Valley in the hills	Eastern Ghats (north)	North of the Godavari, near the Odisha boundary
Srisailam	Hydroelectric project site on the Krishna	Eastern Ghats (south)	In the Nallamala
Tirumala	Pilgrimage town	Eastern Ghats (south)	On the Seshachalam hills, near Tirupati
Kadapa city	District headquarters	Among the southern ranges	Surrounded on three sides by the Nallamala and the Palkonda
Gandikota gorge	River gorge	Plateau	On the Penna, between the cliffs of the Erramala hills, Kadapa district
Belum caves	Limestone caves, a karst feature	Plateau	Belum, Nandyal district
Horsley Hills	Hill station; ZSI records a site there at 1,236 m	Eastern Ghats (Topic 216)	Southern Andhra Pradesh, near Madanapalle

How to hold it in memory:

- **East to west:** lakes and deltas on the coast; ranges in the middle; gorge and caves on the plateau.
- **Two lines in the south:** the higher Palkonda, Lankamala and Nallamala in the west; the lower Velikonda in the east, ending in the coastal plain of Nellore district (ZSI).
- **One range across the plateau:** the Erramala trends north-east to south-west and lies between the Krishna basin and the Penna basin.

Three common exam traps

1. **Taking the Rayalaseema region for the plateau.** The region is a group of districts; the plateau is a landform. Tirupati district is counted in the Rayalaseema region, yet Pulicat Lake and Sriharikota lie in it, on the coast. The Seshachalam and Nallamala ranges also lie in the region but belong to the Eastern Ghats.
2. **"Arma Konda is the highest peak of the Eastern Ghats on every source."** ZSI gives Arma Konda (1,680 m) in Andhra Pradesh. NCERT's Class IX book gives Mahendragiri (1,501 m), and Wikipedia names Deomali (1,672 m) for the northern section, which lies mostly in Odisha. Follow the source the question names; when it follows NCERT, give Mahendragiri.
3. **Mixing up the two lakes.** Kolleru is a freshwater lake, a wildlife sanctuary since 1999 and a Ramsar site since 2002, the State's only one in the list as on 21 April 2026. Pulicat is a brackish-water lagoon, separated from the sea by Sriharikota, and protected as a bird sanctuary since 1976; it is not a Ramsar site in the list as on 21 April 2026.

Aadhaar, India Stack and digital public infrastructure

Concept in one line

Aadhaar is the identity number issued by the Unique Identification Authority of India (UIDAI) under the Aadhaar Act, 2016, and together with UPI, DigiLocker and the consent-based Account Aggregator framework it forms India Stack, the core of India's digital public infrastructure (DPI). The examination asks about the Aadhaar law and the 2018 judgment, the layers of India Stack and the bodies behind them, and India's DPI abroad.

Revision notes

2.1 Recall from Topic 127

- Topic 127 gave Aadhaar as a 12-digit number, UIDAI set up on 28 January 2009 by a Planning Commission notification, UPI built by the National Payments Corporation of India (NPCI) in 2016, DigiLocker (2015, MeitY), ONDC (2022) and the United Nations description of DPI. This topic adds the law, the judgment, the layers and India's DPI abroad.

2.2 Aadhaar and UIDAI

- **The law:** the Aadhaar (Targeted Delivery of Financial and Other Subsidies, Benefits and Services) Act, 2016. It was notified on 26 March 2016. It was amended by the Aadhaar and Other Laws (Amendment) Act, 2019, which was notified on 23 July 2019 and has effect from 25 July 2019, as UIDAI states.
- **What the 2019 amendment did:** it was meant to add further safeguards for the privacy of data, and it allowed the voluntary use of Aadhaar authentication for getting a SIM card and opening a bank account, with matching changes in the Indian Telegraph Act, 1885 and the Prevention of Money Laundering Act, 2002.

- **UIDAI's journey:** an attached office of the Planning Commission from 28 January 2009; attached on 12 September 2015 to the Department of Electronics and Information Technology (DeitY), then within the Ministry of Communications and Information Technology; a statutory authority under the Aadhaar Act from 12 July 2016. Its current administrative ministry is MeitY.
- **The first Aadhaar:** the scheme was launched on 29 September 2010 at Tembhli, a village in Nandurbar district of Maharashtra (UIDAI), where the first Aadhaar was issued (Comptroller and Auditor General of India, CAG). UIDAI's own page says the first number was issued on 29 September 2010 to a resident of Nandurbar, Maharashtra.
- **How many:** UIDAI's enrolment dashboard showed 145.32 crore Aadhaar generated in total when read on 1 November 2026 (page last updated on 28 September 2026). Topic 127's "over 144 crore" was the March 2026 figure. The Government's backgrounder of 6 March 2026 adds that over 2,707 crore authentication transactions were carried out in 2024-25.
- **What Aadhaar is not:** under section 9 of the Act, an Aadhaar number or its authentication is not, by itself, proof of citizenship or of domicile. It is a proof of identity.

2.3 The Puttaswamy (Aadhaar) judgment, 26 September 2018

A Constitution Bench of five judges upheld the scheme by 4 to 1; Justice D.Y. Chandrachud dissented. The holdings below follow the summary in CAG Report No. 24 of 2021; the section 57 row follows the majority judgment itself.

Point	What the Court held
The Act and privacy	The Aadhaar Act, 2016 does not violate the fundamental right to privacy; section 7 (Aadhaar for subsidies, benefits and services) is valid

Point	What the Court held
When Aadhaar is compulsory	Aadhaar is not mandatory for every service. Section 7 permits specified publicly funded subsidies, benefits and services to require Aadhaar, subject to safeguards. Separate income-tax provisions require PAN–Aadhaar linkage/ quotation for eligible persons, subject to exemptions. The 2018 judgment rejected mandatory Aadhaar for the student admissions and examinations discussed in that case
Authentication failure	No deserving person may be denied a benefit because authentication fails; another means of proving identity must be offered
Children	A child cannot be denied a section 7 benefit for want of an Aadhaar number; identity can be shown by another document
Section 57	Struck down only in part: the part that let a body corporate or a person use Aadhaar authentication under a contract was declared unconstitutional; any other use of Aadhaar to establish identity must be backed by law
Regulation 27	Struck down: it allowed authentication data to be archived for five years; keeping data beyond six months became impermissible
PAN and Aadhaar	Section 139AA of the Income-tax Act, 1961, on seeding PAN with Aadhaar, held constitutional
Bank accounts	Rule 9 of the Prevention of Money-laundering (Maintenance of Records) Rules, 2005, as amended in 2017, which required Aadhaar to be linked with bank accounts, held unconstitutional
Mobile numbers	The Department of Telecommunications circular of 23 March 2017, which mandated linking mobile numbers with Aadhaar, held unconstitutional

2.4 India Stack and its layers

- **What it is:** India Stack describes itself as "open APIs and digital public goods". It credits UIDAI with Aadhaar and eKYC, the Controller of Certifying Authorities (CCA) with eSign, MeitY with DigiLocker, and NPCI with the payment systems (UPI, the Aadhaar Payments Bridge and the Aadhaar Enabled Payments System).
- **The layers, as NITI Aayog's paper on the Data Empowerment and Protection Architecture (DEPA, draft for discussion, August 2020) describes them:**

Layer	What it holds or does
Aadhaar (launched 2010)	A unique, digitally verifiable identity; supports eKYC and eSign
UPI (launched 2016)	An interoperable mobile payments platform
DigiLocker	Gathers digital documents from official sources
DEPA, the consent layer	Secure data sharing through consent; the paper calls it "the final layer of India Stack". It governs how data is shared and does not hold the data itself

- Topic 127 grouped the same systems as three layers (identity, payments, data), with DigiLocker and the Account Aggregator framework in the data layer; the DEPA paper splits consent out as the final layer.

2.5 UPI

- Developed and run by NPCI, an initiative of the Reserve Bank of India (RBI) and the Indian Banks' Association; the RBI regulates payment systems under the Payment and Settlement Systems Act, 2007.
- Launched on a pilot basis in April 2016 with 21 member banks (the pilot was inaugurated on 11 April 2016 by RBI Governor Raghuram G. Rajan) and opened to the public in August 2016.

- **Volume, dated:** in September 2026 UPI handled 24.07 billion (2,407 crore) transactions worth Rs 29.37 lakh crore, by NPCI data (DD News, 1 October 2026). In July 2026 it handled 2,365.8 crore transactions worth Rs 29.87 lakh crore, with 741 banks live (Government backgrounder of 24 August 2026).

2.6 The Account Aggregator framework and DEPA

- **RBI framework:** the Account Aggregator framework began with the NBFC–Account Aggregator Directions of 2 September 2016. Current consolidated rules are the Reserve Bank of India (Non-Banking Financial Companies – Account Aggregator) Directions, 2025, issued on 28 November 2025. An AA is an NBFC; it needs RBI registration and net owned funds of at least Rs 2 crore, or a higher amount specified by RBI. The consent, no-transactions and no-resident-financial-information rules below continue in the 2025 Directions (paragraphs 11 and 14–15).
- **What an AA may and may not do:**
  - It serves a customer only on the customer's explicit consent.
  - It carries on no business other than account aggregation and does not support transactions.
  - The customer's financial information is not its property, and the information it obtains from providers must not reside with it.
  - It may share the data only with the customer or with a Financial Information User the customer has authorised.
- **Who is at each end:** Financial Information Providers include banks, NBFCs, asset management companies, depositories, insurance companies and GSTN. A Financial Information User is an entity registered with and regulated by a financial sector regulator.
- **DEPA:** NITI Aayog's draft framework for consent-based data sharing. In its words, "Consent Managers in the financial sector will be known as Account Aggregators (AAs)", and Consent Managers are "data blind by design".

2.7 DigiLocker and ONDC, a line each

- **DigiLocker (2015, MeitY):** a digital document wallet with consent-based access (its figures are in Topic 127); its use in daily life comes in Topic 627.

- **ONDC (Open Network for Digital Commerce, 2022):** an open network for online trade; over 1.16 lakh retail sellers were live on it as of December 2025, as in Topic 127.

2.8 DPI in the G20 and the world

- **G20 New Delhi Leaders' Declaration (9 and 10 September 2023), paragraph 55:** it describes DPI "as an evolving concept and as a set of shared digital systems", built on secure and resilient infrastructure and able to use open standards and open-source software.
- **Paragraph 56:** the leaders welcomed the G20 Framework for Systems of Digital Public Infrastructure, "a voluntary and suggested framework"; welcomed India's plan to build and maintain a Global Digital Public Infrastructure Repository (GDPIR), a virtual store of DPI that countries share voluntarily; and took note of India's proposal of the One Future Alliance, a voluntary initiative for capacity building, technical help and funding for DPI in low and middle income countries.
- The Government's backgrounder of 6 March 2026 says the Declaration "explicitly recognised DPI as a development accelerator", and that India contributed the highest number of DPI solutions to the repository.
- **Social Impact Fund:** a fund to fast-track DPI in the Global South, announced by the Prime Minister at the Virtual G20 Leaders' Summit (22 November 2023), with an initial US $25 million from India.

2.9 India's DPI abroad

Item	What it is	Reach, dated
UPI abroad	Acceptance or cross-border remittances through UPI, partly through NPCI International Payments Limited (NIPL)	Live in 11 foreign countries by 24 August 2026: Bhutan, Nepal, Singapore, the UAE, France, Sri Lanka, Mauritius and Qatar, then Cambodia and Greece (June 2026) and the Maldives (30 July 2026)

Item	What it is	Reach, dated
MOSIP (Modular Open Source Identity Platform)	Modular, open-source technology with which countries build and own their national identity systems; established in 2018 at the International Institute of Information Technology Bangalore (IIIT Bangalore)	32 country engagements and 14 national rollouts, as shown on its site on 1 November 2026; the Government's backgrounder of March 2026 says more than 25 nations are adopting or exploring it
DPI agreements	Memorandums of understanding and agreements on DPI with other countries	24 countries as of February 2026, among them Armenia, Sierra Leone, Trinidad and Tobago, Kenya, Brazil and Malaysia

- **India Stack Global:** a platform set up to showcase India's DPI and help partner countries adopt it.

2.10 The issues

Issue	What the official or court source says
Privacy	The Supreme Court (2018) held that the Aadhaar Act does not violate the right to privacy. The 2019 amendment was meant to add further safeguards for the privacy of data (CAG). The general data law is the Digital Personal Data Protection Act, 2023 (Topic 467)
Exclusion through authentication failure	The Supreme Court (2018): no deserving person may be denied a benefit because authentication fails, and another means of identity must be offered; no child may be denied a section 7 benefit for want of Aadhaar

Issue	What the official or court source says
Data security and retention	The Supreme Court (2018) struck down Regulation 27, so keeping authentication data beyond six months is impermissible, and struck down the part of section 57 that let a body corporate or a person use Aadhaar authentication under a contract. Under the RBI's Master Direction, an Account Aggregator must not keep the financial information it carries

- Later topics, a line each: Jan Dhan, DBT and digital payments (Topic 434); data protection (Topic 467); UPI and DigiLocker in daily life (Topic 627); blockchain and digital currency (Topic 797).

Extra section: chronology of Aadhaar and India Stack

Date	Event
28 January 2009	UIDAI set up as an attached office of the Planning Commission
29 September 2010	Aadhaar launched at Tembhli, Nandurbar district, Maharashtra; first Aadhaar issued
2015	UIDAI attached to DeitY in the then Ministry of Communications and Information Technology (12 September); DigiLocker
26 March 2016	Aadhaar Act notified
April 2016	UPI pilot with 21 member banks; open to the public in August 2016
12 July 2016	UIDAI becomes a statutory authority under the Act
2 September 2016	RBI's Master Direction on NBFC Account Aggregators
2018	MOSIP established at IIIT Bangalore
26 September 2018	Puttaswamy (Aadhaar) judgment
25 July 2019	Aadhaar and Other Laws (Amendment) Act, 2019 takes effect

Date	Event
August 2020	NITI Aayog's DEPA draft for discussion
2022	ONDC
9 and 10 September 2023	G20 New Delhi Leaders' Declaration on DPI
22 November 2023	Social Impact Fund for DPI announced, with an initial US $25 million from India; Global DPI Repository declared complete
24 August 2026	UPI live in 11 foreign countries
September 2026	UPI handles 24.07 billion transactions in the month

- The pattern: identity came first (2009 to 2010), the law and the payments and consent rules came together in 2016, the court settled the limits in 2018, and from 2018 India began to take its DPI abroad (MOSIP, the G20, UPI links).

Three common exam traps

1. **"Aadhaar proves that the holder is an Indian citizen."** Under section 9 of the Act, an Aadhaar number or its authentication is not, by itself, proof of citizenship or domicile. It proves identity.
2. **"UPI is run by the RBI."** NPCI developed UPI and runs it; the RBI regulates it. In the same way, the Account Aggregator framework began under RBI's 2016 Directions and now has consolidated RBI Directions, 2025 (binding on the entities covered), while DEPA is a NITI Aayog draft for discussion, not a law.
3. **"The Supreme Court struck down Aadhaar" or "Aadhaar is mandatory everywhere."** Both are wrong. The Court upheld the framework in 2018 while invalidating specified provisions and mandatory-linking requirements. Section 7 benefits have statutory safeguards, and separate PAN–Aadhaar requirements apply to eligible persons subject to exemptions. The 2019 amendment enabled specified voluntary uses; distinguish the historical judgment from later law.

Remote sensing: principles, spatial resolution and passive versus active sensors

Concept in one line

Remote sensing is the gathering of information about the earth's surface by a sensor that does not touch it, using the electromagnetic energy that the surface reflects or emits. The examination asks about its stages, the parts of the spectrum it uses, the four kinds of resolution and the difference between passive and active sensors.

Revision notes

2.1 What remote sensing is, and its stages

- **NCERT's definition:** "the total processes used to acquire and measure the information of some property of objects and phenomena" by a recording device (the sensor) that is not in physical contact with them. NASA Earthdata puts it in one line: "Remote sensing is the acquiring of information from a distance."
- **Source of energy:** "Sun is the most important source of energy used in remote sensing" (NCERT). Energy may also be produced artificially, as by flashguns or the energy beams used in radar.
- **NCERT's eight stages**, as one flow:

Stage (NCERT)	What happens
1. Source of energy	The sun, or the object's own emission
2. Transmission to the earth	Energy travels from the source to the earth's surface
3. Interaction with the surface	The surface absorbs, transmits, reflects or emits the energy

Stage (NCERT)	What happens
4. Propagation through the atmosphere	The reflected or emitted energy passes up through the atmosphere
5. Detection by the sensor	The sensor records the reflected or emitted energy
6. Conversion into data	The energy received is turned into photographic or digital form
7. Extraction of information	The information is drawn out of the data products
8. Conversion into maps or tables	The information is presented as maps or tables

- **Sensor:** a device that gathers electromagnetic radiation and converts it into a signal (NCERT). Sensors are photographic (analogue) or non-photographic (digital); the non-photographic ones build the image bit by bit and are called scanners.

2.2 The electromagnetic spectrum and atmospheric windows

- NCERT groups energy waves by wavelength into gamma rays, X-rays, ultraviolet, visible, infrared, microwave and radio waves, and says that "the visible, infrared and microwave regions of energy are used in remote sensing."
- **Atmospheric window:** a region of the electromagnetic spectrum that can pass through the earth's atmosphere. The optical, infrared and radio windows are the three main windows; they depend on clouds, water vapour and trace greenhouse gases. Remote sensing works with wavelengths that lie inside these windows (Wikipedia, citing NASA and other sources).

Region	Wavelength (source)	What it shows
Visible	Green 0.5 to 0.6 μm and red 0.6 to 0.7 μm (NCERT)	Turbid water reflects more in the blue and green and looks light (NCERT); healthy vegetation absorbs blue and red light for photosynthesis (NASA)

Region	Wavelength (source)	What it shows
Near infrared	0.7 to 1.1 μm (NCERT)	Healthy leaf structure produces strong near-infrared reflection. Chlorophyll absorbs strongly in red and blue light. Fresh water generally absorbs near-infrared energy and appears dark in this band
Thermal infrared	8 to 15 μm (NASA)	Energy that objects emit as heat; satellites use it to study changes in land and sea surface temperatures, and infrared images show which clouds are warmer and which cooler (NASA)
Microwave (radar bands)	X band 2.4 to 3.8 cm; C band 3.8 to 7.5 cm; S band 7.5 to 15 cm; L band 15 to 30 cm (NASA)	Radar imagery can be made night or day, regardless of weather, even of land under cloud. A longer wavelength (L band, about 23 cm) goes deeper through a tree canopy (NASA)

2.3 Spectral signatures

- Each kind of surface reflects and absorbs the bands of the spectrum in its own pattern. Scientists graph these patterns to tell surfaces apart, for example one crop from another (NASA).
- **Vegetation:** absorbs blue and red, and reflects strongly in the near infrared because of its many-layered leaf structure. In NCERT's standard false colour composite, near-infrared is shown in red, so healthy vegetation appears in red tones.
- **Water:** fresh water absorbs more energy in the red and infrared and looks dark; turbid water reflects more in the blue and green and looks lighter.
- **Soil and other surfaces:** smooth, dry surfaces reflect more energy than rough, moist ones (NCERT).

2.4 The four resolutions

Every dataset has four kinds of resolution: radiometric, spatial, spectral and temporal (NASA). Examples below are from the National Remote Sensing Centre (NRSC) brochure for Resourcesat-1 and from NCERT. LISS stands for Linear Imaging Self-Scanning Sensor, and AWiFS for Advanced Wide Field Sensor (NRSC).

Resolution	What it means	Example from an official source
Spatial	NCERT: the capability of the sensor to distinguish two closely spaced surfaces as two different surfaces. NASA: the smallest horizontal distance between successive elements of data, that is, the size of the ground cell that one pixel stands for	LISS-IV on Resourcesat-1: 5.8 m at nadir (NRSC)
Spectral	The sensing and recording power of the sensor in different bands of electromagnetic radiation (NCERT): how many bands, and how narrow	LISS-III records 4 bands (three visible and near-infrared bands plus one short wave infrared band, 1.55 to 1.70 μm); LISS-IV records 3 (NRSC)
Radiometric	The capability of the sensor to discriminate between two targets (NCERT) by small differences in the energy they send; shown by the number of grey levels	IRS sensors record grey levels 0 to 127, Landsat TM 0 to 255 (NCERT); LISS-III data are sent as 7 bits (NRSC)
Temporal	The revisit time: the interval after which a satellite observes the same area again (NCERT). It is not the orbital period (see 2.7)	LISS-III: 24 days; AWiFS: 5-day revisit for 80 per cent of the area it covers (NRSC)

- **Why a finer resolution is a smaller number:** the figure is the size of the ground cell a pixel represents. A 5.8 m pixel stands for a small patch, so smaller objects can be told apart than with a 56 m pixel. "Higher" or "finer" resolution therefore means a smaller figure.

- **IFOV (Instantaneous Field of View):** NCERT describes the scanner's optical head as having a particular dimension, the IFOV, with which it views the ground while scanning; the whole width covered by the oscillating sensor is the Total Field of View (TFOV).
- **Two kinds of scanner (NCERT):** a whiskbroom scanner has a rotating mirror and a single detector that sweeps across the field of view. A pushbroom scanner has a line of detectors, each collecting the energy from one ground cell; the number of detectors equals the swath divided by the spatial resolution.

2.5 Passive and active sensors

Point	Passive sensor	Active sensor
Energy source	Natural: "Passive instruments detect energy emitted from the natural environment" (NASA): sunlight reflected by the surface, or heat the surface emits	Its own: "Active instruments emit energy and collect data based on changes in the return signal" (NASA)
Day and night	Sensors of reflected sunlight depend on the sun to light the scene; thermal infrared sensors record emitted heat	Day and night (NRSC for EOS-04; NASA for synthetic aperture radar)
Cloud	Optical imagery does not show land hidden under cloud; NASA names this as an advantage of radar	Radar works in all weather and can image land covered by cloud (NASA, NRSC)
Examples	Optical cameras and scanners: LISS-IV, LISS-III and AWiFS on Resourcesat-1; the 6-channel Imager on INSAT-3DS, whose first images included a thermal infrared band	Radar: the C-band synthetic aperture radar (SAR) on EOS-04; the L-band and S-band SAR of NISAR (NASA-ISRO Synthetic Aperture Radar). Lidar: pulsed laser light

- **Synthetic aperture radar (SAR):** an active sensor that sends out a pulse of microwave energy and records the return. It combines a sequence of observations from a short antenna to simulate a much longer one (NASA).

- **Lidar (Light Detection and Ranging):** uses light in the form of a pulsed laser to measure distances to the earth. Topographic lidar typically uses a near-infrared laser to map land; bathymetric lidar uses green light, which enters water, to measure seafloor and riverbed heights (NOAA).

2.6 Indian sensors as examples of each type

Satellite and sensor	Type	What the official source gives
Resourcesat-1: LISS-IV	Passive, optical	5.8 m at nadir; bands at 0.52 to 0.59, 0.62 to 0.68 and 0.77 to 0.86 μm (green, red and near infrared by NCERT's ranges); swath 70 km in single-band mode; 5-day revisit by tilting (NRSC)
Resourcesat-1: LISS-III	Passive, optical	23.5 m; the same three bands plus short wave infrared; swath 141 km; 24-day repetivity (NRSC). NCERT's table gives IRS LISS-III as 23 m
Resourcesat-1: AWiFS	Passive, optical	56 m at nadir; four bands like LISS-III; swath 740 km; 5-day revisit for 80 per cent of the area (NRSC)
INSAT-3DS	Passive; visible and infrared	6-channel Imager and 19-channel Sounder in geostationary orbit, for meteorological observation (ISRO)
EOS-04 (RISAT-1A)	Active, microwave	C-band SAR; follow-on to RISAT-1 (2012); "all weather, day and night imaging capability"; modes from 50 m (223 km swath) to 3 m (25 km swath) (NRSC)
NISAR (NASA and ISRO)	Active, microwave	Collects L-band and S-band SAR data (NASA)

- The 23 m and 23.5 m for LISS-III are two sources, not two sensors. Give NCERT's 23 m when a question follows NCERT.

- ISRO gives the same three resolutions (LISS-IV 5.8 m, LISS-III 23.5 m, AWiFS 56 m) for the similar cameras on Resourcesat-2A, launched on 7 December 2016.

2.7 Orbits and temporal resolution

Point (NCERT, Box 6.1)	Sun-synchronous satellites	Geostationary satellites
Altitude	700 to 900 km	About 36,000 km
Coverage	81 degrees N to 81 degrees S	One-third of the globe
Orbital period	About 14 orbits per day	24 hours
Resolution	Fine (182 m to 1 m)	Coarse (1 km × 1 km)
Uses	Earth resources applications	Telecommunication and weather monitoring

- A sun-synchronous satellite comes back over the same area only after its revisit time, such as 24 days for LISS-III. A geostationary satellite stays over one spot (Topic 7), so it can look at the same third of the globe again and again; this suits weather watching.
- **Recall:** Topic 17: PSLV carries remote sensing satellites to sun-synchronous polar orbit (1,750 kg to 600 km). Topic 87: NavIC gives navigation, not imagery, from geostationary and inclined geosynchronous orbits. Topic 276: INSAT-2A, a communication satellite, also carried a Very High Resolution Radiometer with 2 km resolution in the visible and 8 km in the infrared, an example of the coarse resolution of geostationary sensing.

Extra section: worked examples on resolution

Question	Working	What it teaches
How much ground does one pixel cover?	LISS-IV: 5.8 × 5.8 = 33.64 m^2. AWiFS: 56 × 56 = 3,136 m^2. 3,136 ÷ 33.64 is about 93	One AWiFS pixel covers about 93 LISS-IV pixels' worth of ground, so the smaller figure is the finer resolution

Question	Working	What it teaches
How many detectors does a pushbroom scanner need?	NCERT's example, SPOT HRV-I: swath 60 km = 60,000 m; resolution 20 m; 60,000 ÷ 20 = 3,000 detectors	Number of detectors = swath ÷ spatial resolution
What do grey levels 0 to 127 mean?	0 to 127 is 128 levels = 2 to the power 7, so 7 bits. 0 to 255 is 256 levels = 2 to the power 8, so 8 bits	More grey levels means finer radiometric resolution; NRSC's 7 bits for LISS-III matches NCERT's 0 to 127 for IRS sensors
Why not use the finest resolution always?	LISS-IV: 5.8 m over a 70 km swath in single-band mode. AWiFS: 56 m over 740 km. EOS-04: 3 m over 25 km, or 50 m over 223 km	A finer resolution comes with a narrower swath; a wide swath gives frequent revisits but coarse detail

Three common exam traps

1. **"A bigger resolution figure means a sharper image."** The figure is the ground size of a pixel, so the smaller the figure, the finer the detail. In NCERT's table, SPOT HRV-II at 10 m shows finer detail than Landsat TM at 30 m.
2. **"Every passive sensor records reflected sunlight."** A thermal infrared sensor records the heat that the surface itself emits, in the 8 to 15 μm region. It is still passive, because it sends out no energy of its own. What makes a sensor active is that it supplies its own energy and records the return.
3. **"The geostationary satellite gives the finest pictures, because it watches all the time."** NCERT's box shows the reverse: from about 36,000 km a geostationary sensor sees one-third of the globe at coarse resolution (1 km × 1 km), while sun-synchronous satellites at 700 to 900 km give fine resolution (182 m to 1 m). The geostationary satellite gains in frequency of looking, not in detail.

Blood relations: coded relations

Concept in one line

In a coded relation question each symbol stands for a relation given in a key printed with the question, and you decode a string of symbols, one link at a time, into a family tree. The exam asks how two members of a coded expression are related, or which expression shows a given relation.

Revision notes

2.1 What carries over from earlier topics

- **Topic 38 (the family tree method):** turn the statements into a family tree, one generation on each level, and mark only what the statements fix. In these notes (M) after a letter means male, (F) female, (?) gender not given, and "=" between two letters a married couple. In a drawn tree a male is a square, a female a circle, a couple is joined by a horizontal line, and a vertical line runs down from parent to child.
- **Topic 178 (pointing and introducing problems):** replace a chain of relations one link at a time, and check the level by the generation count (+1 for a parent, -1 for a child, 0 for a brother, sister, husband or wife). Its Section 2.6 first showed coded strings.
- **Topics 28 and 278 (coding-decoding):** a code is a fixed rule that you take from the question and apply exactly. A coded relation question joins that skill to the family tree.
- The reading conventions of Topic 38 hold: different letters are different people; a child of one member of a couple is a child of both; brothers and sisters have the same father and the same mother, so two children of the same parent are siblings.
- Later days cover relationships through marriage (Topic 548), puzzles with many members (Topic 558), blood relations with direction and seating (Topic 698) and the statement-sufficiency type (Topic 818).

2.2 Reading a code: what each symbol fixes

Each symbol joins the two letters on its two sides and stands for one relation. In most keys the relation word describes the first letter: "P + Q means P is the father of Q".

Kind of relation word in the key	Example meaning	Level of P compared with Q	Gender it fixes
Parent word with a gender	P is the father (or mother) of Q	One level above	P only
Child word with a gender	P is the son (or daughter) of Q	One level below	P only
Sibling word with a gender	P is the brother (or sister) of Q	Same level	P only
Spouse word	P is the husband (or wife) of Q	Same level	Both: a husband is male and his wife female
Word with no gender	P is a parent, a child or a sibling of Q; P is married to Q	Above, below or the same, as the word says	Neither

- **The key belongs to the question.** The same symbol means different things in different questions. In the key used in Topic 178, "−" means mother; one guidebook example uses "−" for wife, and another uses "+" for brother. Read the key afresh each time, as in coding-decoding.
- **Watch the direction.** A few keys describe the second letter: "P & Q means Q is the father of P". Before you start, note which letter the relation word describes.

The key of Topic 178, used again in the drill (Section 3) as **Key A**:

Code	Meaning	Gender it fixes
P + Q	P is the father of Q	P male

Code	Meaning	Gender it fixes
P − Q	P is the mother of Q	P female
P × Q	P is the brother of Q	P male
P ÷ Q	P is the sister of Q	P female
P @ Q	P is the husband of Q	P male, Q female
P # Q	P is the wife of Q	P female, Q male

2.3 Decoding an expression link by link

This is the standard method of aptitude guidebooks: replace each symbol by its relation, write each pair as a sentence, draw the tree, then read the relation off it.

1. **Split the expression into links.** "A + B ÷ C − D" is three links: "A + B", "B ÷ C" and "C − D". Each middle letter belongs to two links. Why: a symbol relates only the two letters next to it.
2. **Write each link as a sentence** in the direction the key gives: "A is the father of B". Why: a sentence shows which letter the relation word describes.
3. **Draw from left to right,** one link at a time: one level up or down for a parent or child word, the same level for a sibling or spouse word. Why: each new link then names a member already in the tree, so nobody is placed loosely.
4. **Mark a gender only where a code fixes it** (2.4). Why: a gender you assume can turn "child" into "son" and give a wrong answer.
5. **Apply the conventions:** the sibling of a child is also a child of the same parents; the spouse of a parent is the other parent. Why: these give links that no single symbol states.
6. **Read the answer in the direction asked.** "How is A related to D?" asks what A is to D: start at D and walk to A. The gender of A decides the word.
7. **Check the level** with the generation count of Topic 178. Why: a dropped or doubled link shows up as a level too high or too low.

2.4 Fix a gender only where a code fixes it

- A father, mother, son, daughter, brother or sister code fixes the gender of the one member it describes, never of the other. A husband or wife code fixes both. A parent, child, sibling or married-to code fixes neither.
- A gender can also follow by deduction: the spouse of a female member is male, and if a child's two parents are known and one is male, the other is female.
- The last letter of an expression is often left open. In "Y + Z + X" (Key A), X is a child of Z: a son or a daughter. Guidebooks list "assuming a gender" as a standard mistake: an unstated child is not a son, and neither a name nor the position of a letter gives a gender.
- If the relation asked for needs a gender that no code gives, choose a word that covers both (child, sibling, parent, grandchild, "sister's child") if one is offered; otherwise the answer cannot be determined (Topic 38).

2.5 Common chains and their names

Chain	English name	Telugu word in everyday use
Father's father, mother's father	Paternal grandfather, maternal grandfather	తాత, తాతయ్య
Father's mother	Paternal grandmother	నానమ్మ
Mother's mother	Maternal grandmother	అమ్మమ్మ
Father's brother	Paternal uncle	పెదనాన్న (father's elder brother), చిన్నాన్న or బాబాయి (father's younger brother)
Father's sister	Paternal aunt	అత్త, అత్తయ్య
Mother's brother	Maternal uncle	మేనమామ, మామయ్య

Chain	English name	Telugu word in everyday use
Mother's sister	Maternal aunt	పెద్దమ్మ (mother's elder sister), పిన్ని or చిన్నమ్మ (mother's younger sister)
Brother's son, sister's son	Nephew	మేనల్లుడు, for a man's sister's son or a woman's brother's son
Brother's daughter, sister's daughter	Niece	మేనకోడలు, for a man's sister's daughter or a woman's brother's daughter
Son's son, daughter's son; son's daughter, daughter's daughter	Grandson; granddaughter	మనవడు; మనవరాలు
Son's wife	Daughter-in-law	కోడలు
Daughter's husband	Son-in-law	అల్లుడు
Brother's wife	Sister-in-law	వదిన (elder brother's wife), మరదలు (younger brother's wife)

- As Topic 38 says, మేనల్లుడు and మేనకోడలు are not used for a man's brother's children or a woman's sister's children; say "సోదరుడి కొడుకు", "సోదరి కూతురు" and so on.
- An English word such as "uncle" or "aunt" fixes neither side nor age, while a Telugu family word often fixes one or both (మేనమామ the side; పెదనాన్న the side and the age). Work out the answer in English. In Telugu use a family word only if the question fixes all it carries; otherwise use the plain chain ("తల్లి సోదరుడు").

2.6 The reverse task: building an expression

Some questions give a relation and ask which expression shows it.

1. **Write the relation as a path** from the first member to the second. "M is the maternal uncle of N" means M is the brother of N's mother.

2. **Choose a code for each step, in that order,** with each letter on the side of the symbol that the key's sentence needs.
3. **Make every gender the relation needs come from some code.** For the maternal uncle: M must be male (a brother code) and N's parent female (a mother code). A spare link can be added only to fix a gender: in "Y + Z + X × W", the link "X × W" makes X male.
4. **Check each option** for four things (Topic 178): the first letter, the last letter, the gender at each link, and the level. The practical way is to decode each option in turn and compare it with the relation asked.

- More than one expression can be right: "Q + R @ P" and "Q − R @ P" (Key A) both make P the wife of Q's son. A well-made question offers only one of them.
- An option with the two letters exchanged shows the reverse relation, and an option with a father code where a mother code is needed shows the other side of the family.

2.7 Common slips

Slip	What goes wrong	The correct reading
Using a key from another question	Every link is misread	Use only the key printed with the question
Reading a code backwards	The relation is reversed, or a generation is off	Note which letter the relation word describes
Giving a gender the code does not fix	"Son" or "nephew" for an unstated child	Mark (?) and use a word that covers both
Missing a gender the code does fix	A spouse code fixes both members; a member's gender is lost	Mark both genders at every husband or wife link
Joining a relative to the wrong spouse	The mother's side and the father's side are mixed	A sibling of the wife is on the children's mother's side
Dropping a link of a long expression	The answer is a generation too high or too low	Check the generation count

Extra section: a drill of eight questions with full working

In each tree (M) means male, (F) female, (?) gender not given and "=" a married couple. D1 to D3 and D6 to D8 use Key A (2.2).

D1. Decode: three links

"A + B ÷ C − D". How is A related to D?

- "A + B": A is the father of B; A male, B one level below.
- "B ÷ C": B is the sister of C; B female. C is on B's level and is also a child of A.
- "C − D": C is the mother of D; C female.
- Tree: A (M); his children B (F) and C (F); D (?), the child of C.
- Count from D: mother C +1, her father A +1, total +2.
- Answer: A is D's mother's father, the maternal grandfather (తాత).

D2. Decode: the gender stays open

"P @ Q − R × S". How is S related to P?

- "P @ Q": P is the husband of Q; P male, Q female.
- "Q − R": Q is the mother of R, so her husband P is R's father.
- "R × S": R is the brother of S; R male. S is also a child of P and Q.
- Tree: P (M) = Q (F); their children R (M) and S (?).
- No code describes S. Answer: S is a child of P; whether son or daughter cannot be determined.

D3. Decode: a gender fixed by a wife code

"E × F + G # H". How is G related to E?

- "E × F": E is the brother of F; E male.
- "F + G": F is the father of G; F male.
- "G # H": G is the wife of H; G female, H male.
- Tree: E (M) and F (M), brothers; G (F), the daughter of F; G (F) = H (M).

- Answer: G is E's brother's daughter, his niece. E is a man, so the Telugu word is "సోదరుడి కూతురు", not మేనకోడలు.

D4. Decode: codes that fix no gender

Key B: "P ra Q" means P is the son of Q; "P ti Q" means P is the daughter of Q; "P lo Q" means P is a parent of Q. "A ra B lo C ti D". How is D related to A?

- "A ra B": A is the son of B; A male. B's gender is not given.
- "B lo C": B is a parent of C. A and C share the parent B, so they are siblings.
- "C ti D": C is the daughter of D; C female. D is a parent of C, so also of her sibling A. B and D are the two parents.
- Tree: B (?) = D (?); their children A (M) and C (F).
- Answer: D is a parent of A; father or mother cannot be determined. (The reverse is fixed: A is the son of D.)

D5. Decode: a key that describes the second letter

Key C: "P & Q" means Q is the father of P; "P ! Q" means Q is the sister of P. "A & B ! C". How is C related to A?

- "A & B": B is the father of A; B male.
- "B ! C": C is the sister of B; C female.
- Tree: B (M) and C (F), siblings; A (?), the child of B.
- Answer: C is A's father's sister, the paternal aunt (అత్త).
- Read the codes the usual way round ("A is the father of B") and C becomes A's child: two generations off.

D6. Build: the son's wife

Which expression shows that P is the wife of Q's son (Q's daughter-in-law)?

- Path: Q is the parent of a son R, and R is the husband of P.
- "Q + R @ P": Q is the father of R; "R @ P" makes R male (a husband) and P female. P is the son's wife.
- "Q − R @ P" is also right, with Q as the mother.

- "Q + R # P" fails: "R # P" makes R the wife, so P is the daughter's husband, the son-in-law (అల్లుడు).

D7. Build: the brother's son

Write an expression that shows M is the brother's son of N, a woman.

- Path: N's brother B is the father of M, and M is male.
- "N ÷ B": N is the sister of B; N female.
- "B + M": B is the father of M; B male, so B is N's brother. M is still only a child.
- "M × S": M is the brother of S; M male.
- Answer: "N ÷ B + M × S". N is a woman, so in Telugu M is her మేనల్లుడు. Without "M × S", M could be a niece.

D8. Check: grandson or grandchild

Which of these shows that X is the grandson of Y: "Y + Z + X" or "Y + Z + X × W"?

- "Y + Z + X": Y is the father of Z, and Z is the father of X. X is Y's son's child; no code fixes X's gender. It fails.
- "Y + Z + X × W": the last link makes X the brother of W, so X is male. X is Y's son's son.
- Answer: only "Y + Z + X × W". Count from X: +1 +1 = +2 for Y.

Three common exam traps

1. **The key belongs to the question.** A symbol has no meaning of its own: "+" is father in one question and brother in another. A student who carries over the key of a practice set misreads every link. Read the key printed with the question, as in coding-decoding.
2. **A code fixes the gender of the member it describes, not of the other one.** A brother or son code gives the gender of the member it describes only (the first letter in most keys); a husband or wife code gives both; a parent, child or sibling code gives neither. The last letter of an expression is often left without a gender, so "son" or "nephew" may be wrong where "child" or "sibling's child" is right.

3. **Read each code in the direction its key gives.** Most keys describe the first letter, but some describe the second ("Q is the father of P"). Read the wrong way round, a code turns a father into a child and moves the whole tree by a generation or more, and an expression read backwards shows the reverse relation.

Squares: quick methods

Concept in one line

The quick methods for squares are short ways of using three identities, $(a + b)^2 = a^2 + 2ab + b^2$, $(a - b)^2 = a^2 - 2ab + b^2$ and $a^2 - b^2 = (a + b)(a - b)$, while tests on the last digits and on the digital root show at once that some numbers cannot be squares. The exam asks for a square or a difference of squares in a few seconds, or asks which of four numbers is a perfect square.

Revision notes

2.1 Where this topic starts

- Topic 148: a square number (perfect square) is n^2, where n is a natural number; every square ends in 0, 1, 4, 5, 6 or 9; and $(n + 1)^2 - n^2 = 2n + 1$.
- Notation in this topic: N is the number to be squared. B is a base: 10, 100 or 1,000 (not the "base number" n of Topic 148). The deviation d = N - B is negative when N is below the base.

2.2 Squares from 1 to 30 (learn them by heart)

n	n^2	n	n^2	n	n^2
1	1	11	121	21	441
2	4	12	144	22	484
3	9	13	169	23	529
4	16	14	196	24	576
5	25	15	225	25	625
6	36	16	256	26	676
7	49	17	289	27	729

n	n^2	n	n^2	n	n^2
8	64	18	324	28	784
9	81	19	361	29	841
10	100	20	400	30	900

- Next square from the last one: $(n + 1)^2 = n^2 + n + (n + 1)$, because $2n + 1 = n + (n + 1)$. So $31^2 = 900 + 30 + 31 = 961$.
- Multiples of 10: $(10n)^2 = 100n^2$. So $40^2 = 1{,}600$ and $70^2 = 4{,}900$.

2.3 How squares end

Last digit of the number	Last digit of its square	Tens digit of the square
0	0	0 (the square ends in 00)
1 or 9	1	Even
2 or 8	4	Even
3 or 7	9	Even
4 or 6	6	Odd
5	5	Always 2 (the square ends in 25)

- **Why the last digit.** Write the number as $10a + b$. Then $(10a + b)^2 = 100a^2 + 20ab + b^2$. The first two terms end in 0, so the square ends in the last digit of b^2.
- **Why the tens digit.** $20ab$ adds an even number of tens, so the tens digit of the square is odd or even as the tens digit of b^2 is: odd for 16 and 36, even for 01, 04, 09, 49, 64 and 81. When $b = 5$, $20ab = 100a$, so the square ends in 25.
- NCERT Class VIII ("Squares and Square Roots"): squares end in 0, 1, 4, 5, 6 or 9, and "None of these end with 2, 3, 7 or 8 at unit's place." A square ends in an even number of zeros: 100 and 8,100 are squares, but 1,000 is not.
- Read backwards, the table helps with square roots: a square ending in 6 has a root ending in 4 or 6; one ending in 1, a root ending in 1 or 9 (Topic 419).

2.4 Numbers ending in 5

- **Rule.** Write the number as 10n + 5. Its square is n × (n + 1), never n × n, followed by 25.
- **Why.** $(10n + 5)^2 = 100n^2 + 100n + 25 = 100n(n + 1) + 25$.
- 35^2 = (3 × 4) hundred + 25 = 1,225. 65^2 = 4,225. 85^2 = 7,225. 115^2: 11 × 12 = 132, so 13,225.
- NCERT Class VIII gives the same pattern: 25^2 = (2 × 3) hundreds + 25 = 625.

2.5 The base method: numbers near 10, 100 or 1,000

- **Rule.** $N^2 = B \times (N + d) + d^2$. The left part is N + d (minus when d is negative). The right part is d^2, with exactly as many digits as the base has zeros: one for 10, two for 100, three for 1,000.
- **Why.** N = B + d, so $N^2 = B^2 + 2Bd + d^2 = B(N + d) + d^2$.
- **Fill and carry.** If d^2 has too few digits, put zeros in front (1,003 below). If it has too many, carry the extra digits to the left part and add them (112 below).
- **The carry is always added.** d^2 is never negative, so the carry is added even when the number is below the base (89 below).

Number	Base and deviation	Left part (N + d)	Right part (d^2)	Square
13	10, +3	16	9	169
17	10, +7	24	49, carry 4	289
104	100, +4	108	16	10,816
96	100, -4	92	16	9,216
97	100, -3	94	09	9,409
112	100, +12	124	144, carry 1	12,544
89	100, -11	78	121, carry 1	7,921
988	1,000, -12	976	144	976,144

Number	Base and deviation	Left part (N + d)	Right part (d^2)	Square
1,012	1,000, +12	1,024	144	1,024,144
1,003	1,000, +3	1,006	009	1,006,009

- **Sub-bases.** Any round number near N can be the base. Base 50: take half of N + d as hundreds. 53^2: half of 56 is 28, so 2,809; 46^2: half of 42 is 21, so 2,116. Base 500: take half of N + d as thousands, with three digits for d^2. 508^2 = 258 thousand + 064 = 258,064. Base 200: take twice the value of N + d as hundreds. 203^2 = 412 hundred + 09 = 41,209.
- The method pays when d is small; otherwise use 2.6.

2.6 $(a + b)^2$ and $(a - b)^2$ for two-digit numbers

- **$(a + b)^2 = a^2 + 2ab + b^2$.** Split into tens and ones. NCERT works 23^2 this way: $(20 + 3)^2 = 400 + 60 + 60 + 9 = 529$.
- **$(a - b)^2 = a^2 - 2ab + b^2$.** When the ones digit is large, go up to the next ten. $47^2 = (50 - 3)^2 = 2{,}500 - 300 + 9 = 2{,}209$. $29^2 = (30 - 1)^2 = 900 - 60 + 1 = 841$.

2.7 The difference of two squares

- **$a^2 - b^2 = (a + b)(a - b)$,** since $(a + b)(a - b) = a^2 - ab + ab - b^2$.
- **Use 1: a difference of squares** becomes one product. $87^2 - 13^2 = (87 + 13)(87 - 13) = 100 \times 74 = 7{,}400$.
- **Use 2: two numbers equally far from a round number.** $104 \times 96 = (100 + 4)(100 - 4) = 100^2 - 4^2 = 9{,}984$. $53 \times 47 = 50^2 - 3^2 = 2{,}491$.

2.8 The duplex method: a short note

- For a two-digit number with digits a and b, write a^2, then 2ab, then b^2, and carry from the right. 47^2: the parts are 16, 56 and 49. Keep 9 and carry 4; 56 + 4 = 60, keep 0 and carry 6; 16 + 6 = 22. So 47^2 = 2,209.
- Why: $(10a + b)^2 = 100a^2 + 10 \times 2ab + b^2$, which is $(a + b)^2$ written out by place value.

- Writers on Vedic mathematics call this way of squaring the *duplex* (Dwandwa Yoga) method. *Vedic Mathematics*, by Bharati Krishna Tirtha, appeared in 1965 with sixteen sutras; scholars such as S. G. Dani and K. S. Shukla state that these sutras are not in the Vedas, and Dani calls the book a compilation of tricks in elementary arithmetic and algebra. Each shortcut is ordinary algebra.

2.9 Tests that show a number is not a square

- **Last-digit test.** A number ending in 2, 3, 7 or 8 is not a square.
- **Last-two-digits test (from 2.3).** A number is not a square if it ends in 5 but not in 25 (1,175), ends in 6 with an even tens digit (2,146), ends in 1, 4 or 9 with an odd tens digit (1,231), or ends in an odd number of zeros.
- **Digital-root test.** Add the digits, and again add the digits of the result, until one digit remains: 7,744 gives 22, then 4. This equals the remainder on division by 9, with 9 in place of 0 (Topic 49).
- **The digital root of a square is always 1, 4, 7 or 9.** Why: if $N = 9k + r$, then $N^2 = 81k^2 + 18kr + r^2$ leaves the same remainder on division by 9 as r^2. For r = 1 to 9, r^2 is 1, 4, 9, 16, 25, 36, 49, 64, 81, with digital roots 1, 4, 9, 7, 7, 9, 4, 1, 9. So 7,221 (digital root 3) is not a square.
- **Limits.** These tests reject; they never confirm. 4,321 ends in 21 and has digital root 1, yet it lies between $65^2 = 4{,}225$ and $66^2 = 4{,}356$. To confirm, square the likely root.
- **Checking your own answer.** The digital root of N^2 equals the digital root of the square of the digital root of N. For 88: 16 gives 7, and 49 gives 4; 7,744 also gives 4. A mismatch proves the answer wrong; a match does not prove it right.

2.10 Common slips at a glance

Slip	Wrong	Right
Middle term 2ab left out	$32^2 = 900 + 4 = 904$	$32^2 = 900 + 120 + 4 = 1{,}024$
n × n used before 25	$45^2 = 16$ and 25 = 1,625	$45^2 = 20$ and 25 = 2,025

Slip	Wrong	Right
Deviation applied the wrong way	96^2 = 100 and 16 = 10,016	96^2 = 92 and 16 = 9,216
Carry forgotten	112^2 = 124 and 44 = 12,444	112^2 = 125 and 44 = 12,544
Carry subtracted because the number is below the base	89^2 = 77 and 21 = 7,721	89^2 = 79 and 21 = 7,921
Passing the quick tests taken as proof	4,321 ends in 21, so it is a square	4,321 lies between 65^2 and 66^2

Later topics: square roots (Topic 419), cubes and cube roots (Topic 549), counting squares and rectangles in a figure (Topic 368) and algebraic identities for quick calculation (Topic 799).

Extra section: a drill of eight questions with full working

1. **85^2.** 85 = 10 × 8 + 5. 8 × 9 = 72, followed by 25: 7,225.
2. **108^2.** Base 100, d = +8. Left part 108 + 8 = 116; right part 8^2 = 64 (two digits). 108^2 = 11,664.
3. **993^2.** Base 1,000, d = -7. Left part 993 - 7 = 986; right part 7^2 = 49, written with three digits as 049. 993^2 = 986,049.
4. **46^2 by the sub-base 50.** d = -4. N + d = 42; half of it is 21 hundred. d^2 = 16. So 46^2 = 2,100 + 16 = 2,116. Check: $(50 - 4)^2$ = 2,500 - 400 + 16 = 2,116.
5. **512^2 by the sub-base 500.** d = +12. N + d = 524; half of it is 262 thousand. d^2 = 144 (three digits). 512^2 = 262,000 + 144 = 262,144.
6. **73^2 by $(a + b)^2$ and by the duplex method.** $(70 + 3)^2$ = 4,900 + 420 + 9 = 5,329. Duplex: the parts are 7^2 = 49, 2 × 7 × 3 = 42 and 3^2 = 9. Keep 9; keep 2 of 42 and carry 4; 49 + 4 = 53. So 73^2 = 5,329.
7. **$87^2 - 13^2$, and 104 × 96.** $87^2 - 13^2 = (87 + 13)(87 - 13)$ = 100 × 74 = 7,400. 104 × 96 = $100^2 - 4^2$ = 10,000 - 16 = 9,984.

8. **Which of 6,354 and 7,744 is a perfect square?** 6,354 ends in 4 with the odd tens digit 5, so it is not a square. 7,744 ends in 44 (even tens digit) and its digital root is 4, so it passes both tests; the tests cannot confirm it, so square the likely root. 88 = 100 - 12: left part 88 - 12 = 76; right part 12^2 = 144, carry 1, giving 77 and 44. So 88^2 = 7,744, and 7,744 is a perfect square.

Three common exam traps

1. **The middle term 2ab is not optional.** $(a + b)^2$ is $a^2 + 2ab + b^2$, not $a^2 + b^2$. 32^2 is 1,024, not 900 + 4 = 904. The rule for 5 has the same trap in another form: 45^2 is 4 × 5 = 20 followed by 25, that is 2,025, not 4 × 4 = 16 followed by 25.
2. **In the base method, d^2 must fill exactly as many places as the base has zeros.** For the base 1,000 the right part has three digits: $1{,}004^2$ = 1,008,016, not 100,816 (the zero of 016 dropped). When d^2 is longer than that, the extra digit is carried into the left part: 112^2 is 12,544, not 124,144.
3. **The quick tests reject; they never confirm.** A last digit of 1 or 9 does not make a number a square (Topic 148), and neither does a correct tens digit or an allowed digital root. 2,521 ends in 21 and has digital root 1, yet it lies between 50^2 = 2,500 and 51^2 = 2,601. To show that a number is a square, find its root.

Current affairs: the Economic Stabilisation Fund and supplementary demands for grants

Concept in one line

On 13 March 2026 the Lok Sabha adopted the second and final batch of supplementary demands for grants for 2025-26, which carried Rs 57,381 crore towards a new Economic Stabilisation Fund with an announced total outlay of Rs 1 lakh crore. The examination asks about these figures and dates, the grants under Articles 115 and 116 of the Constitution, and how such a fund differs from the Contingency Fund of India.

Revision notes

2.1 Where this topic starts

- **From Topic 162:** Parliament gives the Budget legal force by voting the demands for grants and passing the Appropriation Bill and the Finance Bill. Withdrawal from the Consolidated Fund of India requires appropriation made by law; Public Account transactions and Contingency Fund advances follow their respective constitutional rules. In particular, "no money shall be withdrawn from the Consolidated Fund of India except under appropriation made by law" (Article 114(3)). The Contingency Fund of India is an imprest placed at the disposal of the President (Article 267(1)). The Budget 2026-27 has 102 demands for grants; generally there is one demand for each Ministry or Department.
- **From Topic 224:** Budget Estimates (BE) are for the coming year, 2026-27; Revised Estimates (RE) are the updated figures for the year then running, 2025-26.
- **From Topic 263:** the fiscal deficit is the government's total expenditure minus its total receipts excluding borrowing; in NCERT's words it "indicates the total borrowing requirements of the government from all sources".

- **Later topics:** fiscal policy (Topic 393), public debt and the FRBM Act (Topic 513) and the Sixteenth Finance Commission (Topic 535).

2.2 The news: what the Lok Sabha approved

Point	Detail
What	The second and final batch of Supplementary Demands for Grants for 2025-26, in the Budget Session of Parliament (28 January to 18 April 2026)
Size	61 grants; gross additional expenditure of more than Rs 2.81 lakh crore
Net cash outgo	About Rs 2.01 lakh crore. The rest of the gross amount is matched by savings of about Rs 80,146 crore across Ministries and departments. These are Finance Ministry figures as reported by news agencies
The new Fund	Rs 57,381 crore for the Economic Stabilisation Fund
Two other items	Rs 19,230 crore for fertiliser subsidy; Rs 37,886 crore for grants to the local bodies of the States
Discussion	Taken up in the Lok Sabha on 12 March 2026
Vote	Adopted by the Lok Sabha on 13 March 2026, followed by the connected Appropriation Bill, 2026, which authorises the payment of further sums out of the Consolidated Fund of India for 2025-26
Rajya Sabha	Returned the Appropriation Bill on 17 March 2026. It does not vote on demands for grants, and on an Appropriation Bill, which is a Money Bill, it can only make recommendations (Topic 162)

- **Gross and net:** gross additional expenditure is the whole amount for which approval is sought. Part of it is met from savings, so the net cash outgo, the fresh cash the year needs, is smaller.

2.3 The Economic Stabilisation Fund

- **Outlay:** the Fund's total outlay is Rs 1 lakh crore. Rs 57,381 crore was sought in this batch of supplementary demands; the balance of a little over Rs 42,000 crore is to come through savings of other Ministries and departments.
- **Stated purpose:** in her reply on 13 March 2026 the Finance Minister, Nirmala Sitharaman, said the Fund would give India fiscal room to respond to global headwinds and the recent global crisis, to supply chain disruptions and to unexpected shocks to sub-sectors of the economy. She said the Government was ready for unexpected events, including supply chain disruptions and LPG (liquefied petroleum gas) shortages.
- **The setting:** the debate took place amid the conflict in West Asia. Members spoke of the situation in West Asia and of the rise in crude oil prices, and on 23 March 2026 the Prime Minister made a statement in the Lok Sabha on the ongoing West Asia conflict and its challenges for India (in the Rajya Sabha on 24 March). In the official reports of the Finance Minister's reply the Fund is linked to global headwinds and the recent global crisis; news reports tied it to the energy supply crunch caused by the conflict.
- **What kind of fund it is:** the Budget 2026-27 Demand No. 30 lists the Economic Stabilisation Fund under Reserve Funds in the Department of Economic Affairs demand. The March supplementary provision was voted by the Lok Sabha and authorised through appropriation. The February revised-estimate entry and March supplementary figures refer to different stages; they must not be substituted for one another. Detailed drawdown rules should not be inferred from a budget classification alone.
- **The general rule on such funds:** the Ministry of Finance's Key to Budget Documents says Parliament's approval is obtained "when amounts are withdrawn from the Consolidated Fund and kept in the Public Account for expenditure on specific objects".

2.4 Grants outside the regular Budget: Articles 115 and 116

Grant	Article	When it is used
Supplementary grant	115(1)(a)	The amount authorised by law for a particular service for the current financial year "is found to be insufficient for the purposes of that year"
Additional grant	115(1)(a)	A need arises during the current year for expenditure upon "some new service not contemplated in the annual financial statement for that year"
Excess grant	115(1)(b)	Money has been spent on a service during a financial year "in excess of the amount granted for that service and for that year"; the Public Accounts Committee first examines the excess, and the demand then goes to the Lok Sabha
Vote on account	116(1)(a)	A grant in advance for the estimated expenditure for a part of a financial year, until the voting of demands and the Appropriation Act are complete
Vote of credit	116(1)(b)	"An unexpected demand upon the resources of India" that, because of the magnitude or the indefinite character of the service, cannot be stated with the details ordinarily given in an annual financial statement
Exceptional grant	116(1)(c)	A grant that "forms no part of the current service of any financial year"
Token supplementary (token grant)	No Article of its own; it is a supplementary demand under Article 115	Extra money is needed under the Ministry of Finance's rules on a new service or new instrument of service, and savings in the same section of the grant can meet it: only a token amount is sought, and the savings are then used by re-appropriation, the transfer of savings from one unit of appropriation to another

- **Same steps as the Budget:** under Article 115(2), Articles 112, 113 and 114 apply to a supplementary statement or an excess demand as they apply to the annual financial statement. So the demand is voted by the Lok Sabha and the

money is then drawn under an Appropriation Act. For a supplementary or additional grant, the President causes another statement to be laid before both Houses; an excess demand is presented to the Lok Sabha.

- **Article 116:** these grants are made by the Lok Sabha, and Parliament authorises the withdrawal from the Consolidated Fund of India by law.
- **This batch:** the Economic Stabilisation Fund provision came as part of supplementary demands under Article 115, before the year 2025-26 ended on 31 March 2026.

2.5 The Economic Stabilisation Fund and the Contingency Fund of India

Point	Economic Stabilisation Fund	Contingency Fund of India
Legal basis	A provision in the second batch of supplementary demands for grants for 2025-26, authorised by the Appropriation Act; no separate law is mentioned in the official reports	Article 267(1): Parliament "may by law establish" it, "in the nature of an imprest"
Size	Total outlay of Rs 1 lakh crore: Rs 57,381 crore through the supplementary demands, the rest through savings	Corpus, as authorised by Parliament, "presently stands at" Rs 30,000 crore (Key to Budget Documents 2026-27)
Who controls it	Proposed by the Finance Minister for the Central Government; the official reports do not name the body that will operate it	"Placed at the disposal of the President" to make advances

Point	Economic Stabilisation Fund	Contingency Fund of India
Does Parliament vote before the money is used	Yes: the Lok Sabha voted the provision as part of the supplementary demands	No: advances are made first, "pending authorisation of such expenditure by Parliament by law under article 115 or article 116"; approval is obtained "ex-post-facto", and an equal amount is drawn from the Consolidated Fund to recoup the Fund
Purpose	Fiscal room against global headwinds, supply chain disruptions and shocks to sub-sectors of the economy	Urgent, unforeseen expenditure

2.6 The fiscal arithmetic

- **The Budget figures (as on 1 November 2026):** in the Budget at a Glance of February 2026 the fiscal deficit is Rs 15,58,492 crore, 4.4 per cent of GDP, in RE 2025-26, and Rs 16,95,768 crore, 4.3 per cent of GDP, in BE 2026-27.
- **The Government's position:** the Finance Minister told the Lok Sabha, as reported, that the fiscal deficit for 2025-26 would remain within the 4.4 per cent of the Revised Estimates. The extra spending is partly matched by savings across Ministries, and the balance of the new Fund also comes from savings. She said the strengthened macroeconomic framework lets India absorb shocks without deviating from the fiscal consolidation roadmap.

Extra section: chronology of the item

Date	What happened
28 January 2026	Budget Session of Parliament begins
1 February 2026	Union Budget 2026-27 presented; RE 2025-26 puts the fiscal deficit at 4.4 per cent of GDP

Date	What happened
12 March 2026	The Lok Sabha takes up the discussion on the second batch of Supplementary Demands for Grants for 2025-26
13 March 2026	The Finance Minister replies, explaining the Economic Stabilisation Fund; the Lok Sabha adopts the demands and passes the Appropriation Bill, 2026
17 March 2026	The Rajya Sabha returns the Appropriation Bill
23 March 2026	The Prime Minister's statement in the Lok Sabha on the West Asia conflict (24 March in the Rajya Sabha)
31 March 2026	Financial year 2025-26 ends
18 April 2026	Both Houses adjourn sine die

Three common exam traps

1. **Gross, net and the Fund's outlay are three different figures.** The gross additional expenditure is the whole amount sought in the batch. The net cash outgo is what is left after savings are set against it. The Fund's announced outlay is not all in the supplementary demands; part of it comes from savings of Ministries and departments.
2. **The Contingency Fund is spent first and approved later.** The President makes advances out of it for unforeseen expenditure, and Parliament authorises that expenditure afterwards by law under Article 115 or 116; the amount is then recouped from the Consolidated Fund. The new Fund took the opposite route: its provision was voted in advance as part of a demand.

3. **A supplementary demand and an excess demand do not reach Parliament the same way.** For a supplementary or additional grant the President causes another statement to be laid before both Houses. A demand for an excess grant is presented to the Lok Sabha alone, after the Public Accounts Committee has examined the excess.