

DEEP PYQ ANALYSIS

GATE CE 2027

High-Probability Question Bank
& 10 Full-Length Mock Tests



Marks per section · sixteen counted papers

MD ANISH AHAMAD

GATE CE 2027 — Deep PYQ Analysis & High-Probability Question Bank

By MD ANISH AHAMAD · First Edition 2026

This preview contains 34 real, unedited pages from the 615-page book, exactly as they appear in the full PDF. Page numbers in the running heads and on the contents pages refer to the full book.

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The full book also has: all nine subject chapters, 274 practice questions with worked solutions and four confidence figures each, all ten mock tests with keys and solutions, the hundred to work first, the what-not-to-skip chapter, the revision plan and the full last-minute sheet.

GATE CE 2027

Deep PYQ Analysis & High-Probability Question Bank

*Sixteen GATE papers counted question by question, and 924 newly written questions built on what they show
for the GATE Civil Engineering paper*

MD ANISH AHAMAD

First Edition · 2026

For the examination of February 2027

gateguide.co.in

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Preface

Every GATE book tells you what is in the syllabus. The syllabus is one page long and the organisers publish it free. This book tries to answer the question the syllabus cannot: **of the eighty-five technical marks in the GATE Civil Engineering paper, where do they actually land — and how much of that can anyone honestly claim to know?**

There is a reason that question is usually answered badly. The organisers have never published a marks breakdown, so every "subject-wise weightage" table you have seen is somebody's count of a past paper. Those tables circulate, get copied, and acquire an authority they never earned. Civil Engineering makes the problem worse than most, because **GATE CE is set as two papers a year**, Set 1 and Set 2, with two different question papers and two official keys. A table that reports "2024" without saying which set has averaged two papers, or counted one and labelled it the year — and you cannot tell which from the table.

So this book does not use those tables. It counts the papers. All of them, both sets.

How this book was built

Sixteen papers, counted question by question. Every GATE Civil Engineering paper from 2019 to 2026 — Set 1 and Set 2 in each of the eight years, 1,040 questions and 1,600 marks — was read one question at a time. Each question was assigned to a section of the 2027 syllabus and to a topic inside it, and every assignment was checked against that year's official answer key. Each paper was made to close: 65 questions, 100 marks, 30 at one mark and 35 at two, General Aptitude at exactly 15. A count that does not close is a count with a mistake in it, and all sixteen close.

Every citation names a year, a set and a question number. Not once in this book will you find a claim like "this pattern recurs in 2021, 2023 and 2025". Because Civil sets two papers a year, a citation without its set names nothing checkable, and the build rejects one — that rule is enforced by a script, not by good intentions. Every historical statement in this book can be checked against a paper you can download.

The 2027 syllabus was compared with 2026, word by word, from the two official PDFs, by a program rather than by reading. That comparison is the part of this book most likely to be wrong if done from memory, and it was: three separate claims in early drafts turned out to be memories rather than facts, and all three were wrong. One asserted that structural dynamics was named in neither document, when 2026 names it — an error that had already misplaced questions before it was caught. Another listed Transportation Planning as material to skip, when the diff shows it is *new for 2027*. The comparison is now generated from the source documents, and Section 2 prints its result in full: **nine phrases gone, twenty-nine new, four differing only in spelling, and 117 carried over unchanged.**

Every number in every question was computed, not remembered. Bearing capacities were evaluated with the factors stated in the question, jumps were solved from the momentum equation, development lengths were divided out, traverses were closed, Bogue's equations were substituted, and Webster's cycle lengths were worked through. Every incorrect option is the output of a specific mistake, and the solution names that mistake, so that a candidate who chose it learns what they did rather than merely that they were wrong.

Nothing derived is typed. The syllabus diff, the counted-paper tables, the topic-level analysis, the top-hundred list, the answer keys and the consolidated solutions are all produced by scripts from the counting files. A hand edit to any of them fails the build, because a derived file edited by hand drifts away from the thing it derives from and nobody notices until a reader does.

What this book refuses to do

It does not claim to know the paper. Four commitments follow:

- **Facts, analysis and predictions are labelled separately.** A statement about what happened in 2020 Set 2 is marked FACT. A statement about what the data suggests is marked ANALYSIS. A statement about 2027 is marked PREDICTION. A statement that is the author's opinion is marked JUDGEMENT. They are never blended.
- **Confidence is reported in four dimensions, not one.** Being confident that consolidation will be examined is not the same as being confident about a particular consolidation question. Every question carries Topic, Concept, Question-pattern and Exact-question confidence, and the last is capped at 35 per cent because GATE repeats concepts, not wording. The highest exact-question figure anywhere in this book's bank is 18 per cent.
- **The confidence figures are called estimates, because that is what they are.** They are not a fitted model and they have not been validated. Section 7 explains how they were arrived at, what they cannot support, and the three errors already found in the reasoning beneath them.
- **Absence of evidence is printed as absence of evidence.** Several topics named in the 2027 syllabus produced no question at all in sixteen papers. Each is said so plainly, with no history invented to fill the gap.

Two things the counting found that should change how you study

Twenty-five marks of recent examination history are no longer on the syllabus. Prestressed concrete is gone from the 2027 Concrete Structures line, and seven of the sixteen counted papers set a prestressed question worth two marks — fourteen marks. Free vibration of an undamped single-degree-of-freedom system is gone, and four papers set it — eight marks. Dynamic pile formulae are gone, and remote sensing and GIS are gone. A candidate practising from past papers will meet all of this repeatedly and should recognise it on sight rather than work it. Section 2 gives the evidence for each deletion and, where there is a counter-argument, states it.

Transportation Planning is new, and it has never been examined. The 2027 syllabus adds a fourth Transportation topic: four-step travel demand modelling — trip generation, trip distribution, mode choice, traffic assignment. Across all sixteen counted papers, 1,040 questions and eight years, that material has drawn **zero marks**. There is no past paper to practise, no established question pattern, and no way to judge the depth expected. What there is, is a named topic in a section worth ten marks. It is not alone. Of the phrases the 2027 syllabus names for the first time, thirteen have never been examined in any of the sixteen counted papers — isolated footings, ground improvement, sharp-crested weirs, landfill design and interchanges among them — and no question bank built from previous years can prepare anyone for those. Eleven others turn out to have been examined already under older wording, and the book cites each one. Section 2 prints both lists, which is why this book tells you to read them.

The two findings point in opposite directions, and that is the point: past papers tell you what to skip as reliably as they tell you what to study, and the syllabus tells you what no past paper can.

What is in it

The official 2027 syllabus with the 2026-to-2027 changes generated from the source documents; a chapter on the organising institute and the two papers IIT Madras has already set; the counted weightage of every section and, inside each section, of every topic, with trends over eight years; nine subject chapters — one for each of the eight technical sections and one for General Aptitude — with 274 newly written questions, each with a worked solution and four confidence figures; a chapter explaining exactly what those figures mean and what they do not; a hundred-question priority list whose quota mirrors the paper's own section weights; a chapter on what not to skip and what can be skipped; ten full-length mock tests in the 2027 pattern with keys and worked solutions, 650 questions more; a staged revision plan; a last-minute sheet of formulae and code constants; and a statement of sources and their limits.

Every one of the 924 questions is new. None is copied from a past paper, and none repeats another question in this book — that second claim is checked by a program that compares all 650 mock questions against all 274 chapter questions, and it found eleven reprints during preparation which were rewritten. What is borrowed from the past is the pattern, and the pattern is what repeats.

Section 1 — Executive Summary

If you read nothing else in this book, read this. Everything here is drawn from sixteen official GATE Civil Engineering papers counted question by question against their official answer keys, and from the two official syllabus documents. Every figure can be checked; every claim names what it rests on.

Statements are labelled. **FACT** is something counted or quoted. **ANALYSIS** is an inference from it. **PREDICTION** is a statement about a paper that has not been set. They are never blended.

The eight things that matter most

1. Prestressed concrete has been deleted from the syllabus, and it was worth 14 marks

FACT. The 2026 CE syllabus ends its Concrete Structures line *"Bond and development length; Prestressed concrete beams."* The 2027 line reads *"Bond and development length."*

FACT. Seven of the sixteen counted papers set a prestressed-concrete question worth two marks — 2020 both sets, 2021 Set 1, 2022 Set 2, 2024 Set 1, 2026 both sets.

ANALYSIS. This is the largest single change between the two syllabi, and it is invisible in every weightage table compiled before the 2027 syllabus appeared, because those tables count those fourteen marks inside Structural Engineering. ***Counted against the 2027 syllabus, Structural Engineering is worth 15.1 marks, not 15.9.***

What to do. If your plan came from a pre-2027 weightage table, this is the section where it is most wrong. Prestressed concrete is the specific line to cut. Verify it yourself: the two Concrete Structures lines, read one after the other; settle it in under a minute.

2. Transportation Planning is brand new, has never been examined, and should be studied

FACT. The 2027 syllabus adds a fourth Transportation topic: *"Four step travel demand modelling – trip generation, trip distribution, mode choice, traffic assignment and its applications."* The 2026 syllabus has no planning topic, and the words *travel*, *trip*, *demand*, *choice* and *assignment* appear nowhere in it.

FACT. Across 1,040 counted questions, four-step travel demand modelling has drawn **zero marks**.

ANALYSIS. The zero is not evidence that examiners avoid the topic. It is evidence that the topic was not on the syllabus, and examiners seldom set what the syllabus does not name. ***The eight-year record contains no information about Transportation Planning in either direction.***

PREDICTION. A newly added named topic is among the more likely places for a question, not the less. An examiner setting the first paper under a revised syllabus has a visible reason to use the part that is new. This book treats it as a topic to prepare and says openly that it does so on the syllabus alone.

3. General Aptitude is 15 marks in every paper, without exception

FACT. Ten questions — five at one mark, five at two — totalling exactly 15 marks, in all sixteen papers.

ANALYSIS. This is the only quantity in the paper with zero variance over eight years. It is worth more than Geomatics and Construction Management combined.

What to do. Do not leave it to the last month. It is the most predictable 15 per cent of your score.

4. IIT Madras sets 2027, and the last paper it set traded concrete for steel

FACT. GATE 2027 is organised by IIT Madras. IIT Madras also set GATE 2019 — the only year in this book's evidence whose setter is the setter of your paper.

FACT. Across both 2019 papers, Concrete Structures drew **1 mark** and Steel Structures drew **10**.

Every other year gives Concrete Structures 2 to 8 (prestressed concrete, deleted for 2027, counted separately), and in no other year does Steel lead it by more than 2. **2019 Set 2 contains no Concrete Structures question at all.**

ANALYSIS. Structural Engineering's section total in 2019 was entirely normal — 16 and 14, against a mean of 15.1 — so a candidate reading a section-level weightage table would have seen nothing coming.

What to do. Do not treat Steel Structures as the part of Structural Engineering you plan to survive.

This is a warning, not a forecast: one paper by one panel eight years ago is one observation. But the assumption that concrete is the heavier half does not survive the count: Steel matched or beat it in five of the eight years, and by the widest margin in the paper set by the institute setting yours — and the 2027 syllabus has just removed prestressed concrete while leaving Steel Structures almost untouched.

5. The year is the unit of evidence, not the paper

FACT. Within a year, the two sets differ by 0 to 16 marks across all sections. Between years, the same set number differs by 6 to 30.

ANALYSIS. The blueprint moves about two and a half times as much between years as between the two sets of one year. Sixteen papers are therefore closer to eight independent observations than to sixteen, and this book averages within a year rather than treating every paper as a separate draw.

What to do. Read the range beside every mean in this book. Your paper gets one value out of that range and you do not choose which. 2022's two sets differed by 16 marks — which is why GATE normalises scores across sessions in the first place.

6. Where the marks are

FACT. Mean marks across sixteen papers, counted against the 2027 syllabus, with the full range:

Section	Mean	Range
General Aptitude	15.0	15-15
2. Structural Engineering	15.1	12-19
3. Geotechnical Engineering	13.8	12-16
1. Engineering Mathematics	12.9	10-15
4. Water Resources Engineering	12.6	11-14
5. Environmental Engineering	11.1	8-13
6. Transportation Engineering	10.0	6-12
7. Geomatics Engineering	4.4	1-7
8. Construction Materials and Management	3.5	0-7
<i>Material outside the 2027 syllabus</i>	<i>1.6</i>	<i>0-4</i>

ANALYSIS. The top four sections — Structural, Geotechnical, Mathematics and Water Resources — carry 54.4 marks of the 85 technical marks between them, before General Aptitude is counted. The bottom two carry 7.9 and range from 1 to 14 combined.

7. Engineering Mathematics is 13 marks, three times out of four

FACT. Exactly 13 marks in **twelve of the sixteen papers**. The exceptions are 2019 Set 1 (10), 2020 Set 1 (12), 2022 Set 1 (15), 2022 Set 2 (14). The last four years are 13 in all eight papers.

ANALYSIS. The most stable technical section in the paper. An earlier version of this book's research claimed it was "always exactly 13" — a claim three years supported and eight destroyed. Thirteen is a sound planning figure; "always" was not a sound claim.

8. The question format has changed more than the content has

FACT. Multiple-select questions did not exist in GATE CE in 2019 or 2020. They enter in 2021 with two questions and then move without pattern: 14 in 2022, 21 in 2023, 8 in 2024, **26 in 2025**, 10 in 2026 (counts over both sets).

FACT. MSQ carries no negative marking and no partial credit. You score only by selecting every correct option and no incorrect one.

ANALYSIS. This is the largest change in how the paper is answered over the counted period, and it is the least predictable structural feature of the paper. Prepare for anywhere between roughly four and thirteen MSQs in your own paper; and practise the format itself — it punishes partial knowledge far harder than an MCQ does.

What this book will not do

It will not tell you it knows the paper. Three commitments follow from that, and they are kept everywhere in this book:

- **Facts, analysis and predictions are labelled separately**, as above.
- **Confidence is reported in four dimensions.** Being confident that shallow foundations will be examined is not the same as being confident about a particular bearing-capacity question. Every question in the bank carries Topic, Concept, Question-pattern and Exact-question confidence, and the last is capped, because GATE repeats concepts and not wording.
- **Absence of evidence is printed as absence of evidence.** Several topics named in the 2027 syllabus produced no question in sixteen papers. Each is said so plainly, with no history invented to fill the gap, and questions written on syllabus authority alone say that this is what they rest on.

It will not cite a year it has not counted. Every historical claim in this book names the year, the **set** and the question number. "2026 Q34" is not a checkable citation in Civil Engineering, because there are two 2026 papers; this book writes "2026 Set 1 Q34" or it does not print the claim.

It will not copy a question. Every question in this book was written for it, and every numerical answer was computed rather than estimated.

What was wrong in this book's own research, and how it was found

Three claims behind this summary were wrong before they were right, and they are described in full in Section 4.7. Two were killed by counting more papers — a "doubling" in Transportation that was a dip misread as a trend, and an Engineering Mathematics figure that three years supported and eight did not. The third was a claim about a syllabus document that nobody had opened, and finding it exposed the prestressed concrete error above, worth fourteen marks.

They are printed because the alternative is a book that shows only its surviving claims, which is a book that gives you no way to judge how its claims are made.

Traffic Engineering: Traffic studies on flow and speed, peak hour factor; accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections and interchanges; Highway capacity and level of service.

Transportation Planning: Four step travel demand modelling – trip generation, trip distribution, mode choice, traffic assignment and its applications.

"using IRC codes" appears twice in this section and names no edition, and the soil classification line in Section 3 names none either. Every question in this book that depends on a code states which edition it uses.

Section 7 — Geomatics Engineering

Principles of surveying; Plane and geodetic surveying, GNSS surveying, errors and their adjustment; Maps – Scale, coordinate system; Distance and angle measurement – Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Principles of topographic, cadastral, engineering; Introduction to cartography, map projections.

Photogrammetry – Introduction to photogrammetry, digital photogrammetry, photographic scale, flying height; Space resection, parallax equations, elevations by parallax differences, camera calibration.

Section 8 — Construction Materials and Management

Construction Materials: Steel – Composition, material properties and behaviour; Cement – composition, hydration and microstructure, chemical and mineral admixtures; Concrete – Constituents, mix design, short-term and long-term properties.

Construction Management: Types of construction projects; Estimation and costing – Quantity estimation using long wall and short wall method, center line method, analysis of rates;

Project planning and scheduling: AOA and AON network analysis – PERT and CPM; Project updating and monitoring; Construction equipment – Equipment for earthwork, concreting, hoisting and transportation of materials; Types of contracts.

2.2 What changed between 2026 and 2027

FACT: The comparison below was made by a program that reads the two official PDFs and compares them word by word. No coaching site's "GATE 2027 syllabus changes" article was opened, quoted or checked against, for the reason given in the preface: those articles are copied from each other, and a change list that is wrong is worse than no change list at all.

Deciding what counts as a change is harder than it sounds, and the method matters. Comparing phrases by string similarity does not work: 2026's "Design of beams, slabs, columns" against 2027's "Design and detailing of beams, slabs, columns, and isolated footings"* scores badly and is obviously the same requirement in more words. So the test used here is vocabulary. **A phrase counts as deleted when one of its content words has no relative anywhere in the 2027 document** — no word that contains it and no word it contains. Words that differ only by spelling are held back and not claimed as changes: 2026's run-off against 2027's runoff, 2026's cross-sectional against the official 2027 typo crossectional, 2026's Meyerhoff against 2027's Meyerhof.

On that test: **nine phrases lose a word outright, four lose one only to spelling, 117 carry over unchanged, and twenty-nine 2027 phrases bring vocabulary the 2026 document did not have.**

The removals

Section	Gone from 2027	2026 wording
2 Structural	Prestressed concrete beams	Concrete Structures ended "Bond and development length; Prestressed concrete beams."
2 Structural	Free vibrations of an undamped SDOF system	Engineering Mechanics ended "Centre of mass; Free Vibrations of undamped SDOF system."
2 Structural	The flexibility method	"Stiffness and flexibility methods of structural analysis"
2 Structural	Plate girders	"...beam-column connections, plate girders and trusses"
3 Geotechnical	Dynamic pile formulae	"Deep foundations – dynamic and static formulae"
7 Geomatics	Remote sensing and GIS	"Basics of remote sensing and GIS"; "Photogrammetry and Remote Sensing"
7 Geomatics	Horizontal and vertical curves , as a Geomatics topic	listed under Geomatics in 2026
1 Mathematics	Random variables as "Discrete and Continuous"	replaced by pmf, pdf and cdf

The first two are the most consequential sentences in this chapter, and they are the reason this book counts 25 marks of the sixteen counted papers as material outside the 2027 syllabus.

Prestressed concrete is gone. The 2026 Concrete Structures line reads *"Bond and development length; Prestressed concrete beams."* The 2027 line reads *"Bond and development length."* and puts isolated footings in its place. Seven of the sixteen counted papers set a prestressed-concrete question worth two marks — 2020 both sets, 2021 Set 1, 2022 Set 2, 2024 Set 1, and 2026 both sets. ***That is fourteen marks of recent examination history on material the 2027 syllabus does not name.***

There is a counter-argument and it is not silly: 2027 still names *"Design and detailing of beams"*, and a prestressed beam is a beam. This book rejects it, on the ground that the 2026 syllabus named *"Design of beams, slabs, columns"* **and** *"Prestressed concrete beams"* as two separate items — so the organisers themselves did not read the first as covering the second. Deleting the separate line is a deletion, not a re-absorption. Every affected question in this book's counted record keeps Structural Engineering recorded as its alternative, so a reader who takes the other view can move all fourteen marks back and see exactly what changes.

Free vibration is gone the same way. 2026's Engineering Mechanics ended *"Centre of mass; Free Vibrations of undamped SDOF system."*; 2027's ends *"Centre of mass."* Four of the sixteen papers set a natural-frequency question — eight marks.

Dynamic pile formulae are gone. 2026 read *"Deep foundations – dynamic and static formulae"*; 2027 reads *"Deep foundations – static formulae"*, and the word *dynamic* appears nowhere else in the 2027 document. The Engineering News Record formula, set in 2019 Set 2 for two marks, is a dynamic formula.

Remote sensing and GIS are gone, and Geomatics was not adjusted but rewritten — see below.

The additions

Twenty-nine 2027 phrases contain vocabulary the 2026 document did not have. These are worth as much attention as the removals, for a reason that is easy to state and easy to forget: ***most newly named topics have no past paper behind them, so no amount of previous-year practice will prepare you for them.*** Most, not all — examiners sometimes set material before a syllabus names it, and the exceptions are listed after the table.

Section 3 — The Organising Institute and Its Two Papers

GATE 2027 is organised by IIT Madras.

Each year one institute takes responsibility for the examination, and the paper is set under its supervision. Of the sixteen papers counted for this book, ****exactly two were set by IIT Madras: GATE 2019**

Set 1 and Set 2.** That makes 2019 the only year in this book's evidence base whose setter is the setter of the paper you are preparing for.

This chapter says what those two papers look like. It also says, at some length, what they cannot tell you — because a chapter that offers two eight-year-old papers as a forecast is worth less than no chapter at all.

3.1 What is fact here, and what is not

FACT. GATE 2027 is organised by IIT Madras. GATE 2019 was organised by IIT Madras.

FACT. The organising institutes of the sixteen counted papers are: IIT Madras (2019), IIT Delhi (2020), IIT Bombay (2021), IIT Kharagpur (2022), IIT Kanpur (2023), IISc Bengaluru (2024), IIT Roorkee (2025), IIT Guwahati (2026).

NOT A FACT, and this book will not pretend otherwise. That an institute "has a style" which persists across eight years and a change of everyone involved. Papers are set by subject panels, not by buildings.

The 2019 panel and the 2027 panel are not the same people, and the syllabus they work from is not the same syllabus. Everything below is a description of two papers, offered because it is the only institute-matched evidence that exists, and not because it is a prediction.

3.2 What the 2019 papers actually look like

FACT. Technical marks by section, both 2019 papers, counted question by question against the official key:

Section	2019 Set 1	2019 Set 2	Eight-year mean
1. Engineering Mathematics	10	13	12.9
2. Structural Engineering	16	14	15.1
3. Geotechnical Engineering	15	12	13.8
4. Water Resources Engineering	13	12	12.6
5. Environmental Engineering	10	10	11.1
6. Transportation Engineering	11	11	10.0
7. Geomatics Engineering	5	5	4.4
8. Construction Materials and Management	4	6	3.5
Outside the 2027 syllabus	1	2	1.6
General Aptitude	15	15	15.0

At section level the 2019 papers are unremarkable. Every section lands within three marks of its eight-year mean, and Engineering Mathematics at 10 in Set 1 is the lowest figure that section reaches anywhere in the record. **The interesting thing about 2019 is not at section level. It is one level down.**

3.3 The finding worth your attention: 2019 traded concrete for steel

FACT. Within Structural Engineering, across both 2019 papers:

	Concrete Structures	Steel Structures
2019 (both sets)	1 mark	10 marks
2020	5	5
2021	2	4
2022	4	4
2023	6	5
2024	7	1
2025	8	6
2026	4	6

(Each year is both sets combined. Prestressed concrete is outside the 2027 syllabus and is counted as NOT-IN-2027, not as Concrete Structures — see Section 2.2.)

FACT. The single Concrete Structures mark in 2019 is one question: Set 1, on the nominal cover to reinforcement under IS 456-2000. **2019 Set 2 contains no Concrete Structures question at all.**

FACT. 2019's ten Steel Structures marks come from six questions spread across both sets — limit state design of a bending member, plastic analysis of a T-section, an eccentric fillet-weld group, the effective length of a compression member, a non-dimensional slenderness ratio, and the web bearing strength of a rolled I-section on a bearing plate.

FACT. 2019 set no prestressed-concrete question. Neither did 2023 or 2025.

ANALYSIS. 2019's one mark is the lowest Concrete Structures reaches in any year of the record; every other year runs at 2 to 8 marks. Steel's lead of nine marks in 2019 is the widest gap between the two topics in any year — in no other year did Steel lead by more than two. Steel matching or beating Concrete is not itself unusual: it did so in 2020, 2021, 2022 and 2026 as well. What sets 2019 apart is the size of the gap, and that concrete all but vanished. The section total did not move — Structural

Engineering was 16 and 14, against a mean of 15.1 — so a candidate reading only a section-level weightage table would have seen nothing unusual at all and would have walked into a paper with almost no concrete in it.

PREDICTION, and a narrow one. This book does not predict that 2027 will repeat 2019. One paper by one panel eight years ago is one observation, and the syllabus has changed underneath it since. What the evidence supports is narrower and more useful: ****the assumption that Concrete Structures is the heavier half of Structural Engineering does not survive the count.**** Steel matched or beat Concrete in five of the eight years, and the institute setting 2027 is the one that pushed the gap furthest. A candidate who has drilled concrete thoroughly and treated steel as the section to survive is making a bet the record does not support. Preparing steel to the same standard as concrete costs a few evenings and removes the exposure entirely.

The 2027 syllabus sharpens the point rather than softening it. **Prestressed concrete has been deleted** (Section 2.2), which removes from Concrete Structures the one sub-topic that carried at least two marks in five of the last seven years — while Steel Structures keeps every line it had except plate girders, and gains plastic analysis of portal frames.

Section 4 — What Sixteen Papers Actually Contain

This is the chapter the rest of the book rests on. Everything after it — the subject chapters, the question bank, the mock tests — is built on the counts below, so this chapter shows you the counts, the method that produced them, and the places where the method's first answers turned out to be wrong.

4.1 How the counting was done

FACT. Sixteen official GATE Civil Engineering papers were read one question at a time: every paper from 2019 to 2026, both sets, **1,040 questions and 1,600 marks.**

Each question was read from the organising institute's own question paper — not from a key, not from a summary, not from a solved-papers book. Its marks and its question type were then taken from **that year's official answer key** and from nothing else: the key's own table was parsed out of the PDF and joined to the questions by number, and the parse was rejected unless it produced all 65 rows. So when this book says a question carried two marks and was a multiple-select question, that is the organisers' record of it and not a reading of the paper's layout.

Each question was then assigned to a section of the **2027** syllabus — not to the syllabus in force when it was set. That is the point of the exercise: a 2027 candidate needs to know where the marks would land under the syllabus they will actually sit.

Every count had to close, or it was not a count. Each of the sixteen closes on:

Check	Required	Result
Questions	65	65 in all sixteen
Total marks	100	100 in all sixteen
One-mark questions	30	30 in all sixteen
Two-mark questions	35	35 in all sixteen
General Aptitude	exactly 15	15 in all sixteen
Technical	exactly 85	85 in all sixteen

A count that did not close was re-done rather than adjusted. Nothing was moved, merged or dropped to make a total come out right.

Where a question could honestly sit in two sections, both are recorded. The question is placed where the syllabus wording puts it, the other candidate is recorded beside it, and where the wording does not settle the matter the question is marked unsure with the reason written out. Those rows are published in the research files, not hidden: a reader who disagrees with a placement can find every one of them and see what moving it would do.

Why not use a published weightage table. Because there is nothing to use. GATE CE is set in two sets a year, and **no published weightage table this author has seen distinguishes them.** A table that gives one number for "GATE CE 2024" is averaging two different papers without saying so, or counting one of them and labelling it the year. For Civil Engineering specifically, the published tables are not a shortcut to this work; they are a different and worse version of it.

4.2 The papers

FACT.

Year	Organising institute	Set 1	Set 2
2026	IIT Guwahati	counted, official key	counted, official key
2025	IIT Roorkee	counted, official key	counted, official key
2024	IISc Bengaluru	counted, official key	counted, official key
2023	IIT Kanpur	counted, official key	counted, official key
2022	IIT Kharagpur	counted, official key	counted, official key
2021	IIT Bombay	counted, official key	counted, official key
2020	IIT Delhi	counted, official key	counted, official key
2019	IIT Madras	counted, official key	counted, official key

Three facts about this base that you should have rather than discover:

- **Six of the source files have no text layer** — the 2019 papers, the 2019 keys and the 2021 papers. They were read by rendering pages to images.
- **No official host publishes a separate 2019 or 2020 answer key.** Both years' keys are printed inside the question-paper files themselves, at the end of each session.
- **2019's printed "Set No" is a booklet number, not the paper set.** The headers read Set No 1 and Set No 3. This book's Set 1 and Set 2 follow the archive's own session ordering.

4.3 Marks by section, every paper

FACT. Technical marks by section. General Aptitude is 15 in every paper and is listed last.

Section	19-1	19-2	20-1	20-2	21-1	21-2	22-1	22-2	23-1	23-2	24-1	24-2	25-1	25-2	26-1	26-2	Mean	Range
2. Structural Engineering	16	14	16	15	14	12	17	13	18	19	13	13	16	16	14	15	15.1	12-19
3. Geotechnical Engineering	15	12	15	14	13	13	14	13	16	16	13	13	14	14	13	13	13.8	12-16
1. Engineering Mathematics	10	13	12	13	13	13	15	14	13	13	13	13	13	13	13	13	12.9	10-15
4. Water Resources Engineering	13	12	13	13	11	13	11	12	13	13	12	12	14	14	13	13	12.6	11-14
5. Environmental Engineering	10	10	11	11	13	11	13	13	13	13	8	8	10	11	11	11	11.1	8-13
6. Transportation Engineering	11	11	11	11	9	9	9	12	6	6	11	11	10	10	11	12	10.0	6-12
7. Geomatics Engineering	5	5	4	4	4	4	3	1	3	4	7	7	4	3	7	6	4.4	1-7
8. Construction Materials & Management	4	6	1	2	6	7	3	3	2	1	6	6	4	4	1	0	3.5	0-7
<i>Outside the 2027 syllabus</i>	1	2	2	2	2	3	0	4	1	0	2	2	0	0	2	2	1.6	0-4
General Aptitude	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15.0	15-15

Read the Range column before the Mean column. A mean with no spread beside it is how the first draft of this book's research notes concluded that Transportation Engineering had doubled between 2023 and 2026. It had not: 2023 is the lowest year in the record, and starting a trend line there manufactures a trend out of a dip. Every mean in this book is printed with its range for that reason.

4.4 The two-sets question, and its answer

Civil is set in two sessions with two different papers. That raises a question no single-set analysis can even ask: **are sixteen papers sixteen pieces of evidence, or eight?**

FACT. Setting each year's two sets against each other, section by section, and summing the absolute differences:

Year	Difference between its two sets, marks out of 100
2024	0
2025	2

(round off to three decimal places).

ANSWER 0.667

Acceptance band: 0.660 to 0.675.

Concept Tested: Fourier coefficients on a symmetric interval, and the use of odd/even symmetry to discard half the work before integrating anything.

Why This Question Is High Probability: "Fourier series" opens the 2027 PDE line, it is the most frequent PDE vehicle in the counted record — five of the seventeen PDE questions — and it is the topic that links the PDE area to the separation-of-variables solutions named beside it.

SOLUTION

First use symmetry. $f(x) = x$ is an odd function on $(-\pi, \pi)$, so every cosine coefficient vanishes: $a_0 = 0$ and $a_n = 0$ for all n . Only sine terms survive, and

$$b_n = (1/\pi) \int_{-\pi}^{\pi} x \sin(nx) \, dx = (2/\pi) \int_0^{\pi} x \sin(nx) \, dx.$$

Integrate by parts with $u = x$ and $dv = \sin(nx) \, dx$, so $du = dx$ and $v = -\cos(nx)/n$:

$$\begin{aligned} \int_0^{\pi} x \sin(nx) \, dx &= [-x \cos(nx)/n]_0^{\pi} + (1/n) \int_0^{\pi} \cos(nx) \, dx \\ &= -\pi \cos(n\pi)/n + (1/n) [\sin(nx)/n]_0^{\pi} \\ &= -\pi \cos(n\pi)/n + 0 = -\pi(-1)^n/n. \end{aligned}$$

Hence

$$b_n = (2/\pi) \cdot (-\pi(-1)^n/n) = -2(-1)^n/n = 2(-1)^{n+1}/n.$$

$$\text{For } n = 3: b_3 = 2(-1)^4/3 = 2/3 = \mathbf{0.667}.$$

The sign is where this question is lost. $b_1 = 2$, $b_2 = -1$, $b_3 = 2/3$, $b_4 = -1/2$ — the coefficients alternate, and reporting **-0.667** means the $(-1)^{n+1}$ was taken as $(-1)^n$. A candidate who also forgets the symmetry argument and computes the full integral from $-\pi$ to π without doubling the half-range integral will get half the right magnitude, 0.333.

5.2 Structural Engineering

Structural Engineering is the largest technical section in the GATE Civil paper. Across the sixteen counted papers it averages **15.1 marks** and ranges from 12 to 19 — the widest range of any large section, and three marks wider than Geotechnical Engineering, which is nearly the same size.

It is also **the section the 2027 syllabus changed most**, and the section where a study plan built from a pre-2027 weightage table is most likely to be wrong. Two topics have been deleted outright, and between them they account for 22 marks of the counted record. Read Section 5.2.2 before you plan this section.

The evidence below is **150 questions and 241 marks**, counted question by question from all sixteen papers and checked against the official answer keys. Every citation names the year, the **set** and the question number.

The official 2027 syllabus for this section

FACT — GATE 2027 CE, Section 2: Structural Engineering (official syllabus PDF, IIT Madras)

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass.

Solid Mechanics: Bending moment and shear force in statically determinate beams; Transformation of stress (Mohr's circle); Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion; Combined stresses; Column buckling.

Structural Analysis: Principle of superposition;

Work and energy methods: Principle of virtual work, Castigliano's second theorem; Deflections of statically determinate beams, frames, and trusses; Analysis of statically indeterminate structures by force and displacement methods (method of consistent deformations, slope-deflection method, moment distribution method); Influence lines and moving loads; Stiffness matrix method; Analysis of determinate arches and cables.

Concrete Structures: Working stress and limit state design concepts; Design and detailing of beams, slabs, columns, and isolated footings; Bond and development length.

Steel Structures: Working stress and limit state design concepts; Design of tension and compression members, beams and beam-columns, column bases; Connections – simple and eccentric, beam-column connections; Concept of plastic analysis – beams and portal frames.

Note the odd shape of that text: "**Structural Analysis**" is a heading with a single phrase under it — "Principle of superposition" — and everything a candidate would call structural analysis sits under the next heading, "Work and energy methods". This book treats the two as one topic, because the papers do.

5.2.1 What the 2027 syllabus changed here

Three changes, and the first two are the most consequential in the whole syllabus revision.

FACT — deletion. The 2026 Concrete Structures line ended *"Bond and development length; **Prestressed concrete beams.**"* The 2027 line reads "Bond and development length." and adds isolated footings in place of it.

FACT — deletion. The 2026 Engineering Mechanics line ended *"Centre of mass; **Free Vibrations of undamped SDOF system.**"* The 2027 line ends "Centre of mass."

FACT — deletion. 2026's Steel Structures named *"...beam-column connections, **plate girders** and trusses"*; 2027 names "...beam-column connections" and stops. 2026's Structural Analysis named "Stiffness 0 methods"; 2027 names "Stiffness matrix method" only.

FACT — additions. Principle of virtual work; Castigliano's second theorem; the method of consistent deformations; **influence lines and moving loads** (2026 said only "influence lines"); **detailing** and **isolated footings** in Concrete Structures; and plastic analysis of **portal frames** as well as beams.

ANALYSIS — what the deletions cost. In the sixteen counted papers, prestressed concrete drew ****14 marks across seven papers, and free vibration drew 8 marks**** across four. That is 22 marks of recent examination history on material the 2027 paper cannot examine. Any weightage table compiled before the 2027 syllabus counts all 22 inside this section, which is why published figures put Structural Engineering near 15.9 marks while the count against the 2027 syllabus gives **15.1**.

What to do about it. Cut prestressed concrete and free vibration from your Structural plan. They are the two most drilled "sure thing" topics in this section that the 2027 syllabus no longer names. This book writes no question on either.

The honest caveat, and it matters. A topic absent from the syllabus has still been set before — the counted record contains thin cylindrical pressure vessel questions in 2022 Set 1 and 2026 Set 1, and neither syllabus names pressure vessels. So the risk of dropping prestress entirely is not zero. What it is is small, specific and stated: roughly one two-mark question, on a topic the organisers deliberately removed. The decision is yours; this book's job is to make sure you make it knowingly rather than by inheriting a table.

ANALYSIS — what the additions point at. "Influence lines **and moving loads**" is a real widening: the moving-load problem — locating the position of a train of loads that maximises a bending moment — is a harder and more distinctive question than reading a value off an influence line. And "plastic analysis of

Engineering Mechanics — 18 marks, 7 per cent

FACT: The smallest topic, 1 to 4 marks a year. Counted questions include 2019 Set 1 Q.5; 2020 Set 1 Q39; 2021 Set 1 Q39; 2022 Set 1 Q46; 2024 Set 2 Q16.

ANALYSIS. With free vibration deleted, the topic is down to four items: systems of forces and free-body diagrams, internal forces in structures, friction, and centre of mass. **Zero-force members in a truss** is the single most recurring one-mark vehicle here. It is small, it is cheap, and it should take an afternoon.

5.2.4 How to prepare this section

1. **Cut prestressed concrete and free vibration.** Both are 2027 deletions, together worth 22 marks of the counted record, and both are prominent in pre-2027 drill books.
2. **Structural Analysis first, and thoroughly.** 36 per cent of the section, never below 9 marks a year.
3. **Do not let Steel Structures be the topic you plan to survive.** The institute setting 2027 once gave it ten marks against concrete's one.
4. **Learn the code constants cold.** IS 456:2000 and IS 800:2007 values are expected knowledge, not given data, in every design question in the counted record.
5. **Indeterminacy counting is free marks.** One formula, one careful count, recurring almost every year.

Question Bank — Structural Engineering

Thirty-two questions, written for this book, in proportion to the counted evidence: eleven on Structural Analysis, eight on Solid Mechanics, six on Steel, five on Concrete and two on Engineering Mechanics. ****No question here is on prestressed concrete or free vibration****, for the reason given above. Every numerical answer was computed, and every distractor is the output of a named mistake.

QSE.1

MCQ · 1 mark

Easy

Subject: Structural Engineering | Topic: Engineering Mechanics | Subtopic: Internal forces in structures — zero-force members

Prediction Confidence: Topic 74% | Concept 70% | Question-pattern 62% | Exact-question 15%

Based on PYQs: GATE 2025 Set 2 (Q46), 2020 Set 1 (Q15), 2019 Set 1 (Q.5) · last tested 2025 · new question on the same concept, not a reprint

QUESTION

A plane pin-jointed truss has a joint J at which exactly three members meet. Two of those members are collinear with each other and the third is not. No external load and no support reaction acts at J. The force in the third member is

- (A) equal to the force in each collinear member (B) zero
(C) equal to half the force in each collinear member (D) indeterminate without analysing the whole truss

ANSWER (B)

Concept Tested: The zero-force member rules, derived directly from equilibrium at a single joint.

Why This Question Is High Probability: Zero-force members are the single most recurring one-mark vehicle in Engineering Mechanics, and 2019 Set 1 Q.5 — set by the institute that sets 2027 — asked exactly this, identifying the zero-force members of a plane truss.

Historical Evidence: 2019 Set 1 Q.5 (1M) — identifying zero-force members of a plane truss; 2020 Set 1

Q15 (1M) — number of zero-force members in a determinate plane truss; 2025 Set 2 Q46 (2M) — identifying zero-force members.

SOLUTION

Resolve forces at joint J along the direction **perpendicular** to the two collinear members. The two collinear members have no component in that direction, because they lie along the perpendicular axis. Nothing else acts at J. So equilibrium in that direction reads

$$F_3 \cdot \sin \theta = 0,$$

where $\theta \neq 0$ is the angle the third member makes with the collinear pair. Hence $F_3 = 0$.

The two rules worth memorising, both proved the same way:

- **Three members at an unloaded joint, two collinear** → the third carries zero force.
- **Two non-collinear members at an unloaded joint** → both carry zero force.

Note what the result does *not* say: a zero-force member is not useless. It braces the collinear members against buckling and it carries load under a different load case. This is why **(D)** tempts — it feels as though a global analysis must be needed — but joint equilibrium is a local condition and settles it on the spot. **(A)** and **(C)** both assume force is somehow shared at a joint, which is a confusion between equilibrium and distribution.

QSE.2

NAT · 2 marks

Moderate

Subject: Structural Engineering | Topic: Engineering Mechanics | Subtopic: Friction and its applications

Prediction Confidence: Topic 74% | Concept 64% | Question-pattern 52% | Exact-question 12%

Based on PYQs: GATE 2026 Set 1 (Q50), 2022 Set 1 (Q46), 2021 Set 1 (Q39) · last tested 2026 · new question on the same concept, not a reprint

QUESTION

A block weighing 1000 N rests on a plane inclined at 30° to the horizontal. The coefficient of static friction between the block and the plane is 0.25. The minimum force, applied **parallel to the inclined plane and directed up the slope**, required to prevent the block from sliding down is ____ N (round off to one decimal place).

ANSWER 283.5

Acceptance band: 282.0 to 285.0.

Concept Tested: Equilibrium on an inclined plane; and the direction of friction, which acts **up** the slope when the block is on the point of sliding down.

Why This Question Is High Probability: "Frictions and its applications" is one of only four items surviving in the 2027 Engineering Mechanics line, which concentrates the topic.

SOLUTION

Resolve perpendicular to the plane to get the normal reaction:

$$N = W \cos 30^\circ = 1000 \times 0.8660 = 866.03 \text{ N.}$$

The limiting friction is

$$F = \mu N = 0.25 \times 866.03 = 216.51 \text{ N.}$$

The block tends to slide **down**, so friction acts **up** the plane and helps the applied force. Resolving along the plane, with P the applied force up the slope:

$$P + F = W \sin 30^\circ$$

$$P = 1000 \times 0.5 - 216.51 = 500 - 216.51 = \mathbf{283.5 \text{ N.}}$$

The two errors that matter are both about the direction of friction. Taking friction as acting **down** the plane gives $P = 500 + 216.51 = 716.5 \text{ N}$ — that is the force needed to push the block *up*, which is a different question. Ignoring friction entirely gives 500 N.

Worth noting: $\tan 30^\circ = 0.577 > \mu = 0.25$, so the block genuinely will slide without help. Had μ exceeded $\tan \theta$ the block would be self-supporting and the answer would be zero — checking that inequality first is a five-second guard against solving the wrong problem.

QSE.3

NAT · 1 mark

Easy

Subject: Structural Engineering | Topic: Solid Mechanics | Subtopic: Simple stress and strain relationships

Prediction Confidence: Topic 86% | Concept 76% | Question-pattern 62% | Exact-question 14%

Based on PYQs: GATE 2026 Set 2 (Q50), 2025 Set 1 (Q51), 2020 Set 1 (Q51) · last tested 2026 · new question on the same concept, not a reprint

QUESTION

A steel bar of length 2 m and uniform cross-sectional area 500 mm^2 carries an axial tensile force of 100 kN. Taking $E = 200 \text{ GPa}$, the elongation of the bar is ____ mm (round off to one decimal place).

ANSWER 2.0**Acceptance band:** 1.95 to 2.05.**Concept Tested:** $\delta = PL/AE$, and unit consistency between kN, mm and GPa.**Why This Question Is High Probability:** "Simple stress and strain relationships" is named explicitly and this is its cheapest expression. One-mark items of this shape recur throughout the counted record.**SOLUTION**

Work entirely in newtons and millimetres, which is where unit errors are avoided:

$$P = 100 \text{ kN} = 100 \times 10^3 \text{ N}$$

$$L = 2 \text{ m} = 2000 \text{ mm}$$

$$A = 500 \text{ mm}^2$$

$$E = 200 \text{ GPa} = 200 \times 10^3 \text{ N/mm}^2$$

$$\delta = PL/(AE) = (100 \times 10^3 \times 2000) / (500 \times 200 \times 10^3) = (2 \times 10^8) / (1 \times 10^8) = \mathbf{2.0 \text{ mm}}.$$

As a check, the stress is $\sigma = P/A = 200 \text{ N/mm}^2$, the strain is $\sigma/E = 200/200000 = 0.001$, and the elongation is $0.001 \times 2000 = 2 \text{ mm}$. A stress of 200 MPa is below the yield of ordinary structural steel, so the elastic formula is legitimate — worth a glance, because the formula is invalid past yield and GATE has set that trap.

The dominant error is mixing metres and millimetres, which moves the answer by a factor of 1000.

QSE.4

NAT · 2 marks

Moderate

Subject: Structural Engineering | Topic: Solid Mechanics | Subtopic: Transformation of stress (Mohr's circle)

Prediction Confidence: Topic 86% | Concept 80% | Question-pattern 68% | Exact-question 16%

Based on PYQs: GATE 2025 Set 2 (Q39), 2023 Set 2 (Q39), 2023 Set 1 (Q53) · last tested 2025 · new question on the same concept, not a reprint

QUESTION

At a point in a stressed body the normal stresses are $\sigma_x = 100 \text{ MPa}$ and $\sigma_y = 40 \text{ MPa}$ (both tensile) and the shear stress is $\tau_{xy} = 30 \text{ MPa}$. The **major principal stress** is ____ MPa (round off to two decimal places).

ANSWER 112.43**Acceptance band:** 112.0 to 112.9.**Concept Tested:** The principal stress formula, equivalently the centre and radius of Mohr's circle.**Why This Question Is High Probability:** The 2027 syllabus names the tool explicitly for the first time —"Transformation of stress (**Mohr's circle**)" — and it is among the most recurring Solid Mechanics vehicles in the record.**Historical Evidence:** 2019 Set 1 Q.6 (1M) — normal strain on a plane via transformation; 2019 Set 2 Q.29 (2M) — rotation of a stress element; 2020 Set 2 Q16 (1M) — the state of stress a Mohr's circle centred at the origin represents.

Section 9 — The Hundred Questions to Work First

If you have time for a hundred questions and not for 274, these are the hundred. If you have time for all 274, work these first anyway, because finishing them leaves you in a defensible position if the time runs out.

9.1 How the hundred were chosen

This list is not hand-picked. One rule was applied to all 274 questions in the nine subject chapters and the result printed. The rule is stated here so that you can disagree with it precisely.

How many come from each section. The sixteen-paper counted weights happen to sum to exactly 100:

Section	Marks per paper	Questions in the hundred
Structural Engineering	15	15
General Aptitude	15	15
Geotechnical Engineering	14	14
Engineering Mathematics	13	13
Water Resources Engineering	13	13
Environmental Engineering	11	11
Transportation Engineering	10	10
Geomatics Engineering	5	5
Construction Materials and Management	4	4

So the hundred mirror the paper. An hour spent on this list is divided the way the marks are.

Which questions within a section. Topic confidence highest first — of the four confidence figures this is the one with the most evidence behind it, and Section 7 explains what it is and is not. Ties break on Question-pattern confidence, because a stable question *shape* is a skill that practice transfers to. Any remaining ties break on question id, so the order does not shuffle between printings.

Nothing else enters. Difficulty does not, because an easy question on a near-certain topic is worth more than a hard one on an unlikely topic, and this list is about return on an hour rather than about challenge.

Why the quota is there. A first version of this list ranked all 274 questions on confidence alone. It returned 31 General Aptitude questions, 22 Environmental, and ****not one question from Geotechnical Engineering**** — the second-heaviest section in the paper — because General Aptitude's confidence figures are uniformly high and Geotechnical's are not. That list was faithful to its rule and useless as advice. A study list that silently drops a 14-mark section is wrong however cleanly it was derived.

9.2 The blind spot in the rule, stated before the table

The rule ranks on Topic confidence, and Topic confidence rests mostly on the counted record. Most topics the 2027 syllabus names for the first time have ****no counted history at all**, and so some of the lowest confidence figures in the book ****** — and they drop to the bottom of this list, or off it. (Not all of them: a few were examined under older wording before 2027 named them, and Section 2 lists those.)

That is backwards as a study instruction. A never-examined topic is exactly the material no amount of past-paper practice will force you to meet, so it is the material most likely to be missing from your preparation on the day. Section 9.4 lists those questions separately, together with every other question whose concept the counted record has

never examined. **Work the hundred, then work

Section 9.4. ** Do not let the ranking decide that a topic the examiners have just added to the syllabus is unimportant; it decided that only because it cannot see 2027.

9.3 The hundred

Mk is the question's marks. **T** and **P** are its Topic and Question-pattern confidence. Work the question from the subject chapter; not from this table — the table is an index, and the chapters hold the solutions, the acceptance bands and the reasoning.

#	Question	Section	Topic — subtopic	Type	Mk	T	P
1	QGA.3	General Aptitude	Quantitative aptitude — Average speed	NAT	1	95%	70%
2	QGA.4	General Aptitude	Quantitative aptitude — Time and work	NAT	2	95%	68%
3	QGA.7	General Aptitude	Quantitative aptitude — Probability	MCQ	1	95%	68%
4	QGA.1	General Aptitude	Quantitative aptitude — Percentage error	MCQ	1	95%	66%
5	QGA.13	General Aptitude	Quantitative aptitude — Averages	MCQ	1	95%	66%
6	QGA.2	General Aptitude	Quantitative aptitude — Ratio and proportion	MCQ	2	95%	64%
7	QGA.5	General Aptitude	Quantitative aptitude — Profit, loss and discount	NAT	2	95%	64%
8	QGA.9	General Aptitude	Quantitative aptitude — Mensuration	NAT	2	95%	64%
9	QGA.10	General Aptitude	Quantitative aptitude — Simple and compound interest	NAT	2	95%	64%
10	QGA.11	General Aptitude	Quantitative aptitude — Mixtures and alligation	NAT	1	95%	64%
11	QGA.14	General Aptitude	Quantitative aptitude — LCM and HCF	NAT	1	95%	64%
12	QGA.6	General Aptitude	Quantitative aptitude — Permutations with repeated letters	NAT	2	95%	62%
13	QGA.8	General Aptitude	Quantitative aptitude — Number series	MCQ	1	95%	62%
14	QGA.15	General Aptitude	Quantitative aptitude — Ages	NAT	2	95%	62%
15	QGA.12	General Aptitude	Quantitative aptitude — Clocks	NAT	2	95%	60%
16	QSE.11	Structural Engineering	Structural Analysis and energy methods — Static indeterminacy of a plane frame	NAT	1	92%	72%
17	QSE.14	Structural Engineering	Structural Analysis and energy methods — Fixed end moments — slope deflection and moment distribution	NAT	1	92%	70%
18	QSE.12	Structural Engineering	Structural Analysis and energy methods — Deflection of a determinate beam	NAT	2	92%	68%
19	QSE.16	Structural Engineering	Structural Analysis and energy methods — Analysis of trusses	NAT	2	92%	62%
20	QSE.15	Structural Engineering	Structural Analysis and energy methods — Kinematic indeterminacy	NAT	1	92%	60%
21	QSE.18	Structural Engineering	Structural Analysis and energy methods — Determinate arches	NAT	2	92%	60%
22	QSE.13	Structural Engineering	Structural Analysis and energy methods — Influence lines	MCQ	1	92%	58%
23	QSE.20	Structural Engineering	Structural Analysis and energy methods — Stiffness matrix method	NAT	1	92%	58%
24	QSE.19	Structural Engineering	Structural Analysis and energy methods — Cables	NAT	2	92%	56%
25	QSE.17	Structural Engineering	Structural Analysis and energy methods — Principle of superposition	MSQ	1	92%	52%
26	QSE.21	Structural Engineering	Structural Analysis and energy methods — Effect of support settlement	NAT	2	92%	52%
27	QSE.4	Structural Engineering	Solid Mechanics — Transformation of stress (Mohr's circle)	NAT	2	86%	68%
28	QSE.9	Structural Engineering	Solid Mechanics — Column buckling — Euler load	NAT	2	86%	66%
29	QSE.6	Structural Engineering	Solid Mechanics — Simple bending theory — flexural stress	NAT	1	86%	64%
30	QSE.3	Structural Engineering	Solid Mechanics — Simple stress and strain relationships	NAT	1	86%	62%
31	QGE.24	Geotechnical Engineering	Shallow foundations and bearing capacity — Terzaghi's bearing capacity for a strip footing on clay	NAT	1	86%	68%
32	QGE.25	Geotechnical Engineering	Shallow foundations and bearing capacity — Effect of the water table	NAT	2	86%	64%
33	QGE.26	Geotechnical Engineering	Shallow foundations and bearing capacity — Plate load test	MCQ	1	86%	58%
34	QGE.27	Geotechnical Engineering	Shallow foundations and bearing capacity — Contact pressure distribution	MSQ	1	86%	52%
35	QGE.13	Geotechnical Engineering	Shear strength and stress paths — Mohr-Coulomb failure criterion	NAT	1	84%	68%
36	QGE.14	Geotechnical Engineering	Shear strength and stress paths — Triaxial test — deviator stress at failure	NAT	2	84%	64%
37	QGE.15	Geotechnical Engineering	Shear strength and stress paths — Effective and total stress parameters	MCQ	1	84%	60%
38	QGE.16	Geotechnical Engineering	Shear strength and stress paths — Direct shear test	NAT	2	84%	60%
39	QGE.18	Geotechnical Engineering	Earth pressure and retaining structures — Rankine active earth pressure coefficient	NAT	1	82%	70%
40	QGE.10	Geotechnical Engineering	Settlement and consolidation — Consolidation settlement of a normally consolidated clay	NAT	2	82%	66%
41	QGE.19	Geotechnical Engineering	Earth pressure and retaining structures — Total active thrust on a retaining wall	NAT	2	82%	64%
42	QGE.11	Geotechnical Engineering	Settlement and consolidation — Time rate of consolidation	NAT	1	82%	62%
43	QGE.12	Geotechnical Engineering	Settlement and consolidation — Coefficient of consolidation from a laboratory test	NAT	2	82%	58%
44	QGE.20	Geotechnical Engineering	Earth pressure and retaining structures — Rankine and Coulomb theories compared	MSQ	1	82%	54%
45	QCM.9	Engineering Mathematics	Calculus — Definite integral applied to obtain an area	NAT	2	90%	62%
46	QCM.13	Engineering Mathematics	Calculus — Directional derivative	NAT	2	90%	60%
47	QCM.8	Engineering Mathematics	Calculus — Limits — indeterminate forms	NAT	1	90%	58%
48	QCM.10	Engineering Mathematics	Calculus — Local maxima and minima on a closed interval	MCQ	1	90%	56%
49	QCM.15	Engineering Mathematics	Calculus — Line integral of a vector field	NAT	2	90%	56%
50	QCM.11	Engineering Mathematics	Calculus — Definite integral applied to obtain a volume	NAT	2	90%	54%
51	QCM.12	Engineering Mathematics	Calculus — Total derivative	NAT	1	90%	52%

Section 10 — What Not to Skip, and What to Skip

There are two ways to be wrong about a syllabus. You can study something it does not contain, which costs time. You can skip something it does contain, which costs marks. **These are not symmetric**, and treating them as though they were is the mistake behind most reading lists.

The asymmetry has a practical consequence that runs through this whole chapter: where a topic's status is genuinely unclear, read it briefly rather than skip it. An hour lost is recoverable. A question you cannot attempt is not.

This chapter gives two lists. They are built from different kinds of evidence and they are not mirror images of each other.

10.1 Do not skip, group one: the topics examined in every single counted year

The strongest signal the counted record can produce is a topic that has drawn marks in **all eight** counted years — sixteen papers, both sets, without a gap. That is not a trend that might reverse; it is a topic the examiners have not once left out.

26 of the 46 topics in the counted record did so. They carry 1,256 of the 1,600 marks counted across the sixteen papers. If your preparation is incomplete, it should be incomplete somewhere other than here.

Topic	Section	Counted marks	Years examined
Water and Waste Water Quality and Treatment	Environmental Engineering	123	8 of 8
Quantitative aptitude	General Aptitude	96	8 of 8
Structural Analysis and energy methods	Structural Engineering	86	8 of 8
Verbal ability and comprehension	General Aptitude	64	8 of 8
Traffic Engineering	Transportation Engineering	62	8 of 8
Hydraulics	Water Resources Engineering	61	8 of 8
Solid Mechanics	Structural Engineering	59	8 of 8
Hydrology	Water Resources Engineering	58	8 of 8
Transportation Infrastructure	Transportation Engineering	56	8 of 8
Calculus	Engineering Mathematics	52	8 of 8
Fluid Mechanics	Water Resources Engineering	52	8 of 8
Analytical and logical reasoning	General Aptitude	47	8 of 8
Linear Algebra	Engineering Mathematics	42	8 of 8
Highway Pavements	Transportation Engineering	42	8 of 8
Steel Structures	Structural Engineering	41	8 of 8
Concrete Structures	Structural Engineering	37	8 of 8
Numerical Methods	Engineering Mathematics	35	8 of 8
Air Pollution	Environmental Engineering	32	8 of 8
Irrigation	Water Resources Engineering	31	8 of 8
Ordinary Differential Equation	Engineering Mathematics	29	8 of 8
Probability and Statistics	Engineering Mathematics	28	8 of 8
Settlement and consolidation †	Geotechnical Engineering	28	8 of 8

Topic	Section	Counted marks	Years examined
Construction Materials	Construction Materials and Management	26	8 of 8
Index properties and classification †	Geotechnical Engineering	26	8 of 8
Traversing and triangulation	Geomatics Engineering	25	8 of 8
Engineering Mechanics	Structural Engineering	18	8 of 8

† A topic name this book chose, because the official syllabus gives Section 3 as two unlabelled paragraphs and supplies no topic names of its own.

A caution about the topics *not* in that table

****A low year-count is much weaker evidence than a high one, and this book draws no skip conclusion from it.**** The reason is mechanical. Every counted question is assigned to exactly one topic, so a concept that appears inside questions counted under several other topics shows a low count of its own without being rare in the examination.

This book can show the effect on itself. The first version of its placement rules put ****effective stress**** in only two counted years; the rules were later corrected to follow each counted question's own label first, and effective stress moved to **six** — without a single question in the record changing. A count that can triple when the filing rules are corrected was never evidence that the topic is rare. And effective stress is the single most load-bearing idea in soil mechanics: it sits inside most consolidation, seepage and bearing-capacity questions whichever topic they are filed under. The same caveat applies to the

Geotechnical topic names generally, because the official syllabus gives that section as two unlabelled paragraphs and every topic name in it was chosen by this book rather than taken from the document.

Read the table above as *these are certain*. Do not read its absences as *these are safe*.

10.2 Do not skip, group two: the phrases the 2027 syllabus names for the first time

Twenty-nine phrases in the 2027 syllabus contain vocabulary the 2026 document did not have. Most of them belong on a do-not-skip list for exactly the opposite reason to the topics above: ****they have no past-paper history, so no amount of previous-year practice will make you meet them.****

Most, not all. Being newly named is not the same as never examined: an audit of all 1,040 counted questions found that several of these had already been set under older wording — streamflow measurement in 2023 Set 2, Q.63, and level of service in 2020 Set 1, Q.55, among them. **Thirteen were never examined at all:** isolated footings; ground improvement techniques; flow past sharp crested weirs; landfill design and operation; classification of roadways and design vehicle; interchanges; four-step travel demand modelling; GNSS surveying; cadastral surveying; cartography and map projections; digital photogrammetry; space resection, parallax equations and camera calibration; and long wall, short wall and centre line estimation. Those are the ones a question bank built from the record cannot cover, and this book says so where it applies.

Section 2 gives the evidence for each line, both lists, and every citation.

Section	Named for the first time in 2027
1 Engineering Mathematics	Axioms and theorems of probability; statistical independence; probability mass, density and cumulative distribution functions
2 Structural Engineering	Principle of virtual work; Castigliano's second theorem; method of consistent deformations; influence lines and moving loads; detailing and isolated footings; plastic analysis of portal frames
3 Geotechnical Engineering	Sheet piles; ground improvement techniques

Section 11 — The Ten Mock Tests

Ten full papers follow. Each is 65 questions, 100 marks and three hours, built to the GATE Civil Engineering pattern and to the section weights of the sixteen counted papers. Every question in them was written for this book; none reproduces a past paper, which is why no mock question carries a year as a source.

A mock test is not a question bank with a clock attached. It measures three things the bank cannot: whether you recognise a topic when nothing announces it, whether you can hold accuracy for three hours, and where your time actually goes as opposed to where you think it goes. Use them for that.

The common blueprint

All ten papers are laid out identically, because the real paper is.

Questions	Block	Marks each
Q1 – Q5	General Aptitude	1
Q6 – Q10	General Aptitude	2
Q11 – Q35	Technical	1
Q36 – Q65	Technical	2

That gives 30 one-mark and 35 two-mark questions, General Aptitude at exactly 15 marks and the technical sections at 85 — the shape every one of the sixteen counted papers closes on.

The 85 technical marks are distributed as the sixteen counted papers distribute them, as the means rounded to whole marks:

Section	Marks in each mock
Structural Engineering	15
Geotechnical Engineering	14
Engineering Mathematics	13
Water Resources Engineering	13
Environmental Engineering	11
Transportation Engineering	10
Geomatics Engineering	5
Construction Materials and Management	4

Two consequences are worth saying out loud. ****The mocks hold the weights fixed while the real paper does not****: Section 4 gives Environmental Engineering a counted range of 8 to 13 marks and Construction Materials and Management a range of 0 to 7. A fixed blueprint is right for a practice paper, because varying it would mix two measurements at once, but it means a mock cannot teach you how a thin Geomatics year feels. And ****no mock question rests on material the 2027 syllabus has dropped**** — prestressed concrete, free vibration of an undamped SDOF system, dynamic pile formulae and remote sensing, together 25 marks of the counted record.

Marking, exactly as the official keys apply it.

Type	Correct	Wrong	Partly correct
MCQ	full marks	minus one-third of the question's marks	not possible

Type	Correct	Wrong	Partly correct
MSQ	full marks	no penalty	no credit
NAT	full marks for any value in the band	no penalty	not applicable

So a wrong one-mark MCQ costs $1/3$ and a wrong two-mark MCQ costs $2/3$. MSQ scores only when every correct option is selected and no incorrect one is — no partial credit, no negative marking — which makes it the format that punishes partial knowledge hardest. NAT carries no penalty at all, so a NAT left blank is strictly worse than a NAT guessed.

Each paper states its own conventions — $g = 9.81 \text{ m/s}^2$, unit weight of water 9.81 kN/m^3 , concrete design to IS 456:2000, steel to IS 800:2007, mix design to IS 10262, flexible pavements to IRC:37 and rigid pavements to IRC:58, "log" base 10 and "ln" natural. Every numerical-answer question prints its acceptance band.

Why the MSQ count varies between papers

The number of multiple-select questions is different in each of the ten papers, and that is deliberate, because it is different in each real paper and unpredictably so. Counted from the official answer keys, the sixteen papers contain **no MSQ at all in 2019 or 2020, one in each 2021 paper, seven in each 2022 paper, ten and eleven in 2023, five and three in 2024, eleven and fifteen in 2025, and six and four in 2026.**

That is the least predictable structural feature of the paper: from one question to fifteen in the years since the format appeared. A set of mocks with a constant MSQ count would train you for a paper that does not exist.

Varying it means some of these ten papers will feel harsher than others for reasons that have nothing to do with your preparation — which is exactly what the record supports.

Scoring a paper, and what to do with the score

Sit the paper in one three-hour block. Mark it from Section 12, which gives the key, the type and the section for every question, and read the full working in Section 13.

Then compare section by section, not total by total. Each mock question is tagged with its section, so a paper resolves into nine scores as easily as one. A total moves for too many reasons at once — a hard Geotechnical block, a good day on Aptitude, a lucky MSQ — and comparing totals across papers tells you almost nothing you can act on. Comparing your Environmental score across four papers tells you whether Environmental is improving. Keep one table, nine rows, one column per paper, and the diagnosis reads itself.

And classify every lost mark by cause, because the four causes need four different remedies.

Cause	What it looks like
Misread	You solved a different question — missed "net" for gross, "saturated" for bulk, "per metre width", or the units
Wrong formula	Right topic, right method, wrong expression — the site weld factor for a shop weld, K_p where K_a belongs
Arithmetic slip	Right method, right formula, wrong number out
Not known	You could not begin

- A **misread** is a reading discipline, not a knowledge gap. Reading the question twice costs fifteen seconds; more study fixes nothing here.
- A **wrong formula** is the cheapest of the four to fix. It is a sheet, and Section 15 is that sheet.
- An **arithmetic slip** is a working-layout problem. Write the substitution on its own line, carry units, and sanity-check the magnitude before you type it.

Mock Test 01

Duration: 180 minutes | Maximum marks: 100 | 65 questions

This paper is a forgery of the GATE Civil Engineering pattern for 2027: Q1–Q5 General Aptitude at 1 mark, Q6–Q10 General Aptitude at 2 marks, Q11–Q35 technical at 1 mark, Q36–Q65 technical at 2 marks. Every question here was written for this book. None is taken from a past paper and none reproduces one, so no question carries a year as a source.

Section weights. The 85 technical marks are distributed as the sixteen counted papers distribute them: Structural 15, Geotechnical 14, Engineering Mathematics 13, Water Resources 13, Environmental 11, Transportation 10, Geomatics 5, Construction Materials and Management 4.

Marking. MCQ (exactly one correct option): full marks for the correct option, negative marking of one-third of the question's marks for a wrong option. MSQ (one or more correct options): full marks only if every correct option and no incorrect option is chosen; no negative marking and no partial credit. NAT (numerical answer): type the value; no negative marking. Any value inside the printed acceptance band earns full marks.

Conventions used throughout this paper. Take $g = 9.81 \text{ m/s}^2$ and the unit weight of water as 9.81 kN/m^3 unless a question states otherwise. Concrete design follows **IS 456:2000**, steel design **IS 800:2007**, flexible pavement design **IRC:37** and rigid pavement design **IRC:58**; partial safety factors are those of the relevant code and are not restated in each question. "log" is base 10 and "ln" is natural. Stresses are in N/mm^2 (MPa) unless stated. Soil unit weights are bulk unless the question says saturated or submerged. Every numerical-answer question states its acceptance band.

Q1 – Q5 carry ONE mark each.

Q1

MCQ · 1 mark

Select the option most nearly **OPPOSITE** in meaning to the word in bold.

The inspector's report on the collapse was uncharacteristically **laconic**.

- | | |
|--------------------------------------|------------------------------------|
| ☐ (A) verbose | ☐ (B) abrupt |
| ☐ (C) inaccurate | ☐ (D) hesitant |

General Aptitude — antonyms in context

Q2

MCQ · 1 mark

Select the pair that expresses a relationship most similar to that in the given pair.

mason : trowel

- | | |
|--|---|
| ☐ (A) architect : building | ☐ (B) surveyor : theodolite |
| ☐ (C) concrete : cement | ☐ (D) foreman : worker |

General Aptitude — word analogy

Q3

MCQ · 1 mark

A quantity is first increased by 20 per cent and the result is then decreased by 20 per cent. Compared with the original, the final quantity is

- | | |
|-------------------------------------|--|
| ☐ (A) unchanged | ☐ (B) 4 per cent smaller |
|-------------------------------------|--|

☐ C 4 per cent larger

☐ D 2 per cent smaller

General Aptitude — successive percentage change

Q4 MCQ · 1 mark

Consider the statements: *All surveyors are graduates. Some graduates are contractors.* Which conclusion **NECESSARILY** follows?

☐ A Some surveyors are contractors

☐ B Some contractors are graduates

☐ C All graduates are surveyors

☐ D No surveyor is a contractor

General Aptitude — syllogism

Q5 MCQ · 1 mark

Which one of the following capital letters appears **UNCHANGED** when reflected in a mirror placed horizontally below it?

☐ A F

☐ B G

☐ C B

☐ D P

General Aptitude — spatial reasoning, mirror images

Q6 – Q10 carry TWO marks each.

Q6 MCQ · 2 marks

Pipe A alone fills a tank in 6 hours and pipe B alone in 8 hours. An outlet pipe C alone empties the full tank in 12 hours. With all three open from empty, the tank fills in

☐ A 3.6 hours

☐ B 4.2 hours

☐ C 4.8 hours

☐ D 5.4 hours

General Aptitude — time and work

Q7 NAT · 2 marks

A train 150 m long travelling at 72 km/h crosses a platform 250 m long. The time taken to cross the platform completely is _____ seconds.

Acceptance band: 19.8 to 20.2.

General Aptitude — time, speed and distance

Q8 MCQ · 2 marks

Read the passage and answer the question.

Last year a city water department relined 6 km of old distribution mains in one zone. Over the twelve months that followed, the volume of water pumped into that zone fell by a fifth, while the number of connections served by the zone stayed the same. The department's report concludes that the relining removed a fifth of the zone's losses.

Which one of the following, if true, most **WEAKENS** the department's conclusion?

☐ A The relining was completed three weeks later than the department had planned

☐ B The mains in that zone had been laid more than forty years before they were relined

☐ C Two other zones of the city were relined during the same year

Q62 MCQ · 2 marks

A flexible pavement is designed to IRC:37 with an initial commercial vehicle count of 2000 per day, a lane distribution factor of 0.75, a vehicle damage factor of 3.0, an annual growth rate of 6 per cent and a design life of 10 years. The design traffic is closest to

- ☐ A 21.7 msa
- ☐ B 16.4 msa
- ☐ C 27.4 msa
- ☐ D 32.9 msa

Transportation Engineering — highway pavements

Q63 MCQ · 2 marks

A flexible pavement and a jointed concrete pavement are each to carry the same commercial traffic over the same ground. Fresh testing shows the soaked subgrade CBR to be 4 per cent, not the 8 per cent assumed at the design stage. Which one of the following states the consequence correctly?

- ☐ A Neither design changes, because IRC:37 and IRC:58 both take the design traffic as their only input
- ☐ B The concrete pavement must be thickened appreciably while the flexible pavement changes only marginally, because the slab bears directly on the subgrade
- ☐ C Both must be thickened in the same proportion, because subgrade strength enters the two designs in the same way
- ☐ D The flexible pavement must be thickened appreciably while the concrete slab changes only marginally, because the slab thickness is governed chiefly by the flexural strength of the concrete

Transportation Engineering — highway pavements

Q64 MCQ · 2 marks

A vertical aerial photograph is taken with a 150 mm focal length camera from a flying height of 2000 m above mean sea level, over ground of average elevation 500 m. The photograph scale is

- ☐ A 1 : 10,000
- ☐ B 1 : 7,500
- ☐ C 1 : 13,333
- ☐ D 1 : 15,000

Geomatics Engineering — photogrammetry

Q65 MCQ · 2 marks

An activity has an optimistic time of 5 days, a most likely time of 8 days and a pessimistic time of 17 days. Its PERT expected time and variance are respectively

- ☐ A 8.0 days and 4.00
- ☐ B 9.0 days and 2.00
- ☐ C 10.0 days and 6.00
- ☐ D 9.0 days and 4.00

Construction Management — project planning

Answer key — Mock Test 01

Attempt the whole paper before reading this page. Score with the official scheme: a correct 1-mark question gives +1 and a correct 2-mark question +2; a wrong MCQ costs 1/3 of a mark (1-mark) or 2/3 of a mark (2-mark); MSQ and NAT carry no negative marking, and an MSQ scores only if every correct option is selected and no incorrect one is. NAT answers are given to the precision stated in each question.

This paper contains 38 MCQ, 7 MSQ and 20 NAT questions (30 one-mark and 35 two-mark, 100 marks).

Section 13 — Detailed Mock Test Solutions

Each test's solutions follow, in question order. Attempt and score the paper (Section 12) before reading these.

Mock Test 01

Q1

ANSWER A

Confidence: Pattern 64% | Exact-question 14%

Laconic means using very few words — terse, brief to the point of curtness. Its opposite is **verbose**, using more words than needed.

B. abrupt is a near synonym rather than an opposite; a laconic reply can easily be abrupt. **C.** inaccurate **and D. hesitant** are unrelated to length of expression — a report can be laconic and accurate, or verbose and hesitant. The trap is choosing a word with negative connotation rather than opposite meaning.

Q2

ANSWER B

Confidence: Pattern 74% | Exact-question 10%

The relationship is **worker : characteristic tool of that trade**. A mason works with a trowel; a **surveyor** works with a **theodolite**.

A. architect : building is worker to product, not worker to tool. **C. concrete : cement** is whole to ingredient. **D. foreman : worker** is a hierarchy. Naming the relationship in words before reading the options is what makes analogy questions mechanical.

Q3

ANSWER B

Confidence: Pattern 66% | Exact-question 10%

Take the original as 100.

After +20 per cent: $100 \times 1.20 = 120$

After -20 per cent: $120 \times 0.80 = 96$

So the final value is 4 per cent **smaller**. Answer **B**.

The base changes between the two steps, which is why the percentages do not cancel. The 20 per cent increase is on 100; the 20 per cent decrease is on 120. In general a rise of x per cent followed by a fall of x per cent leaves $(1 - x^2/10^4)$ of the original — always a net loss, never a return to the start.

A. unchanged is the intended error.

Q4

ANSWER B

Confidence: Pattern 68% | Exact-question 13%

All surveyors are graduates places the surveyor set entirely inside the graduate set. **Some graduates are contractors** gives a non-empty overlap between graduates and contractors.

B follows: "some graduates are contractors" converts to "some contractors are graduates". *Some* asserts a non-empty intersection, and intersection is symmetric.

A does not follow. The graduate-contractor overlap may lie entirely outside the surveyor circle. It is *possible* that some surveyors are contractors, but not *necessary* — and the question asks what necessarily follows. This is the intended error. **C** reverses a universal, which never converts. **D** asserts a disjointness nothing establishes.

Q5 **ANSWER C**

Confidence: Pattern 68% | Exact-question 15%

A mirror placed **horizontally below** reflects top to bottom, so a letter appears unchanged if it has a **horizontal** axis of symmetry.

B has one: its upper and lower bowls are mirror images across a horizontal line through its middle.

F, G and **P** have their features concentrated in the upper half and are visibly reversed. The capitals with a horizontal axis are **B, C, D, E, H, I, K, O, X**; those with a vertical axis are **A, H,**

I, M, O, T, U, V, W, X, Y. Reading which mirror is meant is the whole question — a vertical mirror would have a different answer.

Q6 **ANSWER C**

Confidence: Pattern 68% | Exact-question 11%

Add **rates**, taking the outlet as negative:

$$1/6 + 1/8 - 1/12$$

The LCM of 6, 8 and 12 is 24: $4/24 + 3/24 - 2/24 = 5/24$ of the tank per hour.

Time = $24/5 = 4.8$ hours. Answer **C**.

A. 3.6 h is the answer with the outlet ignored ($1/6 + 1/8 = 7/24 \rightarrow 3.43$ h, rounded in the distractor).

D. 5.4 h comes from subtracting the outlet twice. The sign of the emptying pipe is the whole question: its rate is negative, so it *reduces* the combined rate and *increases* the time.

Q7 **ANSWER 20**

Confidence: Pattern 62% | Exact-question 13%

Acceptance band: 19.8 to 20.2.

To cross a platform completely, the train must travel its own length **plus** the platform length:

$$\text{distance} = 150 + 250 = 400 \text{ m}$$

$$\text{speed} = 72 \text{ km/h} = 72/3.6 = 20 \text{ m/s}$$

$$\text{time} = 400/20 = 20 \text{ s}$$

The band is tight because the only plausible errors are gross: using only the platform length gives 12.5 s, and using only the train length gives 7.5 s. ****A** train crossing a platform travels both lengths; a train crossing a pole travels only its own.**

Q8 **ANSWER D**

Confidence: Pattern 64% | Exact-question 13%

The department's reasoning is causal: the mains were relined $\rightarrow$ less water is now pumped into the zone $\rightarrow$ the difference must be leakage that has been stopped. A weakener need not disprove the conclusion. It need only offer another explanation for the same fall, and **D** does exactly that. If the zone's largest industrial consumer stopped drawing water in the very month the work finished, the demand the zone has to meet fell, and a fifth less water would be pumped whether or not a single leak was sealed. The department's own safeguard — that the number of connections was unchanged — does not close this gap, because a connection that stays on the books can stop consuming.

A is irrelevant. When the work finished says nothing about what the work achieved; a three-week delay leaves the argument exactly where it was. **B** cuts the other way if anything: forty-year-old mains are precisely where leakage is expected, so it makes the department's account more plausible, not less.

C mentions other zones but gives no figures for them, and an unquantified comparison neither supports nor undermines a claim about this zone.

Section 15 — The Last-Minute Sheet

What follows is the set of formulae and code constants worth carrying into the last day, grouped by the eight technical sections of the 2027 syllabus. Every entry here is taken from a question already worked in this book, so each one can be traced to a full derivation rather than to a memory of it, and the code constants were cross-checked against the solutions that use them before being printed.

Two things this sheet deliberately is not. **It is not a syllabus.** A formula list cannot tell you what a formula is for, and a candidate meeting one of these for the first time on this sheet is meeting it too late.

And it is not complete. Where a value was not verifiable against a worked question in this book, it was left out, because a wrong constant on a last-minute sheet is the worst defect this book could contain.

Notation: f_{ck} and f_y are characteristic strengths in N/mm², γ_w is the unit weight of water, and "log" is base 10 while "ln" is natural.

1 Engineering Mathematics

Item	Result
Eigenvalue checks	$\Sigma \lambda = \text{trace}$, $\Pi \lambda = \text{determinant}$
Spectral mapping	if λ is an eigenvalue of A, $p(\lambda)$ is an eigenvalue of $p(A)$
Transpose and inverse of a product	$(AB)^T = B^T A^T$, $(AB)^{-1} = B^{-1} A^{-1}$, $(A + B)^T = A^T + B^T$
Infinitely many solutions	rank of A = rank of the augmented matrix, and both are less than the number of unknowns
Standard limit	$(1 - \cos \theta)/\theta^2 \rightarrow 1/2$
Total derivative	$df/dt = (\partial f/\partial x)(dx/dt) + (\partial f/\partial y)(dy/dt)$
Directional derivative	$\nabla \phi \cdot \hat{u}$, with $\hat{u}$ made a unit vector first
Volume of revolution (disc)	$V = \pi \int y^2 dx$
Series	$\ln(1 + x) = x - x^2/2 + x^3/3 - x^4/4 + \dots$
Euler–Cauchy auxiliary equation	$m(m - 1) + am + b = 0$; repeated root gives a $\ln x$ factor
Newton–Raphson	$x_{n+1} = x_n - f(x_n)/f'(x_n)$
Trapezoidal rule weights	1-2-2-...-2-1
Simpson's 1/3 rule weights	1-4-2-4-...-4-1; number of sub-intervals must be even
Explicit Euler step	$y_{n+1} = y_n + h f(x_n, y_n)$
PDE classification	discriminant $B^2 - 4AC$ for $A u_{xx} + B u_{xy} + C u_{yy} + \dots = 0$
Laplace five-point scheme	each interior value is the mean of its four neighbours
Poisson	compute $P(X \geq 1)$ as $1 - P(X = 0)$

2 Structural Engineering

Solid mechanics and analysis

Item	Result
Axial extension	$\delta = PL/AE$
Section modulus, rectangle	$Z = bd^2/6$, with $\sigma = M/Z$

Item	Result
Torsion	$T/J = \tau/r$
Shear flow	$q = VQ/I$, with Q the first moment of the area beyond the cut
Euler buckling	$P_{cr} = \pi^2 EI/L_e^2$, the least I governing
No tension in a section	$e \leq Z/A$ — rectangle $d/6$, circle $D/8$
Core (kern)	rectangle: rhombus of diagonals $b/3$ and $d/3$; solid circle: diameter $D/4$
Static indeterminacy, plane frame	$D_s = 3m + r - 3j$, less one per internal hinge in a two-member joint
Cantilever tip deflection, point load	$PL^3/3EI$
Fixed end moment, UDL, both ends fixed	$wL^2/12$
Member stiffness	$4EI/L$ far end fixed; $3EI/L$ far end hinged
Three-hinged parabolic arch, full-span UDL	$H = wL^2/(8h)$
Cable	horizontal component of tension is constant; maximum tension at the supports
Shape factor Z_p/Z_e	rectangle 1.50; solid circle 1.70; diamond 2.00; I-section about 1.12–1.15

IS 456:2000 — concrete

Item	Value
Partial safety factor on steel, γ_s	1.15 , giving design stress $1/1.15 = \mathbf{0.87 f_y}$
Partial safety factor on concrete, γ_c	1.5 , giving $0.67 f_{ck}/1.5 = \mathbf{0.446 f_{ck}}$
Stress block	compression $0.36 f_{ck} b x_u$, acting $0.42 x_u$ from the extreme compression fibre
$x_{u,max}/d$	Fe250 0.53 , Fe415 0.48 , Fe500 0.46
Limiting moment	$M_{u,lim} = 0.36 f_{ck} b x_{u,max} (d - 0.42 x_{u,max})$
Limiting moment, short form	$0.148 f_{ck} b d^2$ (Fe250), 0.138 (Fe415), 0.133 (Fe500)
Limiting strain in concrete	0.0035 in bending, 0.002 in axial compression
Development length	$L_d = \phi \sigma_s / (4 \tau_{bd})$
Design bond stress τ_{bd} , plain bars in tension	1.2 MPa (M20), 1.4 (M25), 1.5 (M30)
Deformed bars	τ_{bd} increased by 60 per cent; a further 25 per cent for bars in compression
Development length, Fe415, deformed, tension	about 47ϕ in M20, 40ϕ in M25, 38ϕ in M30
Development length, Fe500, deformed, tension	about 57ϕ in M20, 48ϕ in M25, 45ϕ in M30
Shear by stirrups	$V_{us} = 0.87 f_y A_{sv} d/s_v$
Modular ratio, working stress	$m = 280/(3 \sigma_{cbc})$ — M20 13.33, M25 10.98, M30 9.33
Minimum curing	7 days for ordinary Portland cement; 10 to 14 days with mineral admixtures

IS 800:2007 — steel

Item	Value
γ_{m0} , yielding of the gross section	1.10
γ_{m1} , rupture of the net section	1.25
γ_{mb} , bolts, shop fabrication	1.25
γ_{mw} , welds	1.25 shop, 1.50 site
Tension member, gross section yield	$T_{dg} = A_g f_y / \gamma_{m0}$

Section 16 — Sources, Conventions and Limits

This chapter says what the book was built from, how the counting was done, and what the book does not claim. It is here so that a reader who doubts a figure knows which file to open.

What the book was built from

Two official syllabus documents. The GATE 2026 Civil Engineering syllabus, published by IIT Guwahati, and the GATE 2027 Civil Engineering syllabus, published by IIT Madras, both held as PDFs in `research/official/`. Section 2 reproduces the 2027 document and compares the two word by word; the comparison is produced by a program that reads the two PDFs, not from memory.

Sixteen official question papers and their sixteen official answer keys. GATE Civil Engineering Set 1 and Set 2 for each year from 2019 to 2026 — 1,040 questions and 1,600 marks. Every file was downloaded from a GATE organising-institute website. No coaching site, aggregator, question repository or blog was used for any paper, key, syllabus or figure in this book.

****The counting files in `research/`.** One JSON file and one readable Markdown file per paper, plus the generated summaries — `paper_overview.md` for the paper-level and section-level totals, `section_evidence.md` for the topic-level tables each subject chapter is written from. The summaries are generated from the counts by script rather than edited by hand, so a chapter cannot drift away from the evidence beneath it.

Three things about the source base a reader should have rather than discover. The pre-2023 Civil papers are published only as merged two-session files, so the per-set files were cut out of the official PDFs with `pymupdf` — pages copied, nothing retyped. No official host publishes a separate 2019 or 2020 answer key; both years' keys are printed inside the question papers. And six source files carry no text layer — the 2019 papers, the 2019 keys and the 2021 papers — so they were read by rendering their pages to images.

The counting conventions

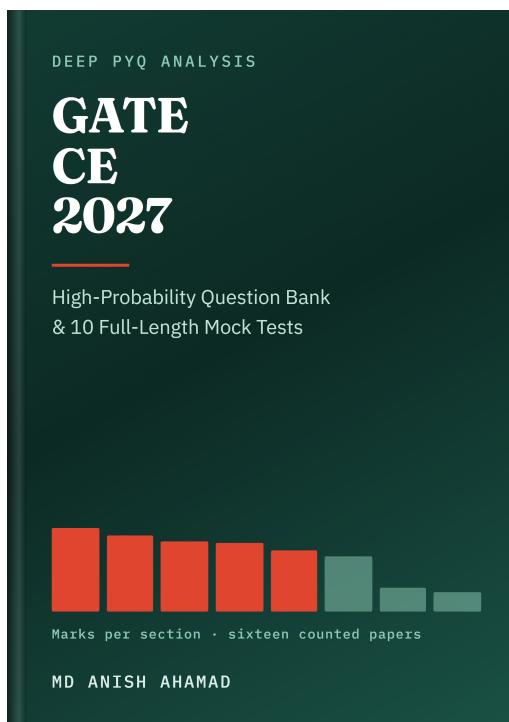
Every count had to close. Each of the sixteen closes on 65 questions, 100 marks, 30 one-mark and 35 two-mark questions, General Aptitude at exactly 15 and the technical sections at exactly 85. A count that did not close was redone, not adjusted; nothing was moved, merged or dropped to make a total come out right.

Marks and question type come from the official answer key, parsed out of the key PDF and joined to the questions by number, with the parse rejected unless it produced all 65 rows — not inferred from the paper's layout.

Every question is classified against the 2027 syllabus, not the syllabus in force when it was set, because a 2027 candidate needs to know where the marks land under the syllabus they will actually sit. Material the 2026 syllabus named and the 2027 syllabus dropped is recorded outside the eight sections, in a row labelled NOT-IN-2027: 25 marks across the sixteen papers. Material named by neither syllabus but examined anyway goes to the nearest section, with the reasoning recorded on the question.

The limits, stated plainly

Classifying a question to a section is a judgement in borderline cases. The question is placed where the syllabus wording puts it and the alternative is recorded beside it; where the wording does not settle the matter, the row is marked unsure with the reason written out. There are twenty-four such rows across the sixteen papers, published in the counting files rather than hidden, so a reader who disagrees with a placement can find it and see what moving it would do.



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