GATE

DISHA PUBLICATION
ab manzil door nahin...

Computer Science & Information Technology Masterpiece

2015

Thoroughly Revised & Updated

2nd Edition

includes 2014 papers (all sets)

Gate Mock Test CD

General Aptitude

Technical Section

Engineering Mathematics

- To the point theory covering each and every topic in the latest GATE syllabus.
- Covers past 8-10 years questions of GATE exams.
- Practice Exercise with 100-150 MCQ's per chapter.
- Solutions to each question in detail.
- The book provides a MOCK GATE CD containing 4 Mock Tests revised as per GATE 2014 pattern.

Covers Numerical Answer Type Questions

- **Head Office :** B-32, Shivalik Main Road, Malviya Nagar, New Delhi-110017
- **Sales Office :** B-48, Shivalik Main Road, Malviya Nagar, New Delhi-110017
  Tel. : 011-26691021 / 26691713

Price : ₹ 650

Typeset by Disha DTP Team

Developed & Edited by :
Sheenu Kamra, Sanjeev Kumar Jha, Mehndi Hassan

DISHA PUBLICATION

For further information about the books from DISHA,
Log on to **www.dishapublication.com** or email to **info@dishapublication.com**

CONTENTS

Section 1 - General Aptitude S1 (1-124)

Part A - Verbal Ability S1(1-54)

1. English Grammar 1 - 14
2. Sentence Completion 15 - 22
3. Synonyms & Antonyms 23 - 34
4. Verbal Analogies / Contexual Usage 35 - 42
5. Critical Reasoning & Verbal Deduction 43 - 54

Part B - Numerical Ability S1(55-124)

1. Number System 55 - 66
2. Algebra 67 - 78
3. Percentage & Its Applications 79 - 86
4. Time, Work, Speed and Distance 87 - 100
5. Ratio, Proportion, Partnership and Mixtures (Aligations) 101 - 112
6. Permutation and Combination & Probability 113 - 124

Section 2 - ENGINEERING MATHEMATICS S2(1-132)

1. Mathematical Logic 1 - 10
2. Probability 11 - 28
3. Set Theory & Algebra 29 - 46
4. Combinations 47 - 56
5. Graph Theory 57 - 66
6. Linear Algebra 67 - 90
7. Numerical Methods 91 - 102
8. Calculus 103 - 132

Section 3 - TECHNICAL SECTION S3(1-590)

1.	Digital Logic	1 - 46
2.	Computer Organization and Architecture	47 - 118
3.	Programming and Data Structures	119 - 200
4.	Algorithm Analysis	201 - 238
5.	Theory of Computation	239 - 288
6.	Compiler Design	289 - 348
7.	Operating System	349 - 414
8.	Databases	415 - 476
9.	Information System and Software Engineering	477 - 514
10.	Computer Networks	515 - 568
11.	Web Technologies	569 - 590

PREFACE

With an aim to provide the best possible material to the students to prepare for the GATE-2015, GATE Masterpiece is a one of its kind for the preparation of Computer Science & Information Technology Engineering Exams and a result of many years of research. Another unique feature of this book is that it has Numerical Answer Type Questions which have been recently added by the IITs.

The key idea, which allows this book to deal with a wide range of content related to the CS & IT Engineering Exams along with covering each and every topic, is based on the current syllabus introduced by IIT for GATE-2015. Covering 100% topics of the syllabus for CS & IT Engineering Exams, the content of this book includes an extended and thoroughly revised version of a collection of exhaustive theory, past year questions, practice problems and Mock Tests. It also covers 'Simple MCQs,' 'Linked Answer type MCQs' and 'Common Data based MCQs' questions in great numbers.

In writing this book, we have assumed that readers are well acquainted with the very basic concepts of Computer Architecture, Programming, Theory of Computation, Algorithms, etc. Drafted in compliance with current GATE syllabus by qualified and experienced professionals, this book has questions of previous 8-10 years of GATE examinations. Having 100-150 questions in each unit with detailed solutions, this book in helpful in practicing and preparing for the exams in an effective manner within the shortest span of time.

Structured approach, Introduction of Concepts in Simple Terms, Fundamental Principles in Context of Simple Application and Accuracy were our main objectives that we aimed while writing this book. In order to make sure that the students get well prepared for the exams, we have divided into following sections:

Students who read this book will gain a basic understanding of principles, problems and solutions, including an introduction to the current format of GATE exam.

1. General Aptitude - Covering Verbal Ability and Numerical Ability
2. Engineering Mathematics
3. Technical Section

SUPPLEMENTS: MOCK GATE CD which contains 4 Mock Tests designed exactly on the latest pattern of GATE exam.

ACKNOWLEDGEMENTS

Special thanks go to our team which has given its best possible effort to prepare such a book, thoroughly checked the solutions, so as to eliminate any possibility of error.

However, some errors may have crept in, so feedbacks from the readers regarding the same are highly appreciated.

Author

Syllabus for Computer Science & Information Technology

SECTION I : GENERAL APTITUDE(GA)

Verbal Ability:
English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

Numerical Ability:
Numerical computation, numerical estimation, numerical reasoning and data interpretation.

SECTION II : ENGINEERING MATHEMATICS

Mathematical Logic:
Propositional Logic; First Order Logic.

Probability:
Conditional Probability; Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; uniform, normal, exponential, Poisson, Binomial.

Set Theory & Algebra:
Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra.

Combinatorics:
Permutations; Combinations; Counting; Summation; generating functions; recurrence relations; asymptotics.

Graph Theory:
Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.

Linear Algebra:
Algebra of matrices, determinants, systems of linear equations, Eigen values and Eigen vectors.

Numerical Methods:
LU decomposition for systems of linear equations; numerical solutions of non-linear algebraic equations by Secant, Bisection and Newton-Raphson Methods; Numerical integration by trapezoidal and Simpson's rules.

Calculus:
Limit, Continuity & differentiability, Mean value Theorems, Theorems of integral calculus, evaluation of definite & improper integrals, Partial derivatives, Total derivatives, maxima & minima.

SECTION III : TECHNICAL SECTION

Digital Logic:
Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic (fixed and floating point).

Computer Organization and Architecture:
Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.

Programming and Data Structures:
Programming in C; Functions, Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps.

Algorithm Analysis:
Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; Hashing, Sorting, Searching. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concepts of complexity classes - P, NP, NP-hard, NP-complete.

Theory of Computation:
Regular languages and finite automata, Context free languages and Push-down automata, Recursively enumerable sets and Turing machines, Undecidability.

Compiler Design: _____
Lexical analysis, Parsing, Syntax directed translation, Runtime environments, Intermediate and target code generation, Basics of code optimization.

Operating System:_____
Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.

Databases: _____
ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

Information System and Software Engineering: _
information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

Computer Networks:_____
ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers. Network security - basic concepts of public key and private key cryptography, digital signature, firewalls.

Web Technologies: _____
HTML, XML, basic concepts of client-server computing.

TOPIC WISE NUMBER OF QUESTIONS ANALYSIS

GATE Papers (Computer Science & Information Technology)

Subject	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
General Aptitude							10	10	10	10
Engg. Mathematics	18	14	15	18	10	11	9	6	7	6
TECHNICAL SECTION										
Digital Logic	9	6	8	5	2	5	6	4	4	3
Computer Organization and Architecture	13	7	8	12	6	5	5	6	8	4
Programming and Data Structures	8	6	4	4	4	8	11	8	7	40
Algorithm Analysis	12	15	15	17	9	4	1	6	8	7
Theory of Computation	7	8	7	9	7	4	6	5	3	4
Compiler Design	6	6	6	4	1	3	1	4	4	2
Operating system	2	9	8	7	7	5	5	4	2	5
Databases	7	5	6	6	5	5	3	6	5	5

PART-A : VERBAL ABILITY

1 English Grammar

Articles - Kinds, Usage & Common Errors in their uses

An article is a word that is added to a noun to indicate – the type of reference being made by the noun. It's a kind of adjective which gives some information about a noun.

The word '*a*' (becomes '*an*' when the word that follows begins with a vowels - a, e, i, o, u) is called the 'indefinite article' because the noun it combines with is indefinite or general. The word 'the' is called the 'definite article' as it indicates some specific thing

- I went by *a* car.
- I went by *the* car.

The above two sentences differ since in the first sentence I went by just any car while the second sentence refers to a particular car and not just any car.

We use 'A':

1. When a word begins with consonant sound
   - a book, a cat, a chair
2. When a word begins with a vowel but has a consonant sound
   - a university, a one parent family, a Europian
3. With words that have the sense of one
   - The culprit could not speak a word before the judge.
4. With abbreviations said as words.
   - a NATO general
   - a FIFA official
5. We use 'a' not 'one' when we mean 'any one of a particular type of thing.
   - I really need a cup of tea. (not ... one cup of tea)
   - You can never find a mosquito in this house. (not ... one mosquito)
6. With number and quantity expressions such as:
   - two times *a* year, *a* quarter of a litre, *a* day or so.
   - ₹ 100 *a* kg. (we can also say '....' for one kg.)
   - *a* little sugar, *a* huge number of people, *a* few artistes]
7. Rather than '*one*' in the pattern *a .... of .....* with possessives, as in
   - He's a friend of mine.
   - That's a relative of my friend.
8. With exclamatory expressions
   - What a wonderful car!, what a good boy he is!
9. With a person's name who may be unknown to the person addressed.
   - A peter wants to speak to you on the 'phone'.

We use 'An':

1. When, the noun you are referring to begins with a vowel (a, e, i, o, u)
   - an orange, an egg, an idea, an umbrella, an Italian.
2. When the word begins with a silent letter 'h'.
   - an hour, an honest man, an honour, an heir (= a person who inherits money etc., when someone dies)
3. With abbreviations said as individual letters that begins with A, E, F, H, I, L, M, N, O, R, S or X:
   - **an MLA, an FBI** agent, **an MP, an x-ray, an MA**. However, the abbreviations said as words are exceptions.
   - **a NATO** general, **a FIFA** officials

We use, 'The':

1. When we say that someone or something is 'unique' – that there is only one or only one of its kind – (we also use zero article, i.e., no article, but not a/an):
   - Cricket has become the international sports.
   - Sydney is the capital city of New South Wales.
2. When we refer to a person's job title, or their particular position.
   - Bob has been appointed as the director of the company.

   Sometimes 'the' is omitted which is called 'zero article'.
3. Before a superlative adjective (the largest, the cheapest, the most beautiful, etc.) when the superlative adjective is followed by a noun or defining phrase:
   - He is the best player in the team at the moment.
   - His comment was the most awkward in the meeting.

   However, often 'The' is left out, particularly in an informal style, when there is no noun or defining phrase after the superlative adjective.
   - Mr X: Why did you plan to go to Manali?
   - Mr. Y: It was (the) coldest.
4. When we know that there is only one of a particular thing.
   - the earth, the sun, the world, the international market, the film industry, the south pole, the nuclear family.
5. When refer to the things in a general way:
   - the environment, the climate, the human race, the wind, the future, the weather, the atmosphere, the ocean, the sea. However, if we describe them for a particular instance, we use a/an and not 'the', compare.
   - I could hear the wind whistling through the trees in the forest.
   - There was a cold wind blowing from the East.
   - What do you plan for the future?
   - She dreamt of a future where she could spend more time with him.

6. When we expect the listener or reader identifies the thing or person we are referring to, on the other hand, a/an is used when we don't. Compare the following pairs of sentences.
   - Wilson bought a house in Lincon Street last month and
   - Wilson bought the house in Lincon Street last month (= the house we have previously known)
   - A minister has been expelled from the house and
   - The minister has been expelled from the house (= the minister we have previously known)
   - There's a train coming and
   - The train is coming. (= it's the train we are talking about)
   - There is a man on the door and
   - There is the man on the door. (= You know which man I am talking about)
7. When it is clear from the situation which person or thing we are referring to.
   - What do you think of the carpet? (= the carpet is lying before us)
   - How did you prepare the broth? It tastes good (= the broth I am just eating)
   - The plants are blooming now that it's spring. (= the plants here in the garden)
8. When we repeat something about something:
   - Bob ordered a cake and an apple pie but the cake was found to be stale. In the sentence, we say a 'cake' when we first mention it and 'the cake' after that, when the listener knows which cake we are talking about.
   - There was a severe fire in a building in Connaught place yesterday. The building was totally destroyed.

   Here again, we say 'a building' when we first talk about it. We use 'the building' when we mention it again because the listener will know which building we are talking about.
9. With the names of:
   (a) Religious books
      - the Bible, the Vedas, the Ramcharitmanas, the Kuran.

   (b) Mountains, Islands, Oceans, Rivers
      - the Himalayas, the Pacific, the Ganges, the Bay of Bengal, the Arabian Sea, the Indian Ocean

   (c) Religious groups
      - the Hindus, the Sikhs, the Mohammedans, the Parsees

   (d) Names of law enforcing agencies
      - the CBI, the FBI, the ISI, the Navy, the Air Force.

   (e) Press, clubs, foundations etc.
      - the PTI, the Rotary Club, the NCC.

   (f) Nationalists
      - the Indians, the Americans, the Chinese, the Norwegian

   (g) Historical events, empires or dynasties.
      - the Tughlak Dynasty, the Second World War, the Non-cooperation Movement, the Mughal Period, the Chinese Revolution.

   (h) Trains, aeroplanes, ships
      - The Sub-way train, the Rajdhani, the Lufthansa Cargo, the Kingfisher, the Air India.

   (i) Ordinals
      - She was the first to come to the party

   (j) Comparatives
      - He is the smarter of the two brothers.

   (k) Adjectives with plural nations indicating a whole class of persons:
      - The poor are not always despondent.

      However, 'the poor men are not always despondent' is wrong.

   (l) Common noun as a substitute for the possessive adjective:
      - Bob stared at Rick in the face. (Rick's face)

   (m) Noun defined by adjectives or adverbial phrases or clauses:
      - He proved himself to be **the dark horse** of this election.
        (he was not well known but won unexpectedly)
      - She was runner-up and got **the red ribbon.**
        (= she came second-place)

   (n) Adjectives and common nouns in the singular form expressing an abstract idea:
      - Nobody knows about **the future.** (= futurity)
      - The man in him prevented him from running away from the accident spot. (= manly feelings)

NOUN: COUNTABLE AND UNCOUNTABLE, GENDER AND CASES

A noun is a word that can be used to refer to a person, place, thing, quality or action. It can be a subject or an object of a verb. They can be modified by an adjective and can take an article or determiner.

Nouns can be categorized as *countable* or *uncountable*. Here are some nouns which are normally uncountable, though in many other languages they may be countable:

- Apart from going to work, there's lots of housework to do for Kiran.
- She wore her jewellery and get ready for the party.

Some more nouns like this:

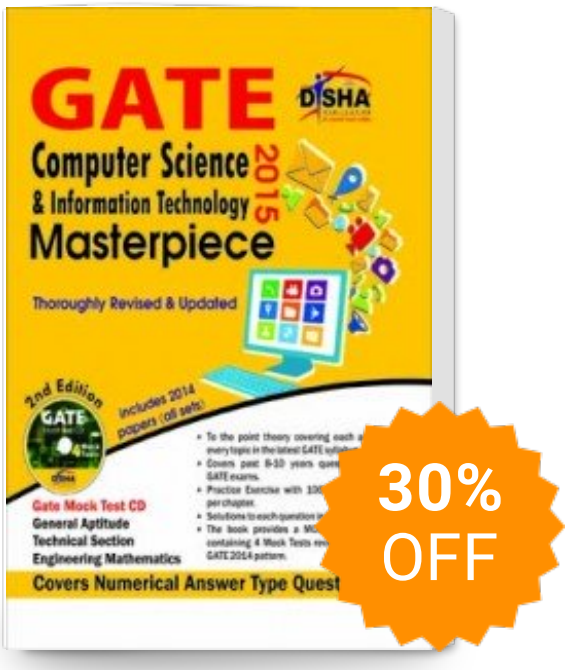
furniture, homework, information, luggage, money, news, scenery, transport, weather, work accommodation, assistance evidence, fun, harm, health, housing, advice, applause, baggage, equipment leisure, litter, luck, machinery, money, mud, music, nonsense, parking, pay, permission, photography, poetry, pollution, produce, progress, publicity, safety, rubbish, research, shipping, sightseeing, violence, undercover, sunshine.

Some common errors in use of nouns:

(i) Nouns which take a plural verb:
- Her all *belongings* were scattered in all over the place.
- She sent him her sincere *congratulations* on his marriage.
- She saves half of all her *earnings* every month.
- He lives on the *outskirts* of Mumbai. (= outlying areas of a city or town)

(ii) Other nouns like these include:
clothes, goods, particulars, premises (= building), riches, savings, stairs, surroundings, thanks.

GATE Computer Science and Information Technology Masterpiece 2015 by Disha Publication



Publisher : Disha Publication ISBN : 9789384089900 Author : Disha Publication

Type the URL : http://www.kopykitab.com/product/3652