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2020

GATE

Graduate Aptitude Test for Engineering

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GATE 2020

Graduate Aptitude Test in Engineering

Electronics & Communication Engineering

**General Aptitude | Engineering Mathematics |
Electronics & Communication Engineering | Practice
Papers | Solved Papers (2015-2019)**

Compiled by
Khanna Editorial Team



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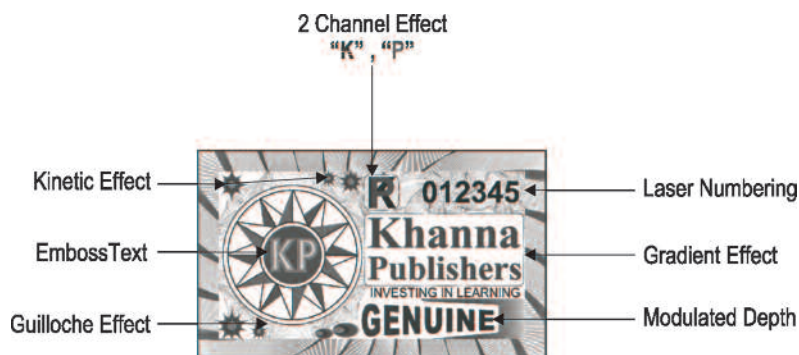
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PREFACE

GATE, Electronics and Communication Engineering, as a complete resource helps the aspirants be ready with conceptual understanding. It is an outcome of classroom tested notes by the author, refined over the years while teaching and guiding students. The number of aspirants appearing for the GATE examination is increasing significantly every year, owing to multifaceted opportunities open to any good performer. Apart from giving the aspirant a chance to pursue an M. Tech. from institutions like the IITs/ NITs, a good GATE score can be highly instrumental in landing the candidate a plush public sector job, as many PSUs are recruiting graduate engineers on the basis of their performance in GATE.

The students must have their own strategy, both for preparation and writing the examination and have to practice many difficult questions to score high. They study most part of the course design their graduation, but still everything has to be revised and requires practice. From a practice point of view, this book is very useful. In this book, the type, level and length of problems have been kept relevant and as close to the recent GATE trends as possible.

In order to have an overview of the examination patterns, the book provides solved previous years question with step by step solution so that students can practice those questions straightway. It is advised to the students that they should solve problems without looking into the solutions given in the book.

It is good to struggle with the difficult questions which develop problems solving skills. A large number of diagrams given in the book provide ease in understanding the concepts, which make the reading more fruitful.

The book is designed in such a manner that even average students can score high percentage if they practice more and more based on the fundamental concepts.

Although every attempt has been made to make this book student friendly. In conclusion, we wish to appreciate any helpful criticisms and suggestions from teachers and students, we shall definitely incorporate all those suggestions, and improve the usefulness of the book.

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ABOUT GATE

WHAT IS GATE?

The Graduate Aptitude Test in Engineering (GATE) is an All India examination administered and conducted in eight zones across the country by the GATE Committee comprising of Faculty members from IISc, Bangalore and other sixteen IIT's on behalf of the National Coordinating Board, Department of Higher Education, Ministry of Human Resources Development. The GATE score/rank is used for admissions to Postgraduate Programmes (ME, M.Tech, MS, Direct Ph.D.) in institutes like IITs and IISc etc. with financial assistance offered by MHRD. PSUs too use the GATE scores for recruiting candidates for various prestigious jobs with attractive remuneration.

In GATE examination, candidates can apply for only one of the 23 papers. Candidates are expected to appear in a paper appropriate to the discipline of their qualifying degree. However, candidates are free to choose any paper according to their admission plan, keeping in mind the eligibility criteria of the institutions in which they wish to seek admission. For more details regarding the admission criteria in any particular institute, candidates are advised to refer to the websites of that particular institute.

WHY GATE 2020?

GATE is considered to be the standard examination conducted not only for postgraduation admissions but also to open the gates for lucrative opportunities in several public sector enterprises and research organizations. Based on the score achieved in GATE, admissions are offered in IITs, IISc, and NITs, and abundant opportunities for campus placements with salary packages ranging from Rs. 6 lakh to 30 lakh. Candidates on qualifying GATE, get a financial aid of 12400/- pm in the form of UGC scholarship.

Students interested in management can swing in the management line by pursuing a PG Diploma of 2 years in Industrial Engineering. Some institutes in India also offer admissions in the postgraduate programmes on the basis of GATE score.

GATE exam is important because of below mentioned factors:

- *M.Tech* : Campus placements in National and International private or public companies
- Several reputed PSUs and research organizations recruits on basis of GATE Score. i.e., IOCL, NTPC, BHEL, PGCIL, BARC etc.
- *Teaching*: Professor, Asst. Professor at IITs, NITs, reputed educational institutes etc.
- *Junior Research Fellowship (JRF)* : ISRO, DRDO, BARC, CSIR, IITs etc.
- *Senior Research Fellowship (SRF)* : ISRO, DRDO, BARC, CSIR, IITs etc.
- Junior Research Associates/ Senior Project Associates
- Scientists "C" grade jobs
- Career in Research & Development
- Technical value addition
- Expertise in subject/domain specialization

GATE 2020 ELIGIBILITY

The following candidates are eligible to appear in GATE 2020:

- Bachelor's degree holders in Engineering/Technology (4 years after 10+2 or 3 years after B.Sc./Diploma in Engineering/ Technology) and those who are in the final year of such programs.
- Bachelor's degree holders in Architecture (Five years course) and those who are in the final year of such programs.
- Bachelor's degree holders of Four year program in Science (B.S.) and those who are in the final year of such programs.
- Master's degree holders in any branch of Science/ Mathematics/ Statistics/Computer Applications or equivalent and those who are in the final year of such programs.
- Holders of Four-year Integrated Master's degree (Post B.Sc.) in Engineering/Technology and those who are in the second or higher year of such programs.
- Holders of Five-year Integrated Master's degree or Dual Degree in Engineering/Technology and those who are in the fourth or higher year of such programs.
- Holders of Five-year integrated M.Sc. or Five-year integrated B.Sc./M.Sc. degree and those who are in the final year of such programs.
- Candidates with qualifications obtained through examinations conducted by professional societies recognized by UPSC/AICTE/ MHRD as equivalent to B.E./B.Tech. Those who have completed Section A of AMIE or equivalent of such professional courses are also eligible.

Multiple Choice Questions (MCQs)

These questions are objective in nature and each question will have choice of four answers, out of which the candidate has to mark the correct answer. Each question carries 1 or 2 marks questions in all the sections.

Numerical Answer Questions

There will be no choices available for these types of questions. A numeric answer question carries 1 or 2 marks questions in all sections. The answer for these questions is a real number to be entered by using mouse and virtual keypad displayed on the monitor. No negative marking for these questions.

TYPES OF QUESTIONS

GATE 2018, Exam consists of Multiple Choice Questions and Numerical Type Questions in all papers & sections. Multiple Choice Questions will contain 4 options, of which only one is correct. For Numerical Type Questions a numerical value as the answer should be entered using mouse and virtual keyboard on the monitor.

The following are type of Questions:

- (a) Recall:** These are based on facts, principles, formulae or laws of the discipline. The candidate is expected to be able to obtain the answer either from his/her memory directly or at most from a one-line computation.
- (b) Comprehension:** These questions will test the candidate's understanding of the basics of his/her field, by requiring him/her to draw simple conclusions from fundamental ideas.
- (c) Application:** In these questions, the candidate is expected to apply his/her knowledge either through computation or by logical reasoning.

- (d) **Analysis and Synthesis:** These can be linked questions, where the answer to the first question of the pair is required in order to answer its successor. Or these can be common data questions, in which two questions share the same data but can be solved independently of one another.
- (e) **Common Data Questions:** Multiple questions may be linked to a common data problem, passage and the like. Two or three questions can be formed from the given common data problem. Each question is independent and its solution obtainable from the above problem data/passage directly. (Answer of the previous question is not required to solve the next question). Each question under this group will carry two marks.
- (f) **Linked Answer Questions:** These questions are of problems solving type. A problem statement is followed by two questions based on the problem statement. The two questions are designed such that the solution to the second question depends upon the answer to the first one. In other words, the first answer is an intermediate step in working out the second answer. Each question in such linked answer questions will carry two marks.

HOW TO PREPARE FOR GATE 2020?

GATE examination consists only of multiple and numerical answer type questions, hence only correct answer fetches marks.

- Practice previous years' question papers and analyze the weak topics and concentrate more on those topics. Candidates must try to solve the papers in a given time limit to obtain an idea as to how many questions are solved within the allotted time.
- Impart equal emphasis on both theory and numerical problems.
- Browse through the GATE syllabus for topics allotted more weightage and prepare them.
- Group Study is an effective way to brush up knowledge about technical topics with fellow partners and also helps to explore new techniques and methods to better understand the topics.
- Do not make wild guess as there is negative marking associated with the questions.
- Prepare the list of important definitions, equations, derivations, theorems, laws in every subject.
- Pay more attention while attempting linked and common data questions.

SYLLABUS

SECTION 1: ENGINEERING MATHEMATICS

Linear Algebra: Vector space, basis, linear dependence and independence, matrix algebra, eigen values and eigen vectors, rank, solution of linear equations – existence and uniqueness.

Calculus: Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima, multiple integrals, line, surface and volume integrals, Taylor series.

Differential Equations: First order equations (linear and nonlinear), higher order linear differential equations, Cauchy's and Euler's equations, methods of solution using variation of parameters, complementary function and particular integral, partial differential equations, variable separable method, initial and boundary value problems.

Vector Analysis: Vectors in plane and space, vector operations, gradient, divergence and curl, Gauss's, Green's and Stoke's theorems.

Complex Analysis: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula; Taylor's and Laurent's series, residue theorem.

Numerical Methods: Solution of nonlinear equations, single and multi-step methods for differential equations, convergence criteria.

Probability and Statistics: Mean, median, mode and standard deviation, combinatorial probability, probability distribution functions - binomial, Poisson, exponential and normal, Joint and conditional probability, Correlation and regression analysis.

Electronics and Communication Engineering

SECTION 2: NETWORKS, SIGNALS AND SYSTEMS

Network solution methods: Nodal and mesh analysis; Network theorems; superposition, Thevenin and Norton's, maximum power transfer; Wye-Delta transformation; Steady state sinusoidal analysis using phasors; Time domain analysis of simple linear circuits; Solution of network equations using Laplace transform; Frequency domain analysis of RLC circuits; Linear 2-port network parameters: driving point and transfer functions; State equations for networks.

Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications; Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals; LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay, digital filter design techniques.

SECTION 3: ELECTRONIC DEVICES

Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell; Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.

SECTION 4: ANALOG CIRCUITS

Small signal equivalent circuits of diodes, BJTs and MOSFETs; Simple diode circuits: Clipping, clamping and rectifiers; Single-stage BJT and MOSFET amplifiers: biasing, bias stability, mid-frequency small signal analysis and frequency response; BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and op-amp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation.

SECTION 5: DIGITAL CIRCUITS

Number systems; Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders and PLAs; Sequential circuits: latches and flip-flops, counters, shift-registers and finite state machines; Data converters: sample and hold circuits, ADCs and DACs; Semiconductor memories: ROM, SRAM, DRAM; 8-bit microprocessor (8085): architecture, programming, memory and I/O interfacing.

SECTION 6: CONTROL SYSTEMS

Basic control system components: Feedback principle, Transfer function, Block diagram representation, Signal flow graph, Transient and steady-state analysis of LTI systems, Frequency response, Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots, Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.

SECTION 7: COMMUNICATIONS

Random processes: Autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems; Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers, circuits for analog communications; Information theory: entropy, mutual information and channel capacity theorem; Digital communications: PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; Timing and frequency synchronization, intersymbol interference and its mitigation; Basics of TDMA, FDMA and CDMA.

SECTION 8: ELECTROMAGNETICS

Electrostatics; Maxwell's equations: Differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector; Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart; Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers.

GATE 2020

Graduate Aptitude Test in Engineering

Computer Science & Information Technology

**General Aptitude | Engineering Mathematics |
Computer Science & IT | Practice Papers |
Solved Papers (2016-19)**

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Khanna Editorial Team



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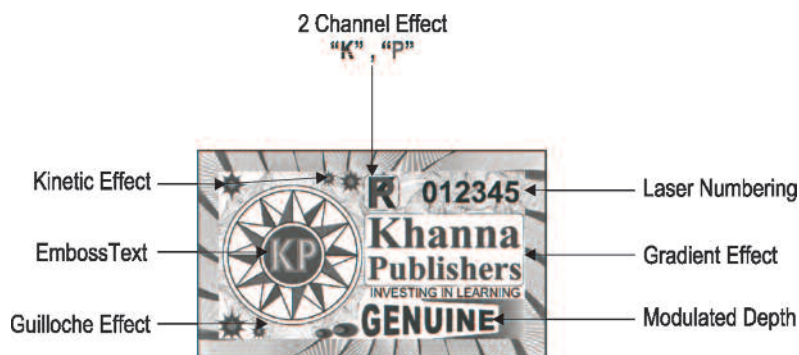
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- Master's degree holders in any branch of Science/ Mathematics/ Statistics/Computer Applications or equivalent and those who are in the final year of such programs.
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- Application:** In these questions, the candidate is expected to apply his/her knowledge either through computation or by logical reasoning.
- Analysis and Synthesis:** These can be linked questions, where the answer to the first question of the pair is required in order to answer its successor. Or these can be common data questions, in which two questions share the same data but can be solved independently of one another.
- Common Data Questions:** Multiple questions may be linked to a common data problem, passage and the like. Two or three questions can be formed from the given common data problem. Each question is independent and its solution obtainable from the above problem data/passage directly. (Answer of the previous question is not required to solve the next question). Each question under this group will carry two marks.
- Linked Answer Questions:** These questions are of problem solving type. A problem statement is followed by two questions based on the problem statement. The two questions are designed such that the solution to the second question depends upon the answer to the first one. In other words, the first answer is an intermediate step in working out the second answer. Each question in such linked answer questions will carry two marks.

HOW TO PREPARE FOR GATE 2020?

GATE examination consists only of multiple and numerical answer type questions, hence only correct answer fetches marks.

- Practice previous years question papers and analyze the weak topics and concentrate more on those topics. Candidates must try to solve the papers in a given time limit to obtain an idea as to how many questions are solved within the allotted time.
- Impart equal emphasis on both theory and numerical problems.
- Browse through the GATE syllabus for topics allotted more weightage and prepare them.
- Group study is an effective way to brush up knowledge about technical topics with fellow partners and also helps to explore new techniques and methods to better understand the topics.
- Do not make wild guess as there is negative marking associated with the questions.
- Prepare the list of important definitions, equations, derivations, theorems, laws in every subject.
- Pay more attention while attempting linked and common data questions.

SYLLABUS

CS: COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

Section 1: ENGINEERING MATHEMATICS

Discrete Mathematics: Propositional and first order logic, Sets, relations, functions, partial orders and lattices. Groups, Graphs, connectivity, matching, coloring. Combinatorics: counting, recurrence relations, generating functions.

Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigen vectors, LU decomposition.

Calculus: Limits, continuity and differentiability, Maxima and minima, Mean value theorem. Integration.

Probability: Random variables, Uniform, normal, exponential, poisson and binomial distributions, Mean, median, mode and standard deviation, Conditional probability and Bayes theorem.

Section 2: DIGITAL LOGIC

Boolean algebra, Combinational and sequential circuits, Minimization, Number representations and computer arithmetic (fixed and floating point).

Section 3: COMPUTER ORGANIZATION AND ARCHITECTURE

Machine instructions and addressing modes, ALU, data-path and control unit. Instruction pipelining, Memory hierarchy: cache, main memory and secondary storage, I/O interface (interrupt and DMA mode).

Section 4 : PROGRAMMING AND DATA STRUCTURES

Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Section 5 : ALGORITHMS

Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph search, minimum spanning trees, shortest paths.

Section 6 : THEORY OF COMPUTATION

Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and context free languages, pumping lemma. Turing machines and undecidability.

Section 7: COMPILER DESIGN

Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.

Section 8 : OPERATING SYSTEM

Processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems.

Section 9 : DATABASES

ER-model, Relational model, relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B⁺ trees). Transactions and concurrency control.

Section 10 : COMPUTER NETWORKS

Concept of layering, LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP), Basics of Wi-Fi. Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.