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Editor's Name : Vinit Garg

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GATE

Graduate Aptitude Test in Engineering

IIT Institutes



GATE 2024 will be conducted by
Indian Institute of Science, IISc Bangalore



GATE 2023 conducted by
Indian Institute of Technology, Kanpur



GATE 2022 conducted by
Indian Institute of Technology, Kharagpur



Indian Institute of Technology, Mumbai



Indian Institute of Technology, Delhi



Indian Institute of Technology, Chennai



Indian Institute of Technology, Guwahati



Indian Institute of Technology, Roorkee

Eligibility Criteria for GATE 2024

Degree/Program	Qualifying Degree/Examination	Description of Eligible Candidates	Expected Year of Completion
B.E. / B.Tech. / B.Pharm.	Bachelor's degree in Engineering / Technology (4 years after 10+2 or 3 years after B.Sc. / Diploma in Engineering / Technology)	Currently in the 3 rd year or higher grade or already completed	2025
B. Arch.	Bachelor's degree of Architecture (5-year course) / Naval Architecture (4-year course) / Planning (4-year course)	Currently in the 3 rd year or higher grade or already completed	2026 (for 5-year program), 2025 (for 4-year program)
B.Sc. (Research) / B.S.	Bachelor's degree in Science (Post-Diploma/4 years after 10+2)	Currently in the 3 rd year or higher grade or already completed	2025
Pharm. D. (after 10+2)	6 years degree program, consisting of internship or residency training, during third year onwards	Currently in the 3 rd /4 th /5 th /6 th year or already completed	2027
M.B.B.S.	Degree holders of M.B.B.S. and those who are in the 5 th /6 th /7 th semester or higher semester of such programme.	5 th , 6 th , 7 th or higher semester or already completed	2025
M.Sc. / M.A. / MCA or equivalent	Master's degree in any branch of Arts/Science/Mathematics/Statistics/Computer Applications or equivalent	Currently in the first year or higher or already Completed	2025
Int. M.E./ M.Tech. (Post-B.Sc.)	Post-B.Sc. Integrated Master's degree programs in Engineering/Technology (4-year program)	Currently in the 1 st / 2 nd /3 rd /4 th year or already completed	Any Year
Int. M.E./ M.Tech. or Dual Degree (after Diploma or 10+2)	Integrated Master's degree program or Dual Degree program in Engineering/Technology (5-year program)	Currently in the 3 rd /4 th /5 th year or already completed	2026
B.Sc. / B.A. / B.Com.	Bachelor degree in any branch of Science / Arts / Commerce (3 years program)	Currently in the 3 rd year or already completed	2024
Int. M.Sc. / Int. B.S. / M.S.	Integrated M.Sc. or 5-year integrated B.S.-M.S. program	Currently in the 3 rd year or higher or already completed	2025
Professional Society Examinations (equivalent to B.E. / B.Tech. / B.Arch.)	B.E./B.Tech./B.Arch. equivalent examinations of Professional Societies, recognized by MoE/UPSC/AICTE (e.g. AMIE by Institution of Engineers-India, AMICE by the Institute of Civil Engineers-India and so on)	Completed Section A or equivalent of such professional courses	Enrolled upto 31 st May 2013
B.Sc (Agriculture, Horticulture, forestry)	4-year Program	Currently in the 3 rd /4 th year or already completed	2025

GATE Syllabus

GENERAL APTITUDE

Verbal Aptitude

Basic English Grammar: tenses, articles, adjectives, prepositions, conjunctions, verb-noun agreement, and other parts of speech.

Basic Vocabulary: words, idioms, and phrases in context, Reading and comprehension, Narrative sequencing.

Quantitative Aptitude

Data Interpretation: data graphs (bar graphs, pie charts, and other graphs representing data), 2-and 3-dimensional plots, maps, and tables.

Numerical Computation and Estimation: ratios, percentages, powers, exponents and logarithms, permutations and combinations, and series, Mensuration and geometry, Elementary statistics and probability.

Analytical Aptitude

Logic: Deduction and induction, Analogy, Numerical relations and reasoning.

Spatial Aptitude

Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping Paper folding, cutting, and patterns in 2 and 3 dimensions.

SECTION 1: ENGINEERING MATHEMATICS

Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors.

Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems.

Differential Equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.

Complex Variables: Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series.

Probability and Statistics: Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.

SECTION 2: APPLIED MECHANICS AND DESIGN

Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation.

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance, critical speeds of shafts.

Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

SECTION 3: FLUID MECHANICS AND THERMAL SCIENCES

Fluid Mechanics: Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

Applications: Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines; steam and gas turbines.

SECTION 4: MATERIALS, MANUFACTURING AND INDUSTRIAL ENGINEERING

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine (CMM).

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools, additive manufacturing.

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing.

Inventory Control: Deterministic models; safety stock inventory control systems.

Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

Chapter-Wise Analysis

GATE PAPERS (Mechanical Engineering)

Subject	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1. Engineering Mathematics											
1 mark Questions	5	5	6	5	5	5	4	6	5	4	5
2 marks Questions	5	7	3	4	4	5	4	4	3	4	4
Total Marks	15	19	12	13	13	15	12	14	11	12	13
2. Engineering Mechanics											
1 mark Questions	0	0	0	2	1	1	2	1	0	2	1
2 marks Questions	1	1	4	2	1	3	2	0	2	2	2
Total Marks	2	2	8	6	3	7	6	1	4	6	5
3. Strength of Materials											
1 mark Questions	4	2	4	2	4	3	5	1	4	3	3
2 marks Questions	1	3	4	4	3	4	5	3	2	1	2
Total Marks	6	8	12	10	10	11	15	7	8	5	7
4. Theory of Machines & Vibration											
1 mark Questions	2	4	2	2	2	3	3	4	3	2	2
2 marks Questions	3	3	4	3	3	4	4	3	3	2	4
Total Marks	8	10	10	8	8	11	11	10	9	6	10
5. Design of Machine Elements											
1 mark Questions	2	2	1	1	1	1	0	1	0	0	4
2 marks Questions	3	2	2	1	1	1	0	2	3	2	2
Total Marks	8	6	5	3	3	3	0	5	6	4	8
6. Fluid Mechanics											
1 mark Questions	2	2	3	3	4	3	3	2	2	1	2
2 marks Questions	2	2	2	4	3	4	2	3	2	2	4
Total Marks	6	6	7	11	10	11	7	8	6	5	10
7. Heat Transfer											
1 mark Questions	2	1	2	1	1	0	0	2	2	2	2
2 marks Questions	4	2	1	3	3	1	2	1	2	3	2
Total Marks	10	5	4	7	7	2	4	4	6	8	6

Subject	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
8. Thermodynamics, IC Engines, Refrigeration & Power Plant Engineering, Air-Conditioning											
1 mark Questions	2	3	2	3	2	2	3	3	4	2	4
2 marks Questions	4	5	5	3	4	3	4	5	4	7	3
Total Marks	10	13	12	9	10	8	11	13	12	16	10
9. Materials, Manufacturing & Industrial Engineering											
1 mark Questions	6	6	5	6	5	7	5	5	5	9	6
2 marks Questions	7	5	5	6	8	5	7	9	10	7	5
Total Marks	20	16	15	18	21	17	19	23	25	23	16
10. General Aptitude											
1 mark Questions	5	5	5	5	5	5	5	5	5	5	5
2 marks Questions	5	5	5	5	5	5	5	5	5	5	5
Total Marks	15	15	15	15	15	15	15	15	15	15	15