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GATE – 2027

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MECHANICAL ENGINEERING

Previous **GATE** Questions with Solutions,
Subjectwise and Chapterwise

Published at:

ACE Engineering Publications

#3rd Floor, Suryalok Complex, Rosary Convent School Road,
Gunfoundary, Basheer Bagh, Hyderabad – 500001,
Telangana, India.

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1st Edition : 2011

15th Edition : 2026

Printed at:

Karshak Art Printers,

Hyderabad.

MRP : ₹. 1000/-

ISBN : 978-1-64597-384-3

Foreword

Dear Students,

The style, quality and content of the Solutions for previous years GATE Questions of Mechanical Engineering, will encourage the reader, especially the student whether above average, average or below average to learn the concept and answer the questions in the subject without any tension. However, it is the reader who should confirm this and any comments and suggestions would be warmly received by the Academy.

The student should not miss to go through the solutions for conventional questions asked prior to 2003, as more concepts are brought out in them that will facilitate to answer the numerical answer type questions, Common data and Linked answer questions , if any, easily.

The student is advised to solve the problems without referring to the solutions. The student has to analyze the given question carefully, identify the concept on which the question is framed, recall the relevant equations, find out the desired answer, verify the answer with the final key such as (a), (b), (c), (d), then go through the hints to clarify his answer. This will help to face numerical answer type questions, better. The student is advised to have a standard text book ready for reference to strengthen the related concepts, if necessary. The student is advised not to write the solution steps in the space around the question. By doing so, he loses an opportunity of effective revision.

It is believed that this book is a Valuable aid to the students appearing for competitive exams like ESE, JTO, DRDO, ISRO and Other PSUs. This book can also be used by fresh lecturers in Engineering in improving their Concepts.

Mathematics & General Aptitude Previous Questions & Solutions of GATE of all branches are available in separate booklets.

With best wishes to all those who wish to go through the following pages.

Y.V. Gopala Krishna Murthy,
M Tech. MIE,
Chairman & Managing Director,
ACE Engineering Academy,
ACE Engineering Publications.
Frost Interactive Service Pvt. Ltd. (ACE ONLINE).

Syllabus for Mechanical Engineering (ME)

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.

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.

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 nontraditional 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.

Previous GATE Questions & Solutions (ME)
Weightage (2020 to 2026)

S. No	Name of the Subject	2020				2021				2022				2023		2024		2025		2026	
		SET 1		SET 2		SET 1		SET 2		SET 1		SET 2									
		1M	2M	1M	2M	1M	2M	1M	2M	1M	2M	1M	2M	1M	2M	1M	2M	1M	2M	1M	2M
01	Production	2	6	4	6	4	6	4	6	3	4	5	5	3	5	5	5	6	6	4	3
02	IM & OR	1	3	2	2	1	4	1	3	2	3	2	3	2	1	2	3	0	3	0	6
03	Fluid Mechanics & Turbo machinery	2	3	2	3	2	2	5	3	2	3	2	3	2	4	1	3	2	4	4	2
04	Heat Transfer	2	1	1	2	2	2	1	2	2	4	2	3	3	2	3	3	1	2	2	3
05	Thermodynamics	3	4	4	4	4	4	3	2	2	2	2	3	1	3	2	3	3	3	2	3
06	Strength of Materials	1	4	1	3	2	2	2	2	2	2	1	3	3	6	0	3	1	3	0	5
07	Machine Design	1	2	1	2	1	3	1	1	0	1	1	1	3	0	2	2	2	2	3	0
08	Theory of Machines	4	1	2	2	3	2	2	4	2	3	2	3	3	1	2	3	2	3	5	2
09	Engineering Mechanics	1	1	2	1	0	2	1	2	2	3	2	2	0	1	2	1	2	0	0	1
10	Material Science	2	0	1	1	1	0	1	0	3	1	1	0	0	3	1	0	1	0	0	1
11	Engineering Mathematics	6	5	5	4	5	3	4	5	5	4	5	4	5	4	5	4	5	4	5	4
12	General Aptitude	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Total No. of Questions		**30**	**35**	**30**	**35**	**30**	**35**	**30**	**35**	**30**	**35**	**30**	**35**	**30**	**35**	**30**	**35**	**30**	**35**	**30**	**35**

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