



GATE

SOLVED QUESTION PAPERS

Mechanical Engineering

Dr. Sadhu Singh

KHANNA PUBLISHERS

GATE

SOLVED QUESTION PAPERS

(Mechanical Engineering)

By

Dr. SADHU SINGH

Ex-Professor and Head of Mechanical Engineering Department

&

Ex-Dean, Faculty of Engineering and Technology

Govind Ballabh Pant University of Agriculture and Technology,

PANTNAGAR-263145 (Uttarakhand)

&

Ex-Director (Colleges)

Punjab Technical University,

Jalandhar (Punjab)

KHANNA PUBLISHERS

Operational Office

B-35/9, G.T. Karnal Road, Industrial Area,

(Near Telephone Exchange), Delhi-11003

Phone : 011-27224179, Mob. 09811541460

E-mail : contactus@khannapublishers.in

Published by :

Romesh Chander Khanna & Vineet Khanna
for **KHANNA PUBLISHERS**
2-B, Nath Market, Nai Sarak,
Delhi-110006 (India)

Visit us at : www.khannapublishers.in

Copyright: Author and Publisher Jointly

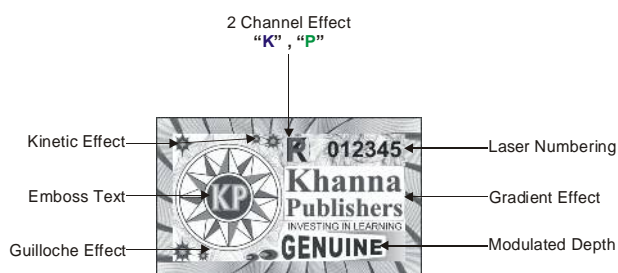
© 1979 and onward.

This book or part thereof cannot be translated or reproduced in any form without the written permission of both Authors and the Publisher. The right to translation, however, reserved with the Authors alone.

Hologram & Description

To all readers of our books, to prevent yourself from being frauded by pirated books. Please make sure that there is an Hologram on the cover of our books with the below specifications. If you find any book without the Hologram or Description, please mail us at **khannapublishers@yahoo.in**.

Thanking you



ISBN No. : 978-81-7409-090-9

***First Edition* : 2012**

Preface

Graduate Aptitude Test in Engineering (GATE) is conducted every year by one of the IIT's /IISc. The GATE score is valid for two years. This score is a necessary requirement for getting admission to M. Tech. programmes in educational institutions/jobs in R and D laboratories, industries, etc. from India and abroad.

An attempt has been made by the author to present as correct answers as possible to the Question Papers of previous years. Only the Multi-choice Questions have been solved as per the trend of the Question Papers being set now. The candidates are advised to consult some good book on General Aptitude comprising of Verbal Ability and Numerical ability.

It is expected that the method of presenting the answers in the Explanatory Notes shall be liked by the candidates while preparing for GATE. Further suggestions for the improvement of presenting the answers shall be welcome by the author.

The author is extremely thankful to the publishers for bringing out this book in a short span of time. Special thanks are due to Mr. Vineet Khanna for his interest in checking the manuscript so precisely.

The work on this book was started when my wife Smt. Manjit Kaur was not keeping good health. She could not survive to see this book in hand. My everlasting gratitude to her for her unfailing support and patience.

2nd January, 2012

Dr. SADHU SINGH

Contents

<i>Chapter</i>	<i>Pages</i>
MULTI-CHOICE QUESTIONS	
Chapter 1. Engineering Mathematics	... 1–15
Chapter 2. Engineering Mechanics	... 16–53
Chapter 3. Strength of Materials	... 54–67
Chapter 4. Theory of Machines	... 68–80
Chapter 5. Design of Machine Elements	... 81–88
Chapter 6. Fluid Mechanics	... 89–99
Chapter 7. Heat Transfer	... 100–104
Chapter 8. Thermodynamics	... 105–113
Chapter 9. Power Plant Engineering	... 114–119
Chapter 10. Internal Combustion Engines	... 120–127
Chapter 11. Refrigeration and Air-conditioning	... 128–133
Chapter 12. Turbomachinery	... 134–146
Chapter 13. Engineering Materials	... 147–153
Chapter 14. Metal Casting	... 154–157
Chapter 15. Forming Processes	... 158–160
Chapter 16. Joining Processes	... 161–164
Chapter 17. Machining and Machine Tool Operations	... 165–170
Chapter 18. Metrology and Inspection	... 171–174
Chapter 19. Tool Engineering	... 175–178
Chapter 20. Manufacturing Analysis	... 179–182
Chapter 21. Work Study	... 183–187
Chapter 22. Production Planning and Control	... 188–192
Chapter 23. Inventory Control	... 193–195
Chapter 24. Operations Research	... 196–201
GATE SOLVED QUESTION PAPERS	
GATE-1992	... 203–208
GATE-1993	... 209–213
GATE-1994	... 214–219
GATE-1995	... 220–226
GATE-1996	... 227–235
GATE-1997	... 236–245
GATE-1998	... 246–255
GATE-1999	... 256–265

<i>Chapters</i>		<i>Pages</i>
GATE-2000	...	266–274
GATE-2001	...	275–285
GATE-2002	...	286–292
GATE-2003	...	293–315
GATE-2004	...	316–339
GATE-2005	...	340–362
GATE-2006	...	363–381
GATE-2007	...	382–405
GATE-2008	...	406–430
GATE-2009	...	431–449
GATE-2010	...	450–466
GATE-2011	...	467–479
Suggested Readings	...	480

Syllabus

GATE SYLLABUS (Mechanical Engineering)

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.

ENGINEERING MATHEMATICS

Linear Algebra : Matrix algebra, Systems of linear equations, Eigen values and eigenvectors.

Calculus : Functions of single variable, Limit, continuity and differentiability, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and minima, Gradient, Divergence and Curl, Vector identities. Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

Differential equations : First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

Complex variables : Analytic functions, Cauchy's integral theorem, Taylor and Laurent series.

Probability and Statistics : Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

Numerical Methods : Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

APPLIED MECHANICS AND DESIGN

Engineering Mechanics : Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

Strength of Materials : Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; thermal stresses.

Theory of Machines : Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

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

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, spur gears, rolling and sliding contact bearings, brakes and clutches.

FLUID MECHANICS AND THERMAL SCIENCES

Fluid Mechanics : Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc.

Heat-Transfer : Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

Thermodynamics : Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle, irreversibility and availability; behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion.

Applications : *Power Engineering* : Steam Tables, Rankine, Brayton cycles with regeneration and reheat, I.C. Engines: air-standard Otto, Diesel cycles. Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes. Turbomachinery: Pelton-wheel, Francis and Kaplan turbines — impulse and reaction principles, velocity diagrams.

MANUFACTURING AND INDUSTRIAL ENGINEERING

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

Metal Casting : Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations.

Forming : 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.

Joining : Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding.

Machining and Machine Tool Operations : Mechanics of machining, 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, principles of design of jigs and fixtures.

Metrology and Inspection : Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

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

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

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

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