

# GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Declared as Deemed to be University u/s 3 of UGC Act, 1956)

Visakhapatnam | Hyderabad | Bengaluru

Accredited by **NAAC** with **A++** Grade

Website: [www.gitam.edu](http://www.gitam.edu)

## GITAM SCHOOL OF TECHNOLOGY

Department of Mechanical Engineering

PhD in Engineering: Mechanical Engineering

PhD Entrance Test Syllabus - 2024-2025

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### PhD in Engineering: Mechanical Engineering

#### 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; 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 center; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; 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.

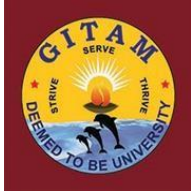
**Vibrations:** Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

**Machine Design:** Design for static and dynamic loading; failure theories; fatigue strength and the SN 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



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**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.

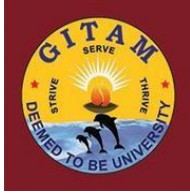
**Casting, Forming and Joining Processes:** Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, 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 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.



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**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.

### Reference Books:

1. Theory of Machines by SS Rattan, McGraw Hill Education; Fourth edition
2. Design of Machine Elements by VB Bhandari, McGraw Hill Education India Private Limited; Fourth edition.
3. Engineering Mechanics by SS Bhavikatti, New Age International Publishers
4. Strength of Materials by SS Rattan, McGraw Hill Education, Third edition
5. Fluid Mechanics by RK Bansal, Laxmi Publications; Tenth edition.
6. Heat & Mass Transfer by PK Nag, McGraw Hill Education, 3<sup>rd</sup> edition
7. Mechanical Vibration by GK Grover, Nem Chand & Bros.
8. Engineering Thermodynamics by Cengel & Boles, McGraw Hill Education; 8<sup>th</sup> edition.
9. Internal Combustion Engine by V Ganesan, McGraw Hill Education; 4<sup>th</sup> edition.
10. Refrigeration & Air Conditioning by CP Arora, McGraw Hill Education; 3<sup>rd</sup> edition
11. Material Science and Engineering by V Rahavan, Prentice Hall India Learning Private Limited; 6<sup>th</sup> Revised edition.
12. Manufacturing Technology by PN Rao, I & II Volumes, McGraw Hill Education; Fifth edition
13. Industrial Engineering by OP Khanna, Dhanpat Rai Publications (2018)
14. Operation Research by SD Sharma, Kedar Nath Publishers.
15. Computer integrated manufacturing by Mikell P. Groover, Pearson Publishers; 4<sup>th</sup> edition.
16. Production Planning and Control, M. Mahajan, Dhanpat Rai & Co.; 2018 edition