भारतीय प्रौद्योगिकी संस्थान तिरुपति
INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
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Syllabus for M.S.(R) & Ph.D. Written test/ Interview – January 2026 semester

Department of Mechanical Engineering – Advanced Manufacturing

Fundamentals from the UG/ PG coursework, Basic Engineering Mathematics and Project work relevant to Advanced Manufacturing.

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials. Introduction to crystallography: Crystal Structure – Atomic bonding, Unit cells and crystal systems, Metallic crystal structures, imperfections in solids; Principles of alloy formation: Solid solution, Hume-Rothery rules, Binary phase diagrams, Development of microstructure under equilibrium cooling and effects of non-equilibrium cooling, Iron-Iron Carbide Phase diagram; Elastic and Plastic deformation: Slip systems, Critical resolved shear stress, Frank-Read source, Work hardening and dynamic recovery, Strengthening Mechanisms, Recovery, Recrystallization and Grain growth, Cold and hot working; Heat Treatment: Types of heat treatment, isothermal transformation diagram and continuous cooling transformation diagram.

Casting, Forming and Joining Processes: Methods of manufacturing – metal casting, metal joining, and metal forming: basic principles, Classification, equipment, process variables, defects in manufactured components, and applications, Non-destructive examination of manufactured components.

Metal Cutting and Metrology: Machine Tools – Types, Parts, Working, Single and multi-point cutting tools, Machining time estimation, Tool Geometry - significance of various angles, Mechanics of chip formation, Merchant's analysis, Effect of tool geometry on cutting forces and surface finish, Tool life and tool wear, Tool materials, Thermal aspects in machining, Grinding and finishing processes, Cutting fluids, Advanced machining processes – mechanical, thermo-mechanical, thermo- electrical, chemical, thermo- chemical and hybrid processes, Basic terminology, Errors in Measurement, Uncertainty and Calibration, Limits, Fits, Tolerances and Gauging, Comparators, Surface Roughness Measurement, Geometric Form Measurement.

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