Manufacturing Qualifier PhD Qualifier Exam


Closed book exam: No Notes (Paper Or Digital Format) or Books Allowed

Duration: 3 hours

This syllabus serves more as a general outline of the topic areas covered on the exam and should not be treated as a definitive, complete, topic list.

Fundamentals of the Mechanical Behavior of Materials
Structures: polycrystalline and single crystal, etc.
Characterization of mechanical properties: strength, hardness, toughness etc.
Heat treatments: quenching, tempering etc.
Properties of ferrous and nonferrous metals and alloys

Surfaces, Subsurface, Dimensional Characteristics, Inspection and Quality Assurance
Surface and subsurface structure, integrity and properties,
Tribology
Surface texture, dimensional Metrology
Testing, inspection and quality assurance

Casting Processes
Solidification of Metals
Casting structures and characteristic properties
Fluid flow and heat transfer
Ingot casting, continuous casting, investment and die

Deformation Processes
Sheet metal processes, Forging, Rolling, Extrusion, Rod, Wire and tube drawing, swaging, peening, etc.

Material Removal Processes- Cutting
Turning, milling, drilling, broaching etc.
Mechanics of chip formation and material removal
Tool Materials, tool wear, machinability, surface finish and integrity
Vibration and chatter

Material Removal Processes-Abrasive
Grinding, lapping, polishing, honing, etc.
Abrasives, mechanics of grinding, finishes obtainable and SSD

Material Removal Processes-other/non traditional
Chemical, electrical and high energy-beams based processes
Removal mechanisms and applications

**Processing of Polymers and Reinforced Plastics**
General properties, characteristics, and applications of thermoplastics, thermosets and reinforced plastics (composites).
Suitable processing technologies

**Processing of Powder Metals and Ceramics**

**Joining and Fastening Processes**
Soldering, brazing, welding, riveting, etc.

**IC manufacture**
Key materials and their properties and fabrication
Structure of ICs
Basic fabrication steps (deposition, removal, patterning etc.)

**Manufacturing Automation and Integrated Manufacturing**
Numerical Control
Adaptive control
Group technology and cellular manufacturing
Flexible manufacturing systems

**Sample exam question(s):** to follow