

Manufacturing Processes I - Video course

Metal Forming

Elastic and plastic deformation. Concept of strain hardening. Hot and cold working processes -rolling, forging, extrusion, swaging, wire and tube drawing. Machines and equipment for the processes. Parameters and force calculations. Test methods for formability.

Sheet Metal Working

Applications of sheet formed products. Shearing mechanism. Processes like blanking, piercing, punching, trimming, etc. Forming processes like bending, cup drawing, coining, embossing, etc. Presses for sheet metal working; Part feeding systems; Elements of die; punch and die clearances; Progressive, compound and combination dies. High energy rate forming processes.

Powder Metallurgy

Introduction. Production of metal powders. Compaction and sintering processes. Secondary and finishing operations. Economics, advantages, and applications of powder metallurgy.

Metal Casting

Introduction: Brief History, Advantages and Limitations, Applications

Patterns: Pattern materials, allowances, types of pattern, color code scheme

Sand Casting: Green and dry sand casting process, types of sand, molding sand and its properties, molding sand composition.

Cores: Use, core material, types of cores, advantages and limitations, core prints, chaplets

Gating and Riser System: Element of gating systems, types of gates, Riser design considerations

Special Molding Processes: Carbon dioxide molding process, Investment casting process, Die casting process, shell molding process, Full molding process, Vacuum-Sealed casting process

Casting defects: Causes and remedies of defects such as blowholes, pinholes, blisters, hot tears, cold shut, metal penetration,

Melting Practices: cupola: charge calculations, construction; other furnaces: working of induction furnace, crucible furnace, and reverberate furnace

Welding

Introduction: Principle of welding, general applications such as construction of bridges, towers, automobiles & electronic circuits, etc.

Classification of welding processes -Classification based on application of filler material & without filler material, source of energy, fusion and pressure welding processes. Various joining processes such as



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welding, brazing and soldering.

Soldering and brazing: Difference between both the processes, consumables used, methods of brazing, fluxes used, their purpose and flux residue treatment. Arc welding power sources; Conventional welding transformers, rectifiers & current and voltage. The influence of these power sources on welding.

Manual metal arc (MMA) or shielded metal arc (SMA) welding: Equipment requirement, electrodes for welding of structural steels, coating constituents and their functions, types of coatings; ISI electrode classification for plain carbon steel (IS 815:1974 & IS 814:1991), current and voltage selection for electrodes.

Submerged arc welding (SAW): Process details, consumables such as fluxes and wires for welding mild steel, variations in submerged arc welding process like single wire, tandem wire, parallel wires, field of applications.

Gas metal arc welding (GMAW) or MIG/MAG welding: Process details, shielding gases, electrode wires, their sizes, and welding current ranges.

TIG welding: Process details, power sources requirements, electrode sizes and materials, current carrying capacities of different electrodes, shielding gases, application of process.

Resistance welding: General principle of heat generation in resistance welding, application of resistance welding processes. Process details and working principle of spot, seam, and projection welding, electrode materials, shapes of electrodes, electrode cooling, selection of welding currents, voltages, II manufacture of resistance seam welded (RSW) tubes by seam welding.

Lecture Details:

1. Elastic and plastic deformation. Concept of strain hardening. Hot and cold working
2. Processes: Forging, rolling, extrusion. Equipment for these processes. Parameters and force calculations.
3. Processes: Swaging, wire and tube drawing. Equipment for these processes. Parameters and force calculations.
4. Tests for formability of sheet metal. Applications of sheet formed products.
5. Sheet metal shearing mechanism. Processes – blanking, punching, piercing, trimming.
6. Processes -bending, cup drawing, coining, embossing.
7. Elements of presses for sheet metal working. Sheet metal part feeding systems.
8. Elements of a die: punch and die clearances, Progressive, compound, and combination dies.
9. Introduction to high-energy rate forming processes.
10. Introduction to powder metallurgy, and P/M processes methods of powder production. Blending of metal powders.
11. Compaction and sintering of metal powders
12. Secondary and finishing operations of P/M parts. Design considerations for P/M parts. Economics, advantages and limitations of P/M parts.
13. Introduction: Brief History, Advantages and Limitations, Applications
14. Patterns: Pattern materials, advantages and limitations.
15. Pattern allowances, types of pattern, color code scheme.
16. Sand Casting: Green and dry sand casting process
17. Types of sand and their properties, advantages and limitations.
18. Molding sand and its properties, molding sand composition.
19. Cores: Use, core material, types of cores, advantages and limitations, core prints, chaplets.
20. Gating System: Element of gating systems, types of gates.
21. Riser System: use, placement, riser design considerations.
22. Special Molding Processes: Carbon dioxide molding process, Investment casting process, advantages and limitations.

23. Die casting process, shell molding process, advantages and limitations.

24. Full molding process, Vacuum-Sealed casting process, advantages and limitations.

25. Casting defects: Causes and remedies of defects such as blowholes, pinholes, blisters, hot tears, cold shut, metal penetration.

26. Melting Practices: cupola: charge calculations, construction.

27. Other furnaces: working of induction furnace, crucible furnace, and reverberate furnace.

28 & 29 Introduction : Principle of welding, general applications such as construction of bridges, towers, automobiles & electronic circuits, etc.

30 & 31 Classification of welding processes -Classification based on application of filler material & without filler material, source of energy, fusion and pressure welding processes. Various joining processes such as welding, brazing and soldering.

32 & 33 Soldering and brazing: Difference between both the processes, consumables used, methods of brazing, fluxes used, their purpose and flux residue treatment.

34 & 35 Arc welding power sources; Conventional welding transformers, rectifiers & current and voltage. The influence of these power sources on welding.

36 & 37 Manual metal arc (MMA) or shielded metal arc (SMA) welding: Equipment requirement, electrodes for welding of structural steels, coating constituents and their functions, types of coatings; ISI electrode classification for plain carbon steel (IS 815:1974 & IS 814:1991), current and voltage selection for electrodes.

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42 & 43 TIG welding: Process details, power sources requirements, electrode sizes and materials, current carrying capacities of different electrodes, shielding gases, application of process.

44 & 45 Resistance welding: General principle of heat generation in resistance welding, application of resistance welding processes. Process details and working principle of spot, seam, and projection welding, electrode materials, shapes of electrodes, electrode cooling, selection of welding currents, voltages, manufacture of resistance seam welded (RSW) tubes by seam welding.