



# MANUFACTURING PROCESSES - CASTING AND JOINING

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**INTENDED AUDIENCE :** UG students; practicing engineers

**INDUSTRIES SUPPORT :** Machine Tool industries; Automobile manufacturing industries; Foundry industries.

### **COURSE OUTLINE :**

This course is intended to introduce the characteristic features of casting and welding processes. Process characteristics, analysis, and design criteria of various casting and welding processes will be discussed in detail with examples and video clips from industries. Typical numerical examples will be discussed to help the students understand the theory in a better way. The course is designed for undergraduate engineering students as a part of the core course on Manufacturing Technology as well as for practicing engineers.

### **ABOUT INSTRUCTOR :**

Prof. Sounak Kumar Choudhury have completed my Ph.D. in Mechanical Engineering from Moscow, Russia in 1985 followed by post-doctoral at the same university till 1986. From 1986 I am involved in teaching and research in the Mechanical Engineering Department of Indian Institute of Technology Kanpur. My areas of specialization are conventional and non-conventional machining, automatic control, hydraulic control, machine tools and manufacturing automation.

### **COURSE PLAN :**

**Week 1:** Casting: Introduction; Classification of casting processes; Advantages and drawbacks; Historical background; Foundry practice on video; Casting of BMW car wheels on video; Patterns; Shrinkage and Mechanical allowances; Moulds; Gating system; Properties of moulding sand; Gating design; Vertical gating: aspiration effect; Optimum riser design;

**Week 2:** Solidification of pure metal and alloy; Solidification time: Chvorinov's rule; Categories of metal casting processes; Steps in sand casting; Mould properties and characteristics; Shell moulding; Investment casting: Process characteristics, Process to show through video, Advantages and disadvantages; Multiple mould casting, Steps in permanent mould casting; Die casting: Hot and Cold Chamber die casting; Centrifugal casting; Continuous casting; Cost analysis of casting; Casting defects; Product design considerations in casting;

**Week 3:** Joining Processes: Preamble, classification of joining processes; Welding: advantages and limitations; Joints in welding; Fusion welding processes; Heat density; Comparison among welding processes; Features of a Fusion Welded Joint; Typical Fusion Welded Joints; Heat Affected Zone; Solidification of Weld; Solid-State (Phase) Welding: Forge welding, butt welding, friction welding, explosion welding, resistance welding;

**Week 4:** Ultrasonic welding: process characteristics and applications; Electron beam welding; Laser beam welding; Plasma arc welding; Arc welding: characteristics; Consumable and non-consumable electrodes; Power source; Shielded metal arc welding: Principles and applications; Gas metal arc welding; Gas Tungsten Arc Welding; Tungsten-Inert Gas Welding (TIG); Submerged Arc Welding; Gas Welding: Principles, types of flames; Brazing and Soldering: Process capabilities; Welding defects;