



THEORY OF PRODUCTION PROCESSES

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PRE-REQUISITES : Introduction to manufacturing technology or manufacturing processes

INDUSTRIES APPLICABLE TO : Manufacturing Industries where casting/forming/welding takes place, for example SAIL, BHEL, Foundry and Forge industries like HEC, Bharat Forge etc.

COURSE OUTLINE :

The course focuses on understanding the science behind technology of primary production processes namely casting, forming and welding. Conventionally, the courses on manufacturing processes deal with study of operational procedures. However, it is desirable to know how any process occurs and the products are finally manufactured, the basic principles behind these processes are required to be highlighted. The course will make the students aware with the theoretical aspects of the different manufacturing processes mentioned above. The course has been divided into three sections namely casting, forming and welding, each being covered in 4 weeks of time. The underlying principles of solidification, fluidity, gating, risering, melting etc. will be covered in casting section whereas mechanics of metalworking, analysis of different metal working processes will be covered in the second section i.e. forming. In the third section i.e. welding, principles of welding processes, thermal effects, weldability etc. will be covered. The course will enable the students be conversant with working principles so that they can use the knowledge gained towards increasing the productivity of manufacturing industries in the long run.

ABOUT INSTRUCTOR :

Prof. Pradeep K. Jha is presently working as Associate Professor in the Department of Mechanical & Industrial Engineering at IIT Roorkee. He has been teaching the courses related to manufacturing technology and theory of production processes to undergraduate and postgraduate students for more than 12 years. He is actively involved in research work related to production processes, tundish steelmaking process, mold solidification in continuous casting etc.

COURSE PLAN :

Week 1:Theory of casting and solidification, Fluidity of liquid metals.

Week 2:Technology of patternmaking and mouldmaking, Pattern allowances, Testing of molding sand, cores.

Week 3:Gating system design, Riser Design, different methods of calculating riser volume, Feeding distance calculations.

Week 4:Theory of melting and production of ferrous and non-ferrous materials, Casting design, Casting defects.

Week 5:Mechanical fundamentals of metalworking: Concept of stress and strain, stress and strain tensors, Hydrostatic and deviatoric stresses, Flow curve.

Week 6:Yield criteria for ductile materials, plastic stress strain relationships, classification of metalworking, mechanics of metalworking.

Week 7:Analysis and classification of rolling and forging processes, Force calculations in rolling and forging processes.

Week 8:Analysis and classification of Extrusion process, Analysis of wire, rod and tube drawing processes, Forming defects.

Week 9:Classification of welding processes, Thermal effects in welding, Basic metallurgy of fusion welds, Heat affected zone in welding.

Week 10: Principles of welding processes: Arc welding, Gas metal arc welding, Solid state welding, Resistance welding, Soldering, Brazing and adhesive bonding.

Week 11:Residual stresses in welding, Methods of measurement of residual stresses in welding, Welding distortion and its types, Methods of reducing residual stresses and distortion in welding.

Week 12:Weldability of materials: Introduction and assessment of weldability, Test for weldability, Weldability of ferrous and non-ferrous materials.