

**Fundamentals of Metal Forming:** Classification of forming process- Mechanics of metal working, Flow stress determination, Effect of temperature, strain rate and metallurgical structure on metal working, Friction and lubrication. Deformation zone geometry, Workability, Residual stresses.

**Forging:** Hot, Cold and Warm Forging – types of presses and hammers. Classification, Open die forging and closed die forging, die design, forging in plane strain, calculation of forging loads, use of software for analysis - forging defects – causes and remedies, residual stresses in forging.

**Rolling:** Classification of rolling processes, types of rolling mills, hot and cold rolling, rolling of bars and shapes, forces and geometrical relationship in rolling, analysis of rolling load, torque and power, rolling mill control, rolling defects- causes and remedies.

**Extrusion:** Direct and indirect extrusion, variables affecting extrusion, deformation pattern, equipments, port – hole extrusion die, hydrostatic extrusion, defects and remedies, simple analysis of extrusion, tube extrusion and production of seamless pipe and tube.

**Drawing:** Drawing of rod, wires and tubes.

**Sheet Metal Forming and Other Processes:** Forming methods – Shearing, Fine and Adiabatic blanking, bending, stretch forming, deep drawing, defects in formed part, sheet metal formability, forming limit diagram. High velocity forming, Comparison with conventional forming, Explosive forming, Electro hydraulic, Electro Magnetic forming.

**Books and References:**

1. Dieter.G.E., “Mechanical Metallurgy”, McGraw – Hill Co., SI Edition, 1995.
2. Surender Kumar, “Technology of Metal Forming Processes”, PHI, New Delhi, 2008
3. Mechanical Working of Metals: Theory and Practice / Pergamon / John Noel Harris 1983
4. DeGarmo's Materials and Processes in Manufacturing/ J. T. Black (Author), Ronald A. Kohser/ Wiley 2011