

# GUJARAT TECHNOLOGICAL UNIVERSITY

## B.E. SEMESTER : VIII

### METALLURGICAL ENGINEERING

Subject Name: **METAL WORKING PROCESSES**

Sr. No.	Course Contents	Total Hrs
1.	Quick review of metal working, Temperature in Metal Working, Hot working Nitrogen, Phosphorous, Sulphur, Workability, Residual stresses, Annealing of cold-worked metals working. Workability, Recovery, recrystallization and grain growth.	8
2.	Fundamentals of metal working: Classification of metal forming processes, Mechanics of metal working, Flow curve for materials, Cold working & Warm working, Strain rate effect of metallurgical structure and non-metallic inclusion on the manufacturing process, Effect of compositional changes i.e. Carbon, Forging: Classification of forging processes, Forging equipment and operations, Open die forging, Closed die forging, Plane strain forging analysis, Forging defects, Metallurgical variables associated with forging, Powder metallurgy forging, Residual stresses in forging.	10
3.	Rolling: Terminology of rolled products, Different kinds of rolling mills, Deformation zone in rolling, Neutral point, Angle of bite, Forward slip, Roll flattening, Rolling variables, Hot rolling, Cold rolling, Rolling of blooms billets rolling of above products, Elementary roll pass design, Forces and geometrical relationships in rolling, Defects in rolled products.	10
4.	Extrusion: Classification of extrusion processes, slabs, plates, strips, sheets, bars, rods & light section, Lay out of different mills for Direct and indirect extrusion, Impact extrusion, Hydrostatic extrusion, Extrusion equipment, Extrusion ratio, Process variables, Lubrication & defects in extrusion, Derivation of extrusion pressure, Extrusion of tubing, Production of seamless pipe and tubing,	8
5.	Drawing of rods, wires and tubes: Theory and practice of wire drawing, Wire drawing equipment, Variables in wire drawing, Defects in formed products.	4
6.	Sheet metal working: Shearing, Blanking, Bending, Stretch forming, Deep drawing, Spinning, Piercing, Swaging, Embossing, Coining, High energy rate forming, formability diagrams, Super plasticity, Advances using Artificial Intelligence based techniques.	8
7.	High energy rate forming: Electric discharge forming, Explosive forming, Pneumatic mechanical press.	6
8.	Instrumentation & Process controls, Temperature measurements: Review of temperature measurement using expansion thermometers, thermocouples, resistance temperature detectors, thermistors and optical pyrometers.	6

#### TEXT BOOKS:

1. Mechanical Metallurgy by G. E. Dieter, McGraw-Hill.
2. Introduction to Industrial Mechanical Working Process by G. W. Rowe
3. Materials & Processes In Manufacturing By E. Paul De Garmo, J T Black & Ronald A Koshav
4. Modern Control Engineering by Ogata, PHI  
Publ. Prentice-Hall of India Pvt. Ltd.
5. Manufacturing Technology (Foundry, Forming and Welding) by P. N. Rao, TMH.

#### REFERENCE:

1. ASM Hand Book Vol. 3
2. Mechanical Working of Metals - Theory and Practice by J N Harris, Pergamon Press  
Technology of Metal Forming Process . by Surendra Kumar PHI-2008