

## **MECHANICAL WORKING OF MATERIALS**

### **Module I (14 Hours)**

Classification of forming processes. Fundamentals of metal working – Flow curve for materials, Effect of temperature, strain rate, metallurgical structure, workability and residual stress. Yielding theories, processing maps. Friction in metal working, Lubrication. Rolling - Classification & processes, load, torque, power, variables controlling process, forward slip. Fundamentals of roll pass design, mill type. Rolling practice, adopted for some common products such as slabs, blooms, billets, plates, sheets etc Rolling defects and their control. Forging - Classification & processes, load for circular & rectangular plate. Calculation of Forging load under sticking and slipping Plain strain forging analysis. Manufacture of rail wheels and tyres.

### **Module II (12 Hours)**

Extrusion - Classification & processes, force & variables affecting it. Deformation and defects in extrusion Calculation of extrusion pressure under plain strain conditions, production of tubes and seamless pipes Drawing of Wires and Tubes- Processes, drawing stress. Calculation of drawing loads, drawing defects. Sheet metal Forming- Forming methods, Forming limit criterion, Special Forming techniques in formed products: deep drawing and redrawing. Formability diagrams, Defects in formed products.

### **Module III (12 Hours)**

Special forming methods such as high energy forming: explosive forming, electro hydraulic and magnetic forming processes Non Destructive Testing: Scope and significance of non destructive testing. Principles, equipment, specifications and limitations of liquid penetrant, Magnetic particle, Eddy current, Ultrasonic and Acoustic emissions, and Radiography (X-Ray and Gamma Ray).

### **Books for reference:**

1. G. E. Dieter, Mechanical Metallurgy, McGraw-Hill.
2. Roll Pass Design, The United Steel Companies Ltd., U.K.
3. C. Suryanarayana, Testing of Metallic materials.
4. C. Russak, G. W. Rowe, Principles of Industrial Metal Working Processes.
5. Baldev Raj, Practical Non Destructive Testing.