5th Semester

PMT5I101 MECHANICAL WORKING AND TESTING OF MATERIALS

Module I (14 Hours)

Classification of forming processes.

Fundamentals of metal working – Effect of temperature, strain rate, metallurgical structure, friction & lubrication, workability and residual stress.

Rolling - Classification & processes, load, torque, power, variables controlling process, forward slip. Fundamentals of roll pass design, mill type. Rolling defects and their control. Forging - Classification & processes, load for circular & rectangular plate.

Extrusion - Classification & processes, force & variables affecting it.

Module II (12 Hours)

Drawing of Wires and Tubes- Processes, drawing stress.

Sheet Metal Forming- Forming methods, Forming limit criterion, Special Forming techniques and defects in formed products

National and International Standards for Mechanical tests

Hardness Tests- Brinell, Rockwell, Vickers, Meyer, Knoop, etc., relationship with flow curve. Compression Test- Comparison with tension, phenomenon of buckling & barreling.

Torsion Test- Stresses for elastic & plastic strain, Torsion vs. Tension.

Bend Test- Pure bending & flexure formula.

Impact Test- Notched bar impact tests, transition temperature & metallurgical factors affecting it.

Module III (14 Hours)

Fracture- Energy based criterion, Strain energy release rate, stress intensity factor, fracture toughness estimation and design of engineering component.

Fatigue – Stress cycles & S-N curve, effect of mean stress, stress concentration, surface, size, metallurgical factors etc. on endurance limit, Cyclic stress-strain curve, Low cycle fatigue, High cycle Fatigue, Paris law.

Creep- Creep & Stress rupture tests, Mechanism of creep deformation, Deformation mechanism Maps, Development of creep resistant alloys, Prediction of long time properties, Creep-Fatigue interaction.

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