Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech. (Manufacturing)	Mechanics of Sheet Metal Forming	MEM 523	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
II	3	3-0-0	3 Hours

Unit - I

Material Properties and Sheet Deformation Processes: Tensile test; Effect of properties on forming; Other mechanical tests; Uniaxial tension; General sheet processes (plane stress); Yielding in plane stress; The flow rule; Work of plastic deformation; Work hardening hypothesis; Effective stress and strain functions; Uniform sheet deformation processes; Strain distributions; Strain diagram; Modes of deformation; Effective stress–strain laws; The stress diagram; Principal tensions or tractions; Exercises. **(08 Hours)**

Unit - II

Simplified Stamping Analysis, Load Instability and Tearing: Introduction; Two-dimensional model of stamping; Stretch and draw ratios in a stamping; Three-dimensional stamping model; Exercises.

Uniaxial tension of a perfect strip; Tension of an imperfect strip; Tensile instability in stretching continuous sheet; Factors affecting the forming limit curve; The forming window; Exercises. **(09 Hours)**

Unit - III

Bending of Sheet: Introduction; Variables in bending a continuous sheet; Equilibrium conditions; Choice of material model; Bending without tension; Elastic unloading and springback; Small radius bends; The bending line; Bending a sheet in a vee-die; Exercises. **(07 Hours)**

Unit - IV

Simplified Analysis of Circular Shells and Cylindrical Deep Drawing: Introduction; The shell element; Equilibrium equations; Approximate models of forming axisymmetric shells; Applications of the simple theory; Exercises.

Drawing the flange; Cup height; Redrawing cylindrical cups; Wall ironing of deep-drawn cups; Exercise. **(07 Hours)**

Unit - V

Stretching Circular Shells and Combined Bending and Tension of Sheets: Bulging with fluid pressure; Stretching over a hemispherical punch; Effect of punch shape and friction; Exercises.

Stretching and bending an elastic, perfectly plastic sheet; Bending and stretching a strain-hardening sheet; Bending a rigid, perfectly plastic sheet under tension; Bending and unbending under tension; Draw-beads; Exercises.

(08 Hours)

Unit - VI

Hydroforming: Introduction; Free expansion of a cylinder by internal pressure; Forming a cylinder to a square section; Constant thickness forming; Low-pressure or sequential hydroforming; Exercises. **(06 Hours)**

Recommended Books:

1. Mechanics of Sheet Metal Forming; Z. Marciniak; J. L. Duncan and S. J. Hu. Butterworth-Heinemann.
2. Metal Forming Analysis; R. H. Wagoner, J.-L. Chenot; Cambridge University Press.
3. Sheet Metal Forming: Processes and Applications; Taylan Altan, A. Erman Tekkaya; ASM International.
4. Sheet Metal Forming Processes: Constitutive Modelling and Numerical Simulation, Dorel Banabic; Springer Science & Business Media.