

Branch Name:	Mechanical Engineering
Semester/Year:	Semester VI / Third Year
Subject Title:	Metal Forming Processes
Subject Code:	1ET1010608
Pre-requisite:	Manufacturing Processes I and II, Material Science and Metallurgy

Course Objectives:

This course will help student to

1. Emphasize the importance manufacturing sciences and to study the basic manufacturing processes and tools used.
2. Acquaint with the basic knowledge on fundamental metal forming processes.
3. Teach metal forming theory and technology, limits of the processes, tool design and machinery selection.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	01	00	04	70	30	-	20	120

Subject Contents				
Sr. No	Topic	Total Hours	Weightage (%)	
01	Fundamentals: Advantages of metal forming as a manufacturing process, Classifications of metal forming processes, Forming equipments, Presses (mechanical, hydraulic). Theoretical analysis: Theory of plasticity, Stress-strain relationship, Strain hardening, Material incompressibility, Work of plastic deformation, Work hardening, Flow rule. Metallurgical aspects of metal forming slip and twinning mechanics of plastic deformation, effects of temperature, strain rate-microstructure and friction in metal forming, yield criteria and their significance.	10	25	
02	Forging and Rolling Processes: Principle classification equipment, tooling processes, parameters and calculation of forces during forging and rolling processes, Post forming heat treatment, Defects (cause and remedy) applications.	10	25	
03	Extrusion and Drawing Processes: Classification of extrusion processes, tool, equipment and principle of these processes, influence of friction, Extrusion force calculation, Defects and applications. Rod/wire drawing-tool, equipment and principle of processes defects, Tube drawing and sinking processes Mannesmann processes of seamless pipe manufacturing.	10	25	

04	Advanced Metal Forming Processes: Details of high energy rate forming (HERF) process, Presses types and selection of presses, formability of sheet metals, principle, process parameters, equipment and application of Spinning, Stretch forming, Electro-magnetic forming, Explosive forming Electro-hydraulic forming, Magnetic pulse forming, Stretch forming, Contour roll forming, Super plastic forming.	10	25
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Course Outcomes:

The student will be able to

1. Approach metal forming processes both analytically and numerically.
2. Design metal forming processes.
3. Solve for strain rates, temperatures and metallurgical states in forming problems.
4. Estimate formability limits for sheets and bulk metals.

List of Reference Books:

1. Lindberg, Roy A. "Processes and materials of manufacture." Prentice-Hall of India Pvt. Limited, 1990 (ISBN: 8120306635, 9788120306639).
2. Narayanasamy, R., "Metal forming technology". Ahuja Pub, 2nd Edition, 2000.
3. Kumar, Surender. "Technology of metal forming processes". PHI Learning Pvt. Ltd., 2008.
4. Hosford, William F., and Robert M. Caddell. "Metal forming: mechanics and metallurgy", Cambridge University Press, 2011.
5. Valberg, Henry S. "Applied metal forming: including FEM analysis". Cambridge University Press, 2010.
6. Dieter, George Ellwood, and David J. Bacon. Mechanical metallurgy. Vol. 3. New York: McGraw-hill, 1986.
7. Wagoner, Robert H., and J-L. Chenot. "Metal forming analysis". Cambridge University Press, 2001.
8. Handbook, A. S. M. "Forming and Forging. v. 14." ASM International: EUA (2005).

List of Tutorial:

Students are required to carry various tutorials based on the above subject contents. Some sample tutorials are listed below. It is desirable to demonstrate the various forming processes in-house or through industrial visits.

1. Exercise on sheet metal process.
2. Study of rolling process.
3. Study of forging process.
4. Study of wire drawing process.
5. Study of Extrusion Process
6. Study of various high energy rate forming (HERF) processes.

E-Resources:

1. <http://nptel.ac.in/courses/112106153/>
2. <http://nptel.ac.in/courses/112107144/>
3. <http://nptel.ac.in/courses/112107145/1> (Video Lectures)
4. <http://nptel.ac.in/downloads/112106153/> (Quiz/Assignments)