

ADVANCED METAL FORMING

CourseCode		Year		Semester	
Course Category	HONORS	Branch	ME	Course Type	Theory
Credits	3	L – T – P	3 – 0 – 0	Prerequisites	Nil
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

	Statement	Skill	BTL	Units
CO1	Illustrates fundamental concepts and their applications of different forming techniques.	Understand Communication	L2	1,2,3,4,5
CO2	Solve for strain rates, temperatures and metallurgical states in forming problems using constitutive relations.	Apply, Communication	L3	1,2
CO3	Estimate formability limits for sheets and bulk metals, deformation process parameters for different engineering components.	Apply, Communication	L3	3,4
CO4	Illustrates the Electromagnetic forming processes and its applications.	Apply, Communication	L3	5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3										3	3
CO2	3	3	3	2	2	2	2						3	3
CO3	3	3	3	2	2	2	2						3	3
CO4	3	3	3										3	3

Syllabus

UNIT	Contents	Mapped COs
I	Introduction: Introduction of metal forming as a manufacturing process and its relation with other processes, Metal Forming from systems point of view, Advantages of metal forming as a manufacturing process, Classifications of metal forming processes, Forming equipment, Presses (mechanical, hydraulic).	CO1
II	Theoretical analysis: Theory of plasticity, Stress-strain relationship, Strain hardening, Material incompressibility, Work of plastic deformation, Work hardening, Yield criteria, Flow rule, and flow rule for Anisotropic material, Initiation, and extent of plastic flow Upper Bound - Slip-Line-Slab Analysis - Problems.	CO1, CO2
III	Bulk Forming Processes: Forging- open-die forging, closed-die forging, coining, nosing, upsetting, heading, extrusion and tooling, rod, wire and tube drawing, Rolling- flat rolling, shape rolling and tooling, spinning, hydroforming, rubber-pad forming, explosive forming, simple problems.	CO 1, CO 3
IV	Sheet Forming Processes: Blanking, piercing, press bending, deep drawing,	CO1,

	stretch forming, formability tests, forming limit diagrams, process simulation for deep drawing and numerical approaches, Case studies. Problems & Case Studies: Case studies on the manufacturing aspects of products using the lessons learned.	CO 3
V	ELECTROMAGNETIC FORMING AND ITS APPLICATIONS : Electromagnetic Forming Process – Electro – Magnetic Forming Machines – Process Variables – Coils and Dies – Effect of Resistivity and Geometry – EM tube and sheet forming, stamping, shearing and welding – Applications – Finite Element Analysis of EM forming.	CO1, CO 4

Learning Resources

Text books
<p>1.R. Narayanasamy, R Ponalagusamy, “Theory of Engineering Plasticity”, Ahuja Book Company, 2000.</p> <p>2.Henry S. Valberg, “Applied Metal Forming - Including FEM Analysis”, Cambridge University Press, 2010.</p> <p>3.G.K. Lal, P.M. Dixit and N.Venkat Reddy, “Modeling Techniques for Metal Forming Processes“, Alpha Science, 2011</p>
Reference books
<p>1.Altan T., Metal forming – Fundamentals and applications – American Society of Metals, Metals park, 2003.</p> <p>2.ASM Hand book, Forming and Forging, Ninth edition, Vol – 14, 2003</p>
E- Resources & other digital material
<p>1. https://nptel.ac.in/courses/112107250</p>