GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3722801
Semester – II
Subject Name: Mechanics of Metal Forming

Type of course: Elective IV

Prerequisite: Nil

Rationale:

This course provides the knowledge and practice regarding basics of Metal Forming. We are learning from the metal forming theory and their relationship with material Principles. Students were strengthening their knowledge from the Rolling, Forging, Bending of Sheet, Extrusion like Processes and their analysis.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
03	0	02	04	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Basics of metal forming - Mohr's circle - isotropic elasticity - yield theories -plastic stress-strain relationship - plastic work - the principle of normality - incremental plastic strain	10
2	Constitutive relationships - mechanical properties - work hardening -compression test, bulge test, plane strain compression test - plastic instability in tension tests.	08
3	Strain rate - super plasticity - slab analysis for sheet drawing - Extrusion and forging - upper bound solution for Extrusion - Indentation and plane strain forging, lower bound soluben	10
4	Slip line field theory and its solution - Formability and its testing.	07
5	Sheet Metal forming - Bending theory, Cold Rolling theory - Hill's anisotropic plasticity theory - Hill's general yield theory, CAD/CAM applications in Extrusion, Forging and sheet metal Forming – Localized necking in biaxial stretching	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**25**	**25**	**20**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Hosford W.F and Caddell, R.M,, "Metal Forming Mechanics and Metallurgy", Prentice Hall, 1983.
2. Narayanasamy R., "Theory of Plasticity", Ahuja Publications, 2000.
3. Scrope Kalpakjian,, "Manufacturing processes for Engineering Materials", Addision Wesley, 1997.
4. Metal forming: Processes and Analysis – B. Avitzer-Tata-MGH
5. Mechanical Metallurgy – Dieter-MGH

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the basics of Metal Forming and their relationship with material Principles.	30
CO-2	Students were strengthening their knowledge from the Rolling, Forging, Bending of Sheet, Extrusion like Processes and their analysis.	40
CO-3	Students were strengthen their knowledge on slip line theory and its application	30

Term Work:
The term work shall be based on the topics mentioned above.

List of Experiments:

1. Basics of metal forming
2. To draw and analyze 2- dimensional Mohr's circle
3. To draw and analyze 3- dimensional Mohr's circle
4. To learn about the concept of constitutive relationship
5. To derive the relationship between two factors in slip line field theory
6. To review different manufacturing processes and analyze upper bound- lower bound theorems with calculations involved in it
7. Discussion on strain rate & its effects and calculations of slab analysis for sheet drawing.
8. To review different sheet metal forming processes and calculations involved in the Hill's theories
9. To study CAD/CAM applications in Extrusion, Forging and Sheet metal Forming

Major Equipment:

1. ANSYS Software
2. Rolling and Forging Industrial Software

List of Open Source Software/learning website:

1. http://www.sciencedirect.com/science/book/9780750653008
2. http://nptel.ac.in