GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Subject Code: ME02000861

Subject Name: Mechanics of Metal Forming

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Nil
Rationale:	This course provides the knowledge and practice regarding basics of Metal Forming. Students 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.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
1	Understand the basics of Metal Forming and their relationship with material Principles.
2	Analyse formability and various testing.
3	Analyse slip line theory and its applications.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	30	20	150

Course Content:

Content	Hours
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
Constitutive relationships - mechanical properties - work hardening -compression	8

test, bulge test, plane strain compression test - plastic instability in tension tests.	
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
Slip line field theory and its solution - Formability and its testing.	7
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
TOTAL	**45**

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**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

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

(b) Open-source software and website:

Suggested Course Practical List:

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

As per the course content and course outcome.

List of Laboratory/Learning Resources Required:

1. ANSYS Software,

2. Rolling and Forging Industrial Software Suggested Activities for Students:

Any activity based on above syllabus content

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