GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (PRODUCTION ENGINEERING) (28)

MECHANICS OF METAL FORMING

SUBJECT CODE: 2722801

SEMESTER: II

Type of course: CORE 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
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
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	**08**	**22**
2	Constitutive relationships - mechanical properties - work hardening - compression test, bulge test, plane strain compression test - plastic instability in tension tests.	**08**	**22**
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	**07**	**20**
4	Slip line field theory and its solution - Formability and its testing.	**05**	**14**
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	**08**	**22**

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 Outcome:

After learning the course the students should be able to:

1. Understand the basics of Metal Forming and their relationship with material Principles.
2. Students were strengthening their knowledge from the Rolling, Forging, Bending of Sheet, Extrusion like Processes and their analysis.

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

Open Ended Problems:

Major Equipments:

1. ANSYS Software
2. Rolling and Forging Industrial Software

List of Open Source Software/learning website: Metal Forming & Extrusion Industrial Visit

1. http://www.sciencedirect.com/science/book/9780750653008
2. http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/MANUFACTURING-PROCESSES/
3. http://nptel.ac.in/courses/112106153/
4. http://web.mit.edu/2.810/www/lecture09/7.pdf

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.