GUJARAT TECHNOLOGICAL UNIVERSITY

METALLURGY ENGINEERING (21)
ALLOY DESIGN
SUBJECT CODE: 2182115
B.E. 8th SEMESTER

Type of course: Engineering

Prerequisite: Students must be aware about the basic concept of Elements of Metallurgy, Physical Metallurgy, and advance materials.

Rationale: Alloy design have an important role in engineering materials applications. Metallurgy engineers design new materials, select the best material for a particular job, monitor its performance and figure out why a material failed and bring expertise on the properties of materials. To do this, Metallurgy engineers need to understand that how Alloys are made for intended applications. The Alloy Design course is to prepare students for careers in metallurgy engineering where they can apply knowledge of designing the alloy and fundamentals related to it.

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)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Concept and of alloy design, Steps in alloy design, Significance of alloy design.	**6**	10
2	Single phase, dual phase and multiphase materials, Effect of size, shape and distribution of second phase on mechanical properties of alloys.	**10**	18
3	Precipitation and particle coarsening, recrystallization and grain growth. Solid/Liquid phase transformation in pure metals, single phase alloys, constitutional super cooling and eutectic alloys.	**10**	20
4	Standards in alloy steels – Study of a few selected standards. Alloy steel design for better tensile strength, ductility, toughness, fatigue strength, creep strength, wear resistance and elevated temperature strength.	**18**	25
5	Alloy design of lightweight, high strength, corrosion resistance Non Ferrous alloys.	**10**	17
6	Application of computer-based methods for alloy designing.	**6**	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**20**	**20**	**15**	**20**

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. ASM Handbook, Vol.1 & 2, Properties and Selection: Metals Park, Ohio.
2. Boyer, H.E.(ed.), Selection of Materials for component Design: Source Book, American Society for Metals, Metals Park, Ohio
3. Ashby, M.F. Materials Selection in Mechanical Design, New York: Pergamon, 1992.
4. Ranganathan S., Arunachalam V.S. and Cahn R.W. (Eds.), Alloy Design, Indian Academy of Science, Bangalore,1981.
5. Tien John K. and Ansell George S. (Eds.), Alloy and Micro structural Design, Academic Press.
6. Structure & Properties of Alloys – Robert M. Brick, Robet B. Gordon & Arthur Phillips, Eurasia Publishing House (private) Ltd., New Delhi
7. Metals Hand Book Ninth Edition – Vol 1

Course Outcome:

After learning the course the students should be able to:

1. To provide knowledge about the basic concept of alloys and its properties
2. To impart the importance of overall design in metallurgy.
3. To help them understand all newer types of alloys and its applications
4. To make them understand strengthening mechanisms used in alloying.
5. To study alloy design for particular mechanical properties & its overall importance
6. How newer materials can be developed and which can be useful in new technologies and development
7. Application of computer based alloy designing

Design based Problems (DP)/Open Ended Problem:

Tutorial and problem related to syllabus

List of Open Source Software/ learning website:

www.nptel.in

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should be submitted to GTU.