GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3142108
Semester – IV
Subject Name: Mechanical properties of Materials

Type of course: Engineering/science

Prerequisite: Basic fundamentals of structural Metallurgy

Rationale: This course is to prepare students for careers in engineering where Principles of Mechanical Metallurgy of metals can be applied to the Industries dealing with Metal forming operations. This course focuses on the origins of stresses and strains in Materials and the resulting deformation/fracture response.

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)	
2	0	4	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Module 1-** Strength of materials - Mohr's circle representation, Stress strain Diagram of Ductile and brittle material ,elements of elasticity and plasticity, yield criteria.	**04**
2	**Module 2-** Deformation of ideal crystal, crystal defects, slip phenomenon, slip system, slip by dislocation , dislocation theory, dislocations in FCC, BCC, and HCP structures, stress fields and energies of dislocations, forces on and between dislocations, reactions and interaction of dislocations, dislocation-precipitate Interactions, Twinning as mode of deformation, Stacking faults, movement of Dislocations by Kink and Jog	**09**
3	**Module 3-** Plastic deformation of single crystals and polycrystals. Strain hardening, cold work, recovery and recrystallization, strengthening mechanism of metals	**08**
4	**Module 4-** Effect of grain boundaries, yield point phenomenon, strain ageing, dynamic strain Ageing. Tensile flow properties, effects of strain rate and temperature, ductile/brittle transition.	**07**
5	**Module 5** (laboratory): Measurement of mechanical properties of metals and alloys like hardness, tensile, creep, impact, compression, fatigue, cupping etc.	

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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	**30%**	**35%**	**10%**	**5%**	**0%**

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. Mechanical Metallurgy by George E Dieter, McGraw-Hill Education; 3 edition June,1986
2 Physical Metallurgy Principles-Robert E. Reed Hill, Publisher: Cengage Learning
3 Mechanical Behaviour and testing of Materials by A.K.Bhargava & C.P.Sharma, Publisher: PHI
4 Dislocations and Mechanical Behaviour of Metals by M.N.Shetty, Publisher: PHI
5 Deformation and Fracture Mechanics of Engineering Materials by R. W. Hertzberb, Publisher: John Wiley & Sons

Course Outcomes
After completing this course, students will able to,

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the strengthening mechanism of metals/alloys	25
CO-2	Distinguish between elastic and plastic deformation of metals	25
C03	Identify the failure mechanism of material under different types of loading	25
C04	Measure different properties of metals and alloys for engineering applications.	25

List of Practical:

1. Brinell Hardness test
2. Rockwell Hardness test
3. Micro Hardness test
4. Tensile test
5. Creep test
6. Izod Impact test
7. Charpy Impact test
8. Fatigue test
9. Cupping test
10. Industrial/Lab visit

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List of Open Source Software/learning website:

I. http://nptel.iitm.ac.in/
II. www.ocw.mit.edu