Course-Plan

School : School of Engineering
Department : Mechanical Engineering Dept.
Course Code : ME 575
Course Name : Advanced Material for Design

Instructor: Dr. Sanjib Banerjee

1. Abstract:

The course offers the detailed knowledge on Advanced Materials which are used in modern / advanced Design applications.

2. Objectives:

a. To give detailed knowledge in advanced engineering materials for Design purposes.
b. To increase interest on advanced Materials and advanced Design / Manufacturing technology.
c. To understand the criteria for selection of materials during advanced Design and Manufacturing for specialized applications.

3. Prerequisites of the course:

Basic knowledge on Material Science is preferable.

4. Course outline:

- Advanced materials for modern Engineering Design: Metals, Polymers, Composites and Ceramics; Proper material selection for design considerations **(5 lectures)**
- Structure-property correlation for design purposes: Role of crystal structure, substructure and microstructure on material properties and machine design **(5 lectures)**
- Metallic alloys for high performance structural design and their applications, Surface engineering of materials and their applications **(5 lectures)**
- Applications of Piezoelectric materials, Shape memory alloys, Smart materials and Composite materials in design of modern engineering components **(10 lectures)**
- Micro-electro-mechanical systems (MEMS) for design: Characteristics of materials for MEMS applications and MEMS components **(2 lectures)**
- Designing components for high temperature applications: Various alloys and composites, Diffusion bond coating **(5 lectures)**
- Application of Powder metallurgy technique in design: Selection of materials, Cost, Design and Manufacturing considerations involved **(3 lectures)**

- Advanced materials for design of Automobile and Transport vehicles, Aerospace, Power generation, Armament, Marine environment and Ocean structures, Materials for other specialized applications **(3 lectures)**
- Advanced material testing for machine design considerations **(2 lectures)**
- Assignment and mini-project.

5. (a) Time-Plan

Topic	Content	Contact Hours	
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	Advanced materials for modern Engineering Design: Metals, Polymers, Composites and Ceramics; Proper material selection for design considerations	5	
	Structure-property correlation for design purposes: Role of crystal structure, substructure and microstructure on material properties and machine design	5	
	Metallic alloys for high performance structural design and their applications, Surface engineering of materials and their applications	5	
	Applications of Piezoelectric materials, Shape memory alloys, Smart materials and Composite materials in design of modern engineering components	10	
	Micro-electro-mechanical systems (MEMS) for design: Characteristics of materials for MEMS applications and MEMS components	2	
	Designing components for high temperature applications: Various alloys and composites, Diffusion bond coating	5	
	Application of Powder metallurgy technique in design: Selection of materials, Cost, Design and Manufacturing considerations involved	3	
	Advanced materials for design of Automobile and Transport vehicles, Aerospace, Power generation, Armament, Marine environment and Ocean structures, Materials for other specialized applications	3	
	Advanced material testing for machine design considerations	2	
	Total contact hours	40	

Textbooks:

1. Callister, W. D. *Material Science and Engineering - An Introduction.* John Wiley & Sons, 7th edition, 2007.
2. Mallick, P.K. *Fiber Reinforced Composites Materials, Manufacturing and Design*. Marcel Dekker, 2007.

References:

1. Otsuka, K. and Wayman, C.M. *Shape Memory Materials.* Cambridge University Press, 1999.
2. Gandhi, M.V. and Thompson, B.S. *Smart Materials and Structures.* Chapman and Hall, 1992.

5. (b) Evaluation Plan:

Test No.	Marks	Duration (minutes)
I	25	45
II (Mid Term)	40	120
III (Assignment type)	25	-
IV (End Term)	60	180
Total Marks	150	

All the tests will be held as per the schedule and protocol notified by the Controller of Examinations, Tezpur University

6. Pedagogy:

Students should know in detail the Advanced Materials which are used in modern / advanced Design applications.

7. Expected outcome:

On the successful completion of the course, the student would be able to:

- Gain detailed knowledge on advanced materials, their properties and applications for modern Design applications.
- Prepare them for advanced design and manufacturing technology.
- Initiate project based on material characterization.
- Can correlate material selection with modern design considerations and manufacturing technology.