ADVANCED MATERIALS

Course code	23ME2701D	Year	IV	Semester	I
Course category	Open Elective - III	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Metallurgy and Material science, Manufacturing Processes, Machine tools
ContinuousInternal Evaluation:	30	SemesterEnd Evaluation:	70	Total Marks:	100

Course Outcomes: At the end of the course students will be able to

CO's	Statement	Blooms Level	Units
CO1	Explain the properties, processing, and applications of advanced metallic materials, superalloys, titanium and nickel-based alloys, intermetallics, cryogenic materials, space materials, and metallic foams.	**L2**	**1**
CO2	Describe the classification, processing methods, properties, and applications of engineering ceramics and cermets.	**L3**	**2**
CO3	Classify composite materials, reinforcements, and matrix systems, and explain their characteristics and engineering applications.	**L2**	**3**
CO4	Analyze the composition, properties, shape memory effect, and applications of shape memory alloys and functionally graded materials.	**L3**	4
CO5	Explain the fundamentals, properties, advantages, limitations, and applications of nanomaterials and compare them with conventional bulk materials.	**L3**	**5**

Contribution of Course outcomes towards the achievement of program outcomes & Strength of correlations (High :3, Medium:2, Low:1)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	2	1	1	2	-	-	1	-	1	3	1
CO2	3	2	2	1	1	2	-	-	1	-	1	2	1
CO3	3	2	3	1	1	2	-	1	1	-	1	3	2
CO4	3	3	2	1	1	2	-	-	1	-	1	2	2
CO5	3	2	2	1	2	2	-	1	2	-	2	2	2

Unit	Contents	CO
I	**ADVANCED METALS & ALLOYS:** Metallic materials- super alloys, titanium and Nickel based alloys and intermetallic, Materials for cryogenic application, Materials for space environment, Evaluation of materials for extreme environment, Introduction to metallic foams.	**CO1**
II	**CERAMICS**: Applications - characteristics- classification-Processing of ceramics- Powder preparations- consolidation- hot compaction-drying, sintering-finishing of ceramics, Al2O3, silicon nitride Si3N4 and Cermets, Areas of applications.	**CO2**
III	**COMPOSITE MATERIALS**: Introduction, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiber- reinforced composites and nature-made composites, and applications. **REINFORCEMENTS:** Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and born carbide fibres.	**CO3**
IV	**SHAPE MEMORY ALLOYS:** Introduction-shape memory effect, classification of shape memory alloys-composition-properties and applications of shape memory alloys. **FUNCTIONALLY GRADED MATERIALS**: Types of functionally graded materials-classification different systems-preparation-properties and applications of functionally graded materials.	**CO4**
V	**NANO MATERIALS:** Introduction-properties at nano scales-advantages & disadvantages applications in comparison with bulk materials (nano – structure, wires, tubes, composites). state of art nano advanced- topic delivered by student.	**CO5**

Learning Resource
Text books:
TEXT BOOKS: 1. Nano material /A.K. Bandyopadyay/New age Publishers 2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH 3. Engineering Mechanics of Composite Materials / Isaac and M Daniel/Oxford University Press
Reference books

1. Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York, 1975.

2. Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold,NY. 1969

3. Analysis and performance of fibre Composites /B. D. Agarwal and L. J. Broutman /Wiley-Interscience, New York, 1980

4. Mechanics of Composite Materials - Second Edition (Mechanical Engineering) /AutarK.Kaw /CRC Press

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