

**19AME75e – INTRODUCTION TO COMPOSITE MATERIALS**

(Open Elective-III)

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**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce composite materials and their applications.
- Build proper background for stress analysis in the design of composite structures.
- Familiarize various properties of composite materials.
- Focus on biodegradable composites.

**UNIT – I: Introduction to composites**

**8 Hrs**

Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the fundamentals of composites. L2
- Classify the composites based on matrix and structure. L2
- Identify the practical applications of composites. L3
- Summarize the properties and advantages of reinforcement materials L2

**UNIT – II: Polymer matrix composites**

**6Hrs**

Polymers - Polymer matrix materials – PMC processes - hand layup process – spray up process – resin transfer moulding – Pultrusion – Filament winding – Autoclave based methods - Injection moulding – sheet moulding compound – properties and applications of PMC's.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the properties of polymer matrix composites. L2
- Identify the polymer matrix composites. L3
- Explain various process used in making the polymer matrix composites L2
- Discuss the autoclave based methods. L6

**UNIT – III: Metal matrix composites**

**6Hrs**

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – In-situ processes. Properties and applications of MMC's.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Outline the various types of metal matrix composite L2
- Explain liquid state processes and solid state processes in MMCs preparation L2
- Demonstrate In-situ processes L2
- Identify the properties and applications of MMCs L2

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**UNIT – IV: Ceramic matrix composites****6 Hrs**

Ceramic matrix materials – properties – processing of CMCs – Sintering - Hot pressing – Infiltration – Lanxide process – In-situ chemical reaction techniques – sol-gel polymer pyrolysis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Summarize the various types of ceramic matrix materials. L2
- Explain the sintering, hot pressing, infiltration and lanxide process L2
- Contrast between cold and hot isostatic pressing. L2
- Examine the properties and applications of CCMs. L3

**UNIT – V: Advances in composites****6Hrs**

Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications.

Characterization of composite materials - Mechanical Properties, Thermal Properties.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the advantages and disadvantages of carbon matrix L2
- Identify composites for aerospace applications L3
- Apply chemical vapour deposition of carbon on carbon fibre perform L3
- Select the carbon - carbon composites. L1
- Classify various bio- degradable composites L3

**Text Books:**

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

**Reference Books:**

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong, Fundamentals of Composite Manufacturing, SME, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bioplastics & Bio-composites for Engineering applications, John Wiley publications.

**Course Outcomes:**

At the end of this Course the student will be able to

- Identify the practical applications of composites. L3
- Identify the polymer matrix composites. L3
- Classify of bio- degradable composites. L2
- Outline the various types of ceramic matrix materials. L2

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