



IIT Mandi

Proposal for a New Course

Course number : ME-511
Course Name : Manufacturing of Composites
Credit Distribution : 3-0-0-3
Intended for : B.Tech. (4th year onwards)/M.Tech./M.Tech.(R)/Ph.D.
Prerequisite : Basic Manufacturing Course
Mutual Exclusion : (courses with high similarity not allowed to credit by the students after or along with this course, if not relevant courses write 'None')

1. Preamble:

Improving manufacturing technology is the greatest challenge today in the field of composites. When composites are chosen for an application principally because of their properties, it is natural that the manufacturing methods would be chosen to optimize those properties. **This course will deal manufacturing of composites spanning polymer matrix, metal matrix and ceramic matrix composites. Topics of process modelling in composite manufacturing will also be covered.**

2. Course Modules with quantitative lecture hours:

Topic 1: Introduction to Composites: Function of the Matrix and Reinforcement in Composites Matrices: Thermosets and Thermoplastic; Fiber Reinforcement (**3 Hours**)

Topic 2: Properties and testing composites: Properties of Composites; Composites testing; Composites design: Laminate theory, Rule of mixtures, symmetry and balance (**6 Hours**)

Topic 3: Thermoset composite manufacturing processes: Lay-up processes, spray up process; Thermoset Composite manufacturing: Fiber placement process; Thermoset Composite manufacturing: Resin transfer moulding, Vacuum assisted resin infusion microwave curing, recycling of thermoset composites, **latest topics in thermoset composite manufacturing.** (**6 Hours**)

Topic 4: Thermoplastic composite manufacturing processes: Thermoset Composite manufacturing: Vacuum assisted resin transfer moulding; Thermoset Composite manufacturing: Compression molding process; Thermoset composites manufacturing: Filament winding, Microwave assisted Compression moulding, Additive manufacturing

techniques for thermoplastic composites, latest topics in thermoplastic composite manufacturing. (6 Hours)

Topic 5: Metal and Ceramic Matrix Composites: Metal Matrix Composites: Metal matrix and reinforcement; Manufacturing processes for Metal Matrix Composites: Dispersion hardened and particle composite; Manufacturing processes for Metal matrix composites: Layer composites and infiltration method; Ceramic Matrix Composite manufacturing, latest topics in metal and ceramic matrix composite manufacturing. (7 Hours)

Topic 6: Secondary Manufacturing Techniques for Composites: Joining techniques: Hot plate welding; Ultrasonic joining; Adhesive binding, composite repair techniques. Machining techniques for composites Machining Techniques for composite, Laser beam machining, electric discharge machining, ultrasonic machining, water jet machining, conventional drilling, milling and turning operations. (7 Hours)

Topic 7: Process modelling in Composite Manufacturing: Transport equations for composite processing, constitutive laws and their characterization, Resin viscosity, Reaction kinetics, crystallization kinetics, model simplification and solution, application of numerical model in short fiber composites, thermoplastic composites, thermoset composites. (7 Hours)

3. Text books:

(Relevant and Latest, Only 2)

1. Strong AB. **Fundamentals of composites manufacturing: materials, methods and applications.** Society of manufacturing engineers; USA, 2008.
2. Mallick PK. **Fiber-reinforced composites: materials, manufacturing, and design.** CRC press; 2007.

4. References:

(No limit on numbers, relevant standard format can be followed, the formats should be similar)

1. ASM International Handbook Committee. **Composites: Volume 21 of ASM Handbook.**

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)
None

S. No.		Course Code	Similarity Content	Approx. % of Content
1.				

6. Justification of new course proposal if cumulative similarity content is >30%:

Not applicable